

Partners in science, technology, and public service

Far from the spotlight of TV cameras in picturesque southern Virginia, 50 years of geomagnetic research were celebrated—and a new future heralded. The Fredericksburg Geomagnetic Observatory in Corbin, which has for half a century been providing magnetic data for navigation—be it hiking, or piloting an aircraft, or sending a space shuttle into orbit—will from now on also be the site of NOAA's National Ocean Service/National Geodetic Survey Laboratory and Training Center.

In pursuit of excellence in science

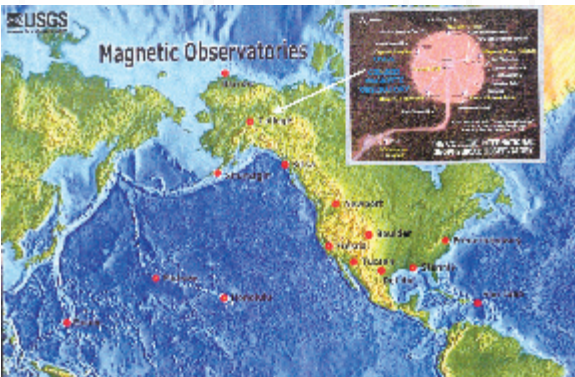
Opened in 1956 as part of a network of U.S. Coast and Geodetic Survey (USC&GS) observatories “to enhance geomagnetic field studies and monitoring programs in support of scientific, general public, basic, and national security needs of the United States,” the Fredericksburg Geomagnetic Observatory in Corbin had multiple reasons to celebrate on May 23. The science conducted on this 187-acre tract of land at the tip of the A.P. Hill Military Reservation underpins every major navigation research activity, and the four historical national agencies that have used the station have, at one time or the other, been in the forefront of the development of the American scientific community.

Pride and history permeated the ceremony—as well as fond remembrances of people, events, and the various ways that the partner agencies conducted their business on the station. The Townshend name often featured in these remembrances. Jack Townshend was a significant contributor to Corbin’s geomagnetic program from its very beginning until his retirement in 2003. His father Samuel had been a senior scientist at the predecessor to Corbin, the Cheltenham, Md., observatory, for more than four decades beginning in 1901.

Other personalities well known in the USGS and NOAA scientific and administrative circles were part of the program of the 50th anniversary ceremony in Corbin. Among the presenters were USGS’ Robert E. Doyle, Leroy Pankratz, Jeffrey Love, David Applegate, and James F. Devine. NOAA was represented by Kendall Fancher, Jack Dunnigan, Gilbert Mitchell, and Dave Zilkoski. Charles Challstrom, retired NOAA NGS Director, attended in his present capacity as President of the USC&GS Heritage Society. Their presentations were very inspirational, highlighting past achievements and outlining NOAA’s and USGS’ future scientific endeavours, and how the Fredericksburg Geomagnetic Observatory will fit into their programs. To understand this future, it might be useful to go back in history—to the early 1800s.

Thomas Jefferson, buoyed by the success of the Corps of Discovery expedition to the West, lobbied Congress to authorize a survey of America’s eastern coast. “With a clear delineation of the coastline,” he reasoned, “many products and ships could be saved, expanding commerce and industry.” He was successful. Congress passed the first of several enabling and reorganization acts that between 1807 and 1882 led to the formation, in 1970, of the National Oceanic and Atmospheric Administration by Executive Order, and the incorporation into NOAA of America’s oldest scientific organization, which includes the National Geodetic Survey.

The Geomagnetism Group in the U.S. Geological Survey (USGS) has roots going back to 1899, when the Division of Terrestrial Magnetism was established in the U.S. Coast and Geodetic Survey. Despite name change and transfer to the USGS, the group has conducted a systematic study of the magnetic field and magnetic



—by Ilse Genovese

The *ACSM Bulletin* thanks the organizers for the invitation to attend the ceremony. This article is based on presentations made during the ceremony.



surveys uninterrupted for more than 100 years. The Corbin observatory is part of that program.

The first U.S. permanent magnetic observatory was constructed by USC&GS in Cheltenham, Md., in 1900. Operation at this site continued until 1956 when it was replaced by the Corbin facility. The move was necessitated by industrial encroachment around Cheltenham in the early 1950s, which compromised the quality of geomagnetic research and data acquisition at the site.

Additional permanent magnetic observatories were constructed in Sitka, Alaska, in 1901 and in Honolulu, Hawaii, in 1902. By 2006, the USGS operated fourteen magnetic observatories spanning the magnetic field from Puerto Rico in the Atlantic Ocean to Guam in the Pacific Ocean to Barrow, Alaska, the most northern tip of the United States on the Chukchi Sea.

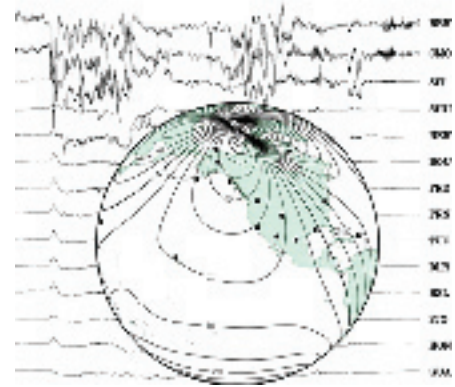
The USGS Geomagnetism Group also cooperates with other organizations in other countries—Canada and Australia, both of which have strong programs—and is looking for other partners with observatories covering the south Pacific and south Atlantic oceans.

But, let's not jump the gun.

In the beginning there was Jefferson and the authority he received from Congress in 1807 to “establish an organization to survey the coasts of the United States under the administration of the Treasury Department.” The Survey of the Coast was established, and Swiss-born Ferdinand Hassler became its first Superintendent. Thirty-six years later, the U.S. Coast Survey welcomed Professor Alexander Dallas Bache (great grandson of Benjamin Franklin) as its Superintendent. Under Bache, the Coast Survey saw a profound transformation—the largely engineering organization became a tool for better science in the field of geophysics.

The huge amount of geographic and geophysical data collected by the Survey was used to build the Nation's knowledge of geophysical phenomena—physical oceanography, marine geology and biology, and meteorology. Initially, this research was done as an adjunct to the original mission of the bureau to chart the Nation's coast.

Bache was concerned with advancing the surveying and charting of the U.S. coast, but he was also mindful of the larger mission of using the Coast Survey as a “tool to raise the stature of American science.” He personally directed the science



The satellite perspective map seen here depicts the magnetic declination (degrees east). The dots represent the locations of USGS magnetic observatories. The stack plot of data depicted behind the globe is of the horizontal component of the magnetic field recorded at those observatories during the magnetic storm of 29-31 October 2003.

[Source: www.usgs.gov]



Summit of Round Top, California, principal triangulation station on the Sierra Nevada.

Astronomic, magnetic, gravimetric, and meteorological observations were also made at this location. Altitude: 10,386 ft.

[Photo by Carleton E. Watkins, 1879]



50 years of achievement at Fredericksburg Geomagnetic Observatory

Geomagnetic Programs

- Proton GyroMagnetic Ratio determined by P.L. Bender and R.L. Driscoll of the National Bureau of Standards, with assistance from Fredericksburg Magnetic Observatory
- U.S. and International Magnetic Standards determined and maintained at the Fredericksburg Magnetic Observatory
- NASA calibrated satellite magnetometers with assistance from FMO staff prior to sending them into orbit
- Hundreds of precision magnets and magnetometers calibrated by FMO staff for U.S. agencies and countries around the world
- Scientists from the U.S. and other countries around the world trained in Geomatic Observatory and field operations. Many trained at FGC became directors of Geophysical Institutes and university professors; one person is a director of a university Space Study Program, and one attained the rank of Real Admiral in NOAA.

Geodetic Programs

- Invention of the Electronic Distance Measuring Instrument (EDMI) by Bud Leslie
- Photo triangulation measurements made taking images of satellites against the night sky
- Corbin Calibration Base Line installed. Only calibration base line in the U.S. measured over its entire length with invar tapes calibrated at the National Bureau of Standards
- Global Positioning System Antenna Phase Center Calibration Site established. Hundreds of GPS antennas from around the world calibrated at this facility.

and engineering accomplished by the military and civilian assistants working within the Coast Survey, and he distributed patronage to leading academic scientists to work on Coast Survey projects.

Bache may have been the first to exploit expertise found in academia and the military to enrich the work of a civilian government organization. He was also the first to appreciate the need for science to be organized to advance public policies for scientific development. To this end, he advocated the formation of the American Association for the Advancement of Science, and in addition, through the establishment of the National Academy of Sciences, he contributed in a lasting manner to the awakening and strengthening of the American scientific community.

Bache interpreted the 1843 Reorganization Act and its “connection between the science of the country and the work of the U.S. Coast Survey” to the letter. The geomagnetic surveys that began in his time and have been performed for more than 160 years since, have contributed to an increasingly more accurate mapping of the magnetic field and, consequently, safer, more accurate navigation.

The first isogonic chart was published in 1855; also around that time, theories emerged about the possible locations of the magnetic poles, based on observations at different locations. In this, as in other observations taken by the Coast Survey, it became obvious that rather than accumulating data indiscriminately, new analytical tools were needed to gain “further insight into the nature of observational errors.”

As Harvard mathematician and Bache’s friend, Benjamin Peirce, noted in 1854 in a Coast Survey report, “there is in every species of observations an ultimate limit of accuracy beyond which no mass of accumulated observations can ever penetrate. A wise observer, when he perceives that he is approaching this limit, will apply his powers to improving methods, rather than to increasing the number of observations.”

The Coast Survey’s work to provide accurate isogonic charts intensified after the purchase of Alaska from Russia in 1867. Alaska added more than 33,900 miles of total shoreline and represented almost one-





fifth of the land area (586,400 square miles) of the country.

Four years after the Alaska acquisition, a geodetic connection between the Atlantic and Pacific coasts was authorized [see *ACSM Bulletin* # 219, 220, and 221 for articles on the Transcontinental Arc]. Geodesy began to play an increasingly stronger role in the work of the Coast Survey, causing the organization to be re-named in 1878 as the U.S. Coast and Geodetic Survey.

Eleven years later, the Division of Terrestrial Magnetism was established within the USC&GS, and in 1926, the production of aeronautical charts was added to the organization's mission to meet the requirements of the new air transportation age. By then the Cheltenham facility was over twenty years in existence.



National Oceanic and Atmospheric Administration. The USC&GS and the Weather Bureau became part of NOAA and were renamed as the National Ocean Survey [in 1982 "Service"] and the National Weather Service.

Two other reorganizations complete the road that led to the re-dedication this year of the Corbin facility as a joint NOAA-USGS research facility and training center. In 1969, USC&GS' terrestrial magnetism research and the Geodetic Instrument Calibration Center were both located at Corbin, and in 1973, geomagnetism and seismology research were transferred from NOAA to the U.S. Geological Survey.

But we need to backtrack once again to include a few highlights from USGS' history that also has a bearing on the future at Corbin. With the survey of the Nation's coastlines in progress, Congress turned, in 1878, to the National Academy of Sciences to recommend a plan for "surveying and mapping the Territories of the United States that would secure the best possible results at the least possible cost." The Academy came up with two concurrent recommendations.

One was to transfer the Coast and Geodetic Survey to the Department of the Interior and give it the responsibility for geodetic, topographic, and land-parceling surveys, in addition to its existing work. This never happened. The second was to establish an independent organization, also within Interior, which would be called the U.S. Geological Survey. This new organization was to study the geological structure and economic resources of the public domain.

Appropriate legislation was introduced, and after some negotiation, the sundry civil expenses bill of 1879 included a section establishing the U.S. Geological Survey, and charging it with a unique combination of responsibilities—"classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain."

For more than 127 years now, the USGS has continued to advance the earth sciences in the service of the public by cooperating with other agencies dedicated to excellence in the study of science and technology of the Earth, its atmosphere, and the space. The Fredericksburg Geomagnetic Observatory has been key to this cooperation.

The opportunity missed by the 45th Congress back in 1878 to bring geology and geodesy together under one umbrella was revised in 2005 and, after



At the peak of its existence in 1965, USC&GS was highly respected by the public, and the business and scientific communities for the integrity, accuracy, and reliability of its data.

A series of organizational changes between 1965 and 1982 ensued, which affected the missions and program directions of present-day NOAA and USGS. In 1965, the Environmental Science Services Administration was created in the Department of Commerce by Executive Order, only to be replaced in 1970 by the

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careful examination of the missions of USGS and NOAA, the dual occupancy of the Corbin facility was reaffirmed. However, in order to allow each agency more freedom in conducting their respective activities, the two agencies agreed on a transfer of 142.67 acres of the land, including buildings, roads, and labs, and the associated operational costs, to NOAA. The remaining land and facilities will continue to serve as a magnetic observatory managed by USGS. The transfer is expected to take effect in the new Fiscal Year.

And thus it came that on May 23, 2006, half a century after it opened its doors to scientists, the Fredericksburg Magnetic Observatory at Corbin, Va., was re-dedicated as the NOAA National Geodetic Survey Laboratory and Training Center and the USGS Fredericksburg Geomagnetic Center.

Offering a toast to NOAA and USGS, Jack Townshend reminded all why we were in Corbin that day: "In honor, memory, and appreciation for all, living and deceased, who have contributed to the work and support of science at FGC ... and for many more years far into the future, working

together as partners dedicated to excellence in the study of science and technology of the Earth, the atmosphere, and space."

