

U.S. Coastal Survey

Notes

Hassler: Ferdinand Hassler b. October 7, 1770 (died nov 1843) , Aarau, Switzerland in N German-speaking region of Switzerland; grew up speaking German. worked with Tralles in the survey of Bern. personal collecting of scientific instruments and books. This work introduced him to most of the eminent scientists of Europe and he became quite proficient in the mathematics, geodesy, astronomy, metrology, chemistry, physics, and mechanical engineering of the day. His personal work in metrology included collecting copies of many of the European standards of weights and lengths. French were to take over Sw survey so Traill left and Hasler went to US sailed for Philadelphia arrived in October 1805. Center for Science, attended American Philosophical Society, elected member 1807; T Jefferson president; Survey of coast proposed to TJ by John Vaughan (philanthropist) and Robert Patterson with Hassler in mind;

Congress on February 10, 1807: President of the United States ... authorized and requested, to cause a survey to be taken of the coasts of the United States, in which shall be designated the islands and shoals, with the roads or places of anchorage, within twenty leagues of any part of the shores of the United States; and also the respective courses and distances between the principal capes, or head lands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts. Secretary Gallatin (Swiss) issued notice fo instrcutions on how to conduct this. Hassler responded in one week, in French; his selected 1807. No action do to international politics until 1811; FH to London to buy equipment – 4 years; FH – wanted lasting scientific work, Congress wanted maps of harbors; FH introduced plane table and its mapping to US; believed that topo mapping should include roads, canals, means of defense.

Reconnaissance and primary triangulation done by FJ in late fall or early spring; followed high ridges 20-40 miles inland with good view; secondary triangulation at 10-mi intervals; then plane table mapping; tertiary triangulation and soundings;

1842 – got the dividing engine (from master instrument maker Edward Troughton; finest machine tool in W Hemisphere; used in production of theodolites) and copper-plate printing press.

Much congressional disapproval – slow, expensive; FH wanted unsurpassed charts;

Bache was born on July 19, 1806, great grandson of Benj Franklin; UPenn scientist – one of foremost in US chemistry, physics, weather; Hired many scientists as experts – Benj Peirce of Harvard, Agassiz, Maria Mitchell etc. Head of class at West Point and hired at least three others. 1850-60 highwater mark of Coast Survey ½-1% of total Federal Budget. Bache dedicated to elevating American science to the front ranks of the world community. As opposed to Hassler who was politically naive, Bache moved smoothly through the American political scene for the benefit of the Coast Survey and American science. The Coast Survey prospered during his tenure as Superintendent and became the first great science organization of the United States Federal Government.

Professionally, he became a guiding light of the American Association for the Advancement of Science [presided over three of the first six meetings of the AAAS] and was a founder of the National Academy of Sciences.

The topographic sheets included natural and cultural features such as: rock outcrops, cliffs, hills, and mountains; sand beaches and dune fields; coastal islands; marsh land; mangrove swamp; prairie lands; inlets; streams and rivers; the limits of pine and deciduous forests; cultivated fields; fence lines; roads, paths, and city streets; and piers, residences, commercial establishments, and public buildings.

Henry Laurens Whiting, the dean of Coast Survey topographers, wrote: "The limit of land and water is the most striking and important outline which exists in nature...." To define this boundary between land and water, the Coast Survey sent topographic mapping crews to every part of the far-flung coast of the United States. In the period 1850 through 1860, 7,295 square miles were surveyed which encompassed more than 25,000 lineal miles of shoreline including tidal rivers and creeks. Superintendent Bache sent out an average of 17 topographic parties per year, each of which surveyed nearly 40 square miles.

Survey: first systematic mapping; extent of man-made and natural change; determination of topo and characteristics for the construction of defense and public works.

(NOAA Coast Survey 1807-1867)

T-Sheet Used Guide 2005

The Survey of the Coast was established in 1807 by Thomas Jefferson and assigned the responsibility of "completing an accurate chart of every part of the coasts" (Shalowitz 1964). The Survey of the Coast became the U.S. Coast Survey in 1836; was renamed the U.S. Coast and Geodetic Survey in 1878, when the agency began establishing a geodetic connection between the two coasts; and since 1970 has been part of NOAA as the National Geodetic Survey (Edney 1986; Shalowitz 1964).

The Coast Survey was established in part for defense of the coastline, but the most pressing reason was the need for accurate navigational charts for safe passage of ships carrying foreign trade and commerce between states. Commercial needs ultimately pushed the funding forward, while the information for military use provided Congress with the constitutional basis for funding (Dupree 1986).

Hassler was a Swiss engineer brought to the United States in 1805 by the U.S. Military Academy at West Point to teach mathematics (Thompson 1979). Hassler proposed an approach that incorporated geodesy—the accurate measurement of the size and shape of the earth—with topographic and hydrographic surveying... Jefferson and Congress both were concerned about the constitutionality of any federal program.... not by any accepted notion that a comprehensive mapping program should be funded by Congress.... Jefferson also had in mind establishing a scientific agency that would rival European efforts (Linklater 2002).

Hassler died in Nov 1843 from pneumonia after suffering a fall when protecting surveying equipment during a storm (Dupree 1986).

Individual surveyors working in the field—from superintendents to aids—had significant impact on the final product, despite attempts to standardize procedures and methods. Geodesy. Without taking the curve of the earth into account, independent but adjacent surveys would not fit together at the edges, and discrepancies as to size, scale, and shape would be evident. A coordinated survey using geodetic controls employs a horizontal geodetic datum and a single point from which all other positions are tied to. The early Coast Survey maps show remarkable consistency and accuracy because a systematic method of measuring the earth was used.

the Coast Survey used a plane table (Figure 4) combined with the geodetic tie points, to survey an area. A plane table is simply a drawing board—usually about 30 by 24 inches in size—that sits on a tripod and can be rotated and leveled. An alidade—which resembles a telescope on top of a compass and allows the surveyor to measure angles—is mounted on top of the plane table. The field team would locate one of the triangulation stations, placing the table directly on top of it, and orienting the plane table so that features on the field survey sheet would line up with and be parallel with the features in the landscape (Shalowitz 1964). A distant triangulation station would be located in the sights of the alidade, which sits on a ruler that corresponds to the direction the alidade is pointed, and the two stations would be connected with a line on the map. Undetermined points would be located in a similar way—i.e. features lined up within the sights of the alidade, with a line drawn to their location. The actual geographic locations were determined through triangulation. To map a coastline, the plane table surveyor was assisted by another Coast Survey employee who would walk along the shoreline and set a rod when the shoreline changed direction. The plane table surveyor would align the rod with the alidade and draw in the corresponding line, and the shoreline in between would be sketched on the map (Shalowitz 1964). The surveyor had the advantage of completing the map in the field, while all the features being captured were still visible (Denny 2000). Because all angles and distances were transferred immediately to the field sheet, there was usually no record of the measurements—especially on the earlier maps—and field notes were not typically kept (Shalowitz 1964). To largely replace the problematic chain as a measuring device, the Coast Survey was an early adapter of the telemeter, a wooden rod about 10 feet long with graduated numbers painted on the surface that could be sighted through the alidade (Shalowitz 1964). In 1846, Bache began directing experiments to use the telegraph to determine longitude. Came to be known as the American method, widely used.

From the inception of the agency, the Coast Survey maps were engraved on copper plates, constraining their production to a limited print run for each engraving. The delicately engraved lines on the copperplates could only withstand perhaps 500 to 2000 impressions before they required re-engraving. Guthorn refers to this process as “slow, laborious, and cumbersome...[resulting in] maps with intricate detail from nearly microscopic size to large lettering, fine to heavy lines, tone variations, and great character” (Guthorn 1984).

Perhaps the most surprising discovery of this era was Stellwagen Bank, on the main route into Boston harbor. This bank is just a few miles to the north of Cape Cod and stretches toward Cape Ann. It is over twenty miles in length and five miles across and lies in the path of major routes from Boston to Europe and points south. In 1854, Lieutenant Commanding Henry Stellwagen, U. S. N., Assistant in the Coast Survey, discovered this bank in the course of regular hydrographic surveys.

Hassler questions from Congress in 1843. Select Committee on the Coast Survey. Interrogated everyone from engraver to ship captain to leader of teams.

1844

Are we not greatly deficient in knowledge of soundings in Buzzard’s Bay, Nantucket Shoals, Cape Cod and Massachusetts Bay?

Answer: Yes, it is more wanted there than anywhere. More tonnage passes. Most vessels from Europe, for New York and Philadelphia, come between the Gulf Stream and Nantucket Shoals, in addition to navigation north of Cape Cod. Most of the coast trading comes through the Vineyard.

MV Work: Triangulation of Buzz Bay and greater part of MV Sound East Rock to East Chop of Holmes Hole. Started in May; 24 stations occupied; 6600 angles measured on 68 objects (44 signals, 13 spires, 9 lights, 1 beacon, 1 telegraph) – 379 sq miles; topo work by WM Boyce and HL Witing (charge of 2nd party) – 3 plane table sheets RI, New Bedford etc.; HL Whiting assisted by Samuel A Gilbert, W.E. Greenwell.

Shoe upon the Vineyard: is described as generally level and sandy, and cut up by numerous ponds; the interior is wooded; earlier note says it is contrary, level, and covered with woods of scrub oak; interspersed with pines;
Area surveyed 139 sq miles; 145.5 miles of shoreline; 102.5 pond shorelines; 182 miles roads.

In the report at the close of the season, Lieutenant Commandant Blake remarks: "In conclusion, I cannot forbear calling your attention to the great deficiencies in all the existing charts of the dangerous section of the coast upon which I have been employed this season. They all appear to have been founded upon the survey of Des Barres, made before the Revolution, with some occasional amendments and additions, but, even immediately off the important port of New Bedford and Fairhaven, where nearly three hundred whale ships are owned, I found dangerous single rocks near one of the main ship channels with but five feet water on them, entirely omitted in the latest publications. These rocks are not marked by buoys, and certainly not generally known. I propose hereafter to name to you certain localities where I think buoys very necessary indeed."

Letter from William Mitchell of Nantucket to Professor A.D. Bache, Superintendent of the Coast Survey:

"My Dear Friend: I have at length obtained the information I desired relative to the number of vessels which annually pass through the sound. Knowing that thou wouldst prefer a modern account I applied to the captain of the light boat, with whom it has been somewhat difficult to communicate. To his politeness I am indebted for the following particulars:

In 1842 there were 144 ships, 1295 brigs, 7551 schooners, 3616 sloops

In 1843 there were 151 ships, 1194 brigs, 8228 schooners, 3525 sloops

In 1844 there were 152 ships, 1175 brigs, 7483 schooners, 2566 sloops

CS also looked at currents in V sound

No Man's Land – The island is entirely bare of trees and covered with grass, so that little or no surface degradation occurs by reason of winds or waves.