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Science on the Edge:
The Story of the US Coast and Geodetic Survey,
Its Transition into ESSA and NOAA,
And the American Triumph of the Earth Sciences in the 20th Century

Introduction

This history is written in preparation for the celebration, in 2007, of the founding of the Survey of the Coast in 1807. This story of the modern end of the long history of the Coast Survey presents key people, events, and technologies in the intricate history of the oldest scientific agency in the US government, which became the foundational element of the National Oceanic and Atmospheric Administration (NOAA). The major focus of the history is the period from 1897 to the near past, beginning with the great Re-organization of the US Coast and Geodetic Survey, in which the modern relationship between the officers and personnel of the Survey and the US military services was devised, culminating a few years after 1917 in the system of the Uniformed Officers Corps, which later became ESSA Corps and is now NOAA Corps.

But the story of the Coast Survey is far larger and more complex than its institutional framings, so this story must necessarily direct some attention to the first century of the Coast Survey, the great foundation upon which the achievements of the second century rest. The significance of the story of a small but vital scientific agency encompasses the history of the United States' interactions with the larger world, because wherever American power and interests were directed, the Coast Survey worked and innovated. And in this work, the personnel of the Coast Survey and its evolving successors have played significant roles in revising the very fundamental conceptions of the Earth and how it works. Ironically, these scientific breakthroughs were achieved by dedication to institutional goals that have remained consistent for two centuries: the Coast Survey and its successors have the fundamental task to develop the best scientific aids to assist human safety and commerce along the edge between the land and the sea. Their role has always been the performance of science on the edge.

Those edges have been the physical margins of the land and sea, the topography of the sea floor, the edges of geodetic survey triangles, the intersection between civilian and military institutions and constraints, and the “cutting edge” of innovative technologies applied to ever larger and more important questions about how earth systems work. The history of these edges involves some complex topics, including the roles that scientific agencies have played in the history of the United States and its government, the inter-connections and competitions between military and civilian authorities in American history, the changing ways that sciences of all kinds have been funded and controlled, the emerging new roles played by universities and independent institutions of science and their interactions with government agencies, and the place of American scientific institutions of all kinds within the larger world of the global earth sciences as they developed in the 19th century and even earlier.

The Coast and Geodetic Survey has been for its entire existence a small technical scientific agency of the US government, authorized and budgeted to produce limited and specific data and products. Nevertheless, in order to accomplish even limited objectives correctly, the Survey has, since its inception, possessed a scientific agenda as broad as the earth itself. This has created tensions and conflicts that are as inevitable, and as natural, as gravity. The roots of the conflict may be seen at the very beginning, in the enabling act of Congress that authorized President Thomas Jefferson to create the Survey. The primary initial tasks were specific and limited: “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 within the extent aforesaid”.¹ First, the coasts of the United States have expanded continually since then, and second, the intersection between land and sea is the single most dynamic and energetic environment on the planet, which makes the concept of “completing an accurate chart” problematical on its face. Finally, the root of the greatest problems and the greatest triumphs in the history of what began as the Survey of the Coast is the fact that the Congress, by authorizing Thomas Jefferson to consider “such other matters as he may deem proper,” began an initiative in the collective earth sciences that extends from the center of the earth to the cosmos, and everything in between.

Ferdinand Hassler, Alexander Dallas Bache, Henry S. Pritchett, E. Lester Jones, and all the other great superintendents (and their staffs) of the Coast Survey and the Coast and Geodetic Survey, as will be examined, have recognized the scope of the “other matters” necessary to accomplish the tasks—their recognition of that is a large part of what made them great. The lesser leaders and staffs have not, or their service was rendered lesser by their inability to convey the importance of the “other matters” to Congress and other institutions whose support they needed to accomplish their tasks.

To the extent that the scientific history of the Coast Survey has been analyzed at all, most analysts have characterized the Survey by the tenures of specific superintendents,

¹ United States Congress, [Act of Feb. 10, 1807, Sess. II, ch. 8, 2 Stat. 413-14 (1807)]

beginning with Ferdinand Hassler, but then essentially ending with his successor, the second superintendent and polymath, Alexander Dallas Bache.²

This was, necessarily, the foundation for analysis but only that. By the time that Henry S. Pritchett was superintendent, the increasing complexity and sophistication of the work of the Coast and Geodetic Survey was such that an emphasis on Pritchett's tenure, adroit as he was in his three years, will only obscure, unfairly, the work of the Survey itself before, during, and after his time. At the same time, all superintendents and directors, however strong or weak their administrations, could only rectify to a small extent the recurrent problems that have impeded the Survey and its successor agencies from the beginning to the present day.

In essence, the Coast Survey and its successors have always been relatively small and relatively independent civilian scientific agencies performing work of great civil and military significance, but never supported at a level commensurate with their worth in either realm. This has created a continual drain on personnel and scientific resources alike that has been a persistent problem. For the first century of the Coast Survey's existence, it was entirely dependent on the Navy and the War Departments for critical personnel and access to ships to perform all manner of activities. A major theme of the Survey's second century, as will be seen, is the forging of a new and more independent, yet still complexly related relationship to the US military services. This is personified in the independent officer corps that the Survey created to substitute for the military services withdrawn, which continues to the present as NOAA Corps, the smallest yet most unique of the uniformed services in the US government.

The leadership of the Survey and its successors has been vital, and the specific eras or distinct superintendents and directors are distinctive, and they will be identified and analyzed as such. Nevertheless, the objective of this and other parts of the NOAA History website is to present the story of the Coast & Geodetic Survey from the people and their work up, rather than the more traditional perspective of from the leadership down. Our objective is to honor the largely uncelebrated staff of the Coast and Geodetic Survey for the achievements of their hard and difficult labors and their breakthroughs in the earth sciences. This approach is also in keeping with the major recent evolution of the philosophy and craft of the history of science and technology. This new strand emphasizes the ways in which the construction of stable knowledge of the natural world, as in, paradigmatically, the extension of geodetic triangulation networks, is inter-related in complex ways to the construction of organizational identities and representations that stabilize political and social order as well.

The key activity and metaphor of the Coast and Geodetic Survey throughout its existence has been the extension of geodetic control, on many levels.³ But by the very

² In 20th century scholarship, Florian Cajori's *The Checkered Career of Ferdinand Rudolph Hassler* (Cajori, 1929) has, rightly or wrongly, set the mold. There is a voluminous literature on A.D. Bache and his role in American life and science; papers and books of particular salience for the history of the Coast Survey include Nathan Reingold (1978), A. Hunter Dupree (1986), and Hugh R. Sloten (1994). Kevles (1978) contrasts the history of the US Geological Society to that of the Coast Survey.

³ See especially Jasanoff (2004).

processes and challenges of this extension of geodetic control, new, novel, and even counter-intuitive knowledge about earth systems has been achieved continually throughout the history of the Coast and Geodetic Survey as well. The extension of terrestrial geodetic networks, the observations of variation in gravitational attraction at different places, the shifting fluxes of the fields of terrestrial magnetism, the discovery of the deep sound channel in the ocean, the discoveries of seamounts, guyots, deep submarine trenches paralleling continental margins, the geo-positioning of belts of seismic activity—all these activities and a myriad more have both advanced core tasks of the Survey, but also provided novel data that scientists inside and outside the Survey have used in rapidly evolving, contesting models of how the earth-moon-sun system works. Survey personnel have mapped the seafloor to assist mariners so they will not drive their ships on the rocks, and at the same time, from the very same mapping, they produced insights into terrestrial processes that overthrew traditional ideas about the very structure of the earth and how it works. Hence, we emphasize a scientific story from the people and the data up, about a technically-grounded scientific agency closely associated with meticulous and novel instruments and their applications, and equipped with sophisticated laboratories, but in reality situated in a larger laboratory which is in fact the earth itself, a curved ellipsoid with edges everywhere.⁴

⁴ For a succinct description of how the earth sciences diverge from traditional laboratory-based hard science and also the social sciences, see Gaddis (2004).

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