

CHAPTER I

Origins

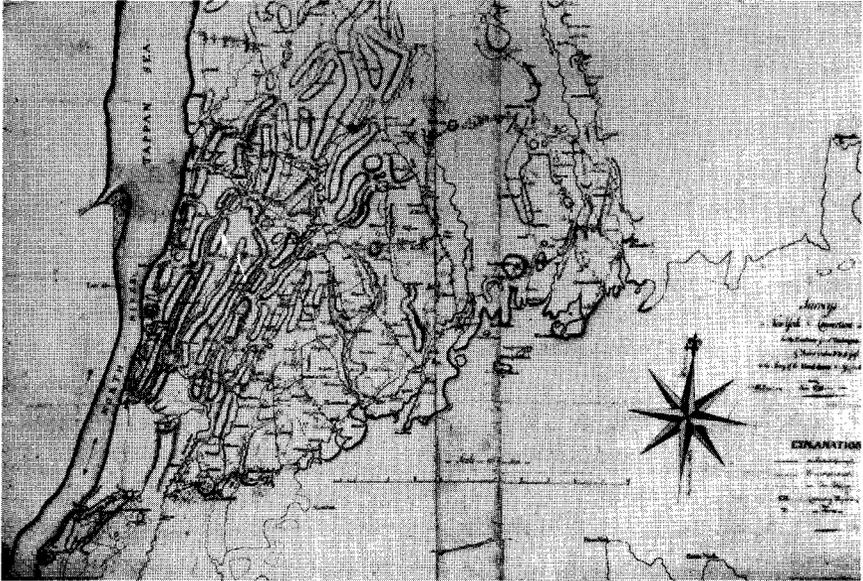
Geographers

Early in the War of Independence, the Army realized that it needed specially trained officers for topographical duty. General George Washington faced a compelling need for technical help in reconnaissance. He particularly wanted men to map “Roads, rivers, Bridges, and Fords over them, the mountains and passes through them.” This need forced him to seek creation of a geographer’s department to supplement the work of his engineers. As usual, Washington had to prod Congress into action. In July 1777 the legislators finally approved his proposal for appointment of a geographer “to take sketches of the country, the seat of war, and to have the procuring, governing, and paying the guides employed under him.”

Washington appointed Robert Erskine, a mapmaker, inventor, and member of the Royal Society of London. The choice was a good one. With his assistants and chain bearers, Erskine prepared numerous valuable sketches before his sudden death in October 1780. His 24-year-old assistant, Simeon Dewitt, carried on the work, aided after May 1781 by Captain Thomas Hutchins, who filled the position of “geographer to the southern army.” DeWitt remained “geographer to the main army” until Congress changed the titles of both men to “geographer of the United States” by a resolution of 11 July 1781. During that year, they provided invaluable aid to the Army in the Yorktown campaign. After the war, Congress drastically reduced the size of the Army and abolished the geographer positions. DeWitt became surveyor general of the state of New York; Hutchins stayed with the Army to direct the surveys of the Northwest Territories.

Topographical Engineers

Thirty years passed before officers with comparable talents served in the Army. In fact, no engineers of any sort were accepted

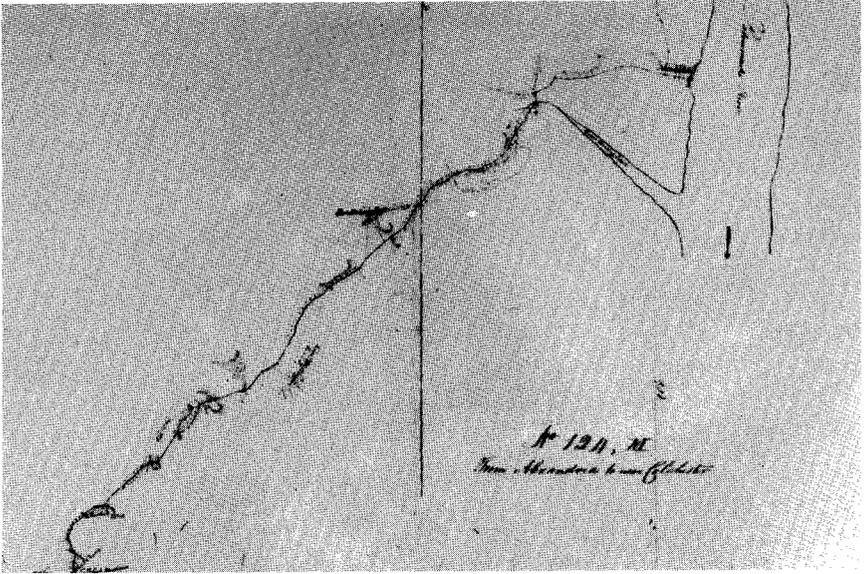


Geographer Robert Erskine (1735-1780), assisted by William Scull, prepared this survey of New York and Connecticut in 1778. The map shows surveyed and unsurveyed roads, footpaths, commanding heights, and taverns. General Washington used this map in planning troop movements around New York City.

in service until war with Britain threatened in 1794. At that time engineers and artilleryists were merged into a single corps. They were separated in 1802 with the establishment of the Corps of Engineers, which included no topographical officers.

When the War of 1812 began, the Army again faced the need for topographical services. Congress responded somewhat more generously than it had in 1777. The act of 2 March 1813 authorized eight Topographical Engineers and eight assistants. However, the topographers were not organized into a corps or provided with any administrative machinery. They were simply attached to the general staff of the Army. Major and later Lieutenant Colonel John Anderson of Vermont was the senior topographer.

The immediate postwar period resembled the situation after the Revolution. In effect, the act of 3 March 1815 abolished the Topographical Engineers. That law specified the entire military establishment, including engineers, but made no mention of topographers. All of the Topographical Engineers received honorable discharges from the Army on 15 June 1815.



The geographer's department under Erskine's successor, Simeon DeWitt (1756-1834), prepared this map of the route from Alexandria, Virginia, crossing Great Hunting Creek and skirting Washington's home at Mount Vernon, to a point near Colchester. One of a series, the map helped guide the armies of Washington and Rochambeau to Yorktown in 1781.

In spite of the 1815 housecleaning, some continuity was maintained. Two of the topographers, Majors Anderson and Isaac Roberdeau, were kept on active duty to complete surveys of the northern frontier and Lake Champlain. They were still at work when the act of April 1816 was passed. The act restored three Topographical Engineers with the rank of major to the general staff of each of the two divisions of the peacetime establishment and an assistant topographer with the rank of captain to all four brigades of the Army. This was a major piece of legislation for the topographers, perhaps the most important one between 1813 and 1838. For the first time, the peacetime army provided a place for military topographers. Like its predecessors, this act also fell short of providing a corps for the topographers or any centralized administrative machinery.

The 1816 act recognized that topographical expertise was essential to successful military operations. Yet such skills also were important for a wide variety of engineering projects that may have enhanced military preparedness but were also valuable for the commercial expansion of the country. For instance,

when Major Stephen H. Long explored the upper Mississippi River in 1817, he was as interested in conveying his ideas about potential river and road improvements as he was in advising his superiors about the best locations for fortifications. Other Topographical Engineers helped survey the nation's coastline. Proper surveys were necessary not only for constructing fortifications, but also for improving navigation.

An 1816 report on national defense by the newly established Board of Engineers for Fortifications clarified the relationship between national defense and commercial expansion. Three Army Engineers-Brigadier General Simon Bernard (recently arrived from France), Captain Joseph G. 'Jbtten, and Major William McRee--and a senior naval officer concluded that national defense rested on four pillars. These were a strong navy, coastal fortifications, a regular army, and good transportation facilities through the country's interior. As to the last point, the authors noted that good lines of communication helped "to develop the agricultural industry of the country, the fundamental basis of public prosperity, and to consolidate the internal peace of the citizen." Secretary of War John C. Calhoun agreed with these conclusions and in 1819 recommended federal help to improve transportation routes, including waterways.

Assignment to the Engineer Department

While this understanding concerning the relationship between military and civil engineering works emerged, the War Department consolidated its engineering talent. On 2 July 1818, the department placed the topographers in the Engineer Department, along with the Corps of Engineers, the U.S. Military Academy, and the Board of Engineers for Fortifications. This action created a total authorized labor pool of 32 men: 10 topographers and 22 officers of the Corps of Engineers. One month later, the Engineer Department placed Major Roberdeau in charge of the newly established Topographical Bureau. This bureau served merely as a depot for instruments, reports, memoirs, and publications. It managed no programs and controlled no personnel. In short, it was a depository, not an administrative entity.

Placement of the Topographical Engineers under the Engineer Department confirmed the close but sometimes strained



Major Isaac Roberdeau (1753-1829) was the first chief of the Topographical Bureau. A practicing civil engineer for many years, he sought for some time to join the Army "with a rank suited either to my support or capacity." The opportunity finally came during the War of 1812. He entered the service as a major of Topographical Engineers in 1813 at the age of 40. After the war, he carried out the survey of the 900-mile segment of the border with Canada that ran from the St. Lawrence River west and north to the falls of St. Mary's River between Lakes Superior and Huron.

relationship that had developed between the topographers and Engineers over the previous two years while working on related or identical projects. While officers of the Corps of Engineers thought of themselves chiefly as fortifications engineers, they too became involved in surveys relating to internal improvements. Thus, while Major Long, a Topographical Engineer, led the 1819 expedition to the trans-Mississippi West, General Bernard and Major Joseph G. Totten, both assigned to the Corps of Engineers, conducted the survey of the lower Mississippi. This pattern of using both topographical and fortifications officers continued in the next several years on the few harbor projects approved by Congress.

The partnership between officers of the Corps of Engineers and the topographers was uneasy. Indeed, the competition for work and influence between the Engineer and topographical officers resulted in substantial bitterness and tension. The antagonism originated in the frustrations that the Topographical Engineers had experienced since at least 1816, when Congress had refused to establish a separate Corps of Topographical Engineers and had authorized only the creation of peacetime Topographical Engineer positions. This disappointment would not have rankled so much if, in 1818, Corps of Engineers officers had accepted the topographers as equals rather than as subor-

dinate functionaries. Instead, the topographers were patronized and isolated. One reason for the animosity was that regular Corps officers were chosen from the top ranks of graduating West Point classes; Topographical Engineers were chosen from the second rank. As West Point graduate and artillery officer John Tidball later explained, it was “a kind of fixture in our minds that the engineers were a species of gods, next to which came the ‘topogs’—only a grade below the first, but still a grade—they were but demigods.”¹

Experience as well as class standing separated the topogs from the regular Engineer officers. According to Totten, the topographers were “not engineers in the sense in which officers of the Corps of Engineers are—any more than the officers of ordnance, artillery, cavalry, riflemen, or infantry are engineers.” He claimed that he had the “highest respect” for the topographers and believed that “a more excellent body of officers is no where to be found,” but greater skills were necessary to plan and construct fortifications than for civil works. The topogs were just not up to the job. “We see,” Totten said, “no where among them any, *not a single individual*, ... whom we could see introduced into the Corps of Engineers without mortification or pain.”

Officers of the Corps of Engineers ran the Engineer Department, and they made sure that management stayed within the immediate family. Colonel Walker K. Armistead, who was Chief Engineer from 1818 to 1821, bypassed Major Roberdeau, the senior topographical officer, to appoint a captain and sometimes even a lieutenant of the Corps of Engineers to take over the department in his absence. His successors, Colonels Alexander Macomb and Charles Gratiot, continued this practice. So correspondence between the War Department and the topogs passed through a junior officer of the Corps of Engineers, Roberdeau remained an administrative nonentity, and the topogs were plainly second-class citizens in the department.

By 1824 the antagonism between topographical and Engineer officers was evident. Major Long thought the Engineer officers “cordially hate us or more probably are jealous of our rising reputation.” Frustrated by the lack of recognition and professional respect, the topographers yearned to prove them-

¹ James L. Morrison, Jr., *"The Best School in the World": West Point, the Pre-Civil War Years, 1833-1866* (Kent, OH: Kent State University Press, 1986), p. 142.

selves. So it was a crushing disappointment when President James Monroe did not name one of them to the new Board of Engineers for Internal Improvements. “Is it honorable to our corps that we are always to remain mere beasts of burden,” Long asked Roberdeau. “Are we incompetent to express our judgment, or to give an opinion in matters of professional duty. ... Are we to be mere chain bearers in the giant work of internal improvement. ... [Are civilians] to be placed over us as directing engineers, while we are to be mere drudges.”

The General Survey Act and the Board of Engineers for Internal Improvements

By 1824 the importance of waterways in the young nation was clear. Rivers were the paths of commerce. They provided routes from western farms to eastern markets. They promised a new life to the seaboard emigrant and financial reward for the Mississippi Valley merchant. Without its great rivers, the vast and thickly forested region west of the Appalachians would have remained impenetrable to all but the most resourceful. But the rivers that beckoned also could destroy the dreams of unwary travelers and shippers whose boats were punctured by snags or stuck on sandbars. Both commercial development and national defense, as shown during the War of 1812, required more reliable transportation arteries. The solution was obvious but difficult: out of those unruly streams engineers had to carve navigation passages and harbors for a growing nation.

In the years before 1824, federal assistance for “internal improvements” evolved slowly and haphazardly, the product of contentious congressional factions and an executive branch that was careful to avoid unconstitutional federal intrusions into state affairs. In 1802 Congress began the practice of appropriating money for specific internal improvements when it authorized a maximum of \$30,000 for the construction and repair of piers in the Delaware River. Seven years later, Congress appropriated \$25,000 to lengthen the Carondelet Canal and to deepen the Mississippi channel at New Orleans. Although by the War of 1812 there was wide agreement that the government would have to guide and assist in public improvements, the war itself temporarily halted improvement programs. The federal government did not authorize money again until 1819, when it appropriated \$6,500 for a survey of the tributaries of the Mississippi



Stephen Harriman Long (1784-1864) graduated from Dartmouth College in 1809. Following a short teaching career, in 1814 he joined the Corps of Engineers as a second lieutenant. He became a Topographical Engineer in 1816. For two years he served as assistant professor of mathematics at West Point. Thereafter he had a wide-ranging career as an explorer, railroad and river engineer, and inventor. His explorations included the upper Mississippi River and its tributaries; the Missouri, Platte, and South Platte; and the eastern range of the Rocky Mountains in Colorado as well as a considerable part of the Arkansas River basin. In the late 1820s, after his important work on the Ohio River, he was assigned by the Department of

and Ohio rivers. In the early 1820s, more money was appropriated for such projects as a survey of the lower Mississippi, seawall and lighthouse construction on the Maine-New Hampshire coast, removing obstacles in Gloucester Harbor, and a harbor survey at Presque Isle, Pennsylvania. This federal assistance was a pittance, however, totaling no more than about \$85,000 between 1802 and 1823.

But in the end money was not the most important form of federal assistance. Indeed, state treasuries and private subscriptions provided most of the funding for the nation's early road and canal expansion. Nevertheless, the federal government rendered one service that was critical to any national program of internal improvements. It provided a body of well-trained engineers dedicated to public service. For a generation after the War of 1812, Army topographers and fortifications engineers designed and constructed numerous national defense and transportation projects. But in the great work of internal improvements, the contribution of the Topographical Engineers was particularly impressive.

Support for an increased government commitment to internal improvements grew gradually after the War of 1812. Each President asked Congress to provide for a federal system of roads and canals and for increased support of the engineering

War to serve as consulting engineer for the Baltimore and Ohio Railroad Company. He soon came to be regarded as an expert in railroad engineering, although friction with the B&O management resulted in his severing ties with the company in 1830. His *Rail Road Manual* (1829) presented tables that eliminated the need for field computations. Later, he surveyed various railroad routes in Georgia and Tennessee and became the chief engineer for the Atlantic & Great Western Railroad. He also served as consulting engineer for a number of other railroad companies. His experience led him to develop a new method of bracing and counter-bracing wooden bridges, and the Long truss bridges became popular throughout New England and elsewhere. In the 1840s and 1850's Long

served as Superintendent of Western Rivers, with the responsibility for ensuring the navigability of the Mississippi and Ohio river systems.

branches of the War Department. Secretary of War Calhoun's 1819 "Report on Roads and Canals" also advocated extensive use of the Army's topographers and fortifications engineers for surveys of these public works. In 1822 Major Roberdeau urged civil functions for Army Engineers, proposing a large corps of Topographical Engineers to develop engineering science for the combined benefit of public improvement and military defense. He cited the lack of civil engineers, the demand for internal improvements, and the military and civil uses of surveys, as well as a need for government encouragement to civil engineering. During the following year, General Bernard also voiced support for a large topographical corps with broad civil functions.

At the same time, western congressmen reminded their legislative colleagues of the importance of internal improvements. There was ample documentation of the need, including Secretary of the Treasury Albert Gallatin's famous 1808 report recommending the construction of various public roads and canals to connect the eastern seaboard with the Ohio and Mississippi valleys. One eastern supporter, Congressman Joseph Hemphill of Pennsylvania, introduced legislation in 1822 to authorize various surveys of proposed transportation improvements. However, Congress did not act on the bill either that year or the next. In 1823 President Monroe recommended that Army

Engineers survey the proposed Chesapeake and Ohio Canal, a project that he thought of great military and commercial value. The President's notion of using Army Engineers dovetailed with a second report submitted by Hemphill, in which he stressed that employing Army Engineers on surveys would "give them experience, and advance their usefulness to their country." Finally, in 1824, led by the redoubtable Henry Clay of Kentucky, proponents of internal improvements had their day. On 30 April 1824, the General Survey Act became law.

The legislation sought "to procure the necessary surveys, plans, and estimates upon the subject of roads and canals." It was a modest act, befitting an administration and Congress generally willing to support legislation that promised much but committed very little federal money. It authorized the President to have "surveys, plans, and estimates" made of road and canal routes (but not rivers) that he deemed of national importance for commercial, military, or postal service purposes. To carry out the surveys, the President was authorized to hire two or more skillful civil engineers and as many officers of the Corps of Engineers as he thought necessary. Congress provided \$30,000 to cover expenses. The act portended a great national program of internal improvements, but it was only planning legislation; no money was appropriated for construction. That important step occurred three weeks later.

On 24 May 1824 President Monroe signed a second important bill. This law appropriated \$75,000 to improve navigation on the Ohio and Mississippi rivers. The act empowered him to employ "any of the engineers in the public service which he may deem proper" and specifically directed that two experiments be conducted at two different Ohio River sandbars to ascertain the best means of removing bars from that river. To clear the Mississippi, the President was authorized to procure the "requisite water craft, machinery, implements, and force" to eliminate various obstructions. While providing navigation channels on the Ohio and Mississippi rivers was of substantial potential military value, there is little question that this act passed in response to the urging of western politicians who were interested mainly in commercial expansion.

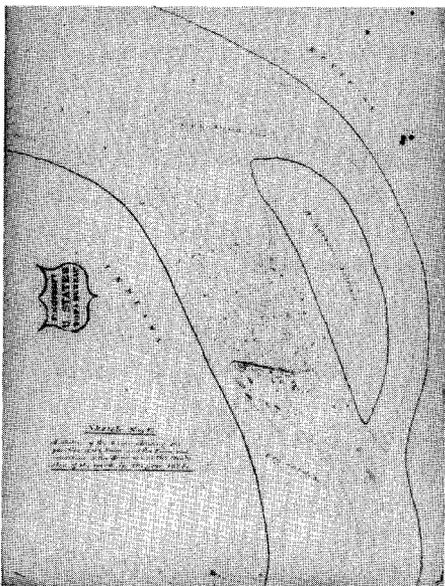
Thus, within one month's time Monroe signed two acts that would have a large impact on the Corps of Engineers and the Topographical Engineers. From that point, both were deeply in-

volved in civil works. When the nation needed engineering talents to design and create internal improvements, it looked to the Army.

At the end of May, Monroe appointed a Board of Engineers for Internal Improvements to administer the General Survey Act. Its members were Chief Engineer Macomb, General Bernard, Major Totten, and civil engineer John L. Sullivan. Although no topogs served on the board, three were attached to it as leaders of the three surveying parties assigned to evaluate possible canal routes. Overall, the President underscored the importance of the new board by assigning experienced and able officers to it. Through the membership of Totten and Bernard, who were also on the Board of Engineers for Fortifications, he also made clear the close relationship between internal improvements and national defense.

Parties known as brigades conducted the surveys under the General Survey Act. In 1830, for example, 13 brigades worked on canal, road, and railroad surveys. Topographers led ten of them; civilians managed the other three. Each brigade had a threefold assignment. It reconnoitered and made a preliminary survey of a potential project. Then it plotted the exact location of the route in question. Finally, it prepared project plans and specifications, including a cost estimate. With only ten Topographical Engineers in the Army, it is easy to see how dramatically this mission changed the work patterns of the topogs. Originally conceived to fill a military need for reconnaissance and maps, the topographers were now deeply involved in national development. They were also well on the way to gaining national fame.

Some controversy centered around who should have the responsibility for the work on the Ohio and Mississippi rivers. Congressman Alexander Smyth of Virginia suggested using the Navy. Reflecting a simplistic, if not simple-minded, view of river improvements, Smyth volunteered the idea that the Navy could build gunboats at Pittsburgh and then send them downstream to New Orleans, presumably obliterating obstructions along the way. Clay and Calhoun supported giving the work to the Army Engineers, who were by far the most experienced and best trained for that responsibility. President Monroe may have been inclined toward the Army Engineers in any case, but the arguments of Calhoun and Clay certainly influenced him, and he directed Macomb to take charge of the river work.



Major Long's 1825 sketch of the wing dam built under his supervision at Henderson Bar, Kentucky. This was the first dam constructed by the federal government and the first in the United States to deepen a channel by increasing the velocity of the current.

While the Engineer Department assumed overall supervision of the surveys and the navigation work on the Mississippi and Ohio rivers, a major portion of the field work fell to the topographers. As it turned out, the enormous amount of work that resulted from the General Survey Act and the great distance separating the survey parties from the Engineer office in Washington necessitated relying on the discretion and competence of the local officers in charge. The animus of fortifications engineers against internal improvements involvement and the nature of much of the work, namely surveying, naturally led to using Topographical Engineers as much as possible, although the Chief Engineer remained in overall charge. By the end of 1824, all ten Topographical Engineers had been assigned to internal improvement projects. The editor of the *National Journal* observed that the Topographical Engineers were no longer being stationed at the entrances to major rivers or along the seacoast as had formerly been the case, but instead were "scattered over the interior of our country, finding the summit levels of our mountains, or tracking the route for vast lines of intercourse through our forests, swamps, and valleys."² Al-

² Quoted in Garry D. Ryan, "War Department Topographical Bureau, 1831-1863: An Administrative History" (Doctoral dissertation, American University, 1968), pp. 19-20.

though understaffed, the topogs set to work developing a system of internal improvements that eventually evolved into the modern civil works program of the Corps of Engineers.

Canal surveys dominated the work of the Topographical Engineers during the first two years following passage of the General Survey Act. The Board of Engineers for Internal Improvements devised a list of 27 canals that were valuable for both military and commercial purposes and rated them in order of priority. A canal to connect the Delaware and Raritan rivers in New Jersey headed the list. Secretary of War Calhoun emphasized the importance to the nation of linking the Potomac to the Ohio River and Lake Erie, of establishing a waterway along the Atlantic Coast connecting major navigable channels, and of building a road from Washington, D.C., to New Orleans. The work overwhelmed a department that numbered only 32 men.

Initially, Congress must have been reasonably happy with the work of the Engineer Department. In 1826 it passed a law that led to an expanded work load for the department. New legislation authorized the President to make river surveys, to clean out and deepen selected waterways, and to carry out various other rivers and harbors improvements. Although the 1824 act to improve the Mississippi and Ohio rivers is often called the first rivers and harbors legislation, the 1826 act was the first to combine authorizations for surveys and projects, thereby establishing a pattern that continues to the present day.

Before long, the work required by specific pieces of rivers and harbors legislation outstripped surveys under the General Survey Act. During the 14-year life of the General Survey Act, Congress appropriated \$424,000 for surveys in accordance with its provisions. On the other hand, rivers and harbors work supervised by the Board of Engineers for Internal Improvements at the behest of Congress totaled \$9 million during the same period. Generally, topogs did the surveys; fortifications engineers supervised construction.

To the extent that Congress was indeed satisfied with the work of the military engineers, the topographers deserved much of the credit. Their work in the field showed that experimentation and innovative design were often superior to the narrower theoretical approach taken by some West Point-trained Engineer officers. By September 1825 Stephen Long, working on the Ohio River just below Henderson, Kentucky, had built a wing

dam consisting of two rows of more than 600 wooden piles, driven to a depth of 16 feet. Between the rows, he placed driftwood and other debris and at the base, broken rock and clay. He experimented with the proper angle, width, and length to achieve the greatest velocity of current. Theory and empirical data both showed that the increased velocity should reduce the sandbar and increase the depth of the river. Long extended the dam another 50 feet and angled it out at about a 45-degree angle. This design worked. The depth of water over the bar ranged from four to eight feet, enough for most vessels of the time. The dam served as the prototype for many others along the Ohio River and required no significant repair until 1872.

Long was not completely satisfied with his work. He realized that the dam would not prevent the formation of bars. Each year, the Ohio would push and carry sediment downstream, forming bars at different points, including at the dams themselves. More and more, he turned his thoughts to mechanical means of improving rivers, including the use of dredges and snagboats and even a diving bell for underwater excavation. Such mechanical contrivances were anathema to those who insisted that theory, properly applied, would allow engineers to regulate a river so as to eliminate natural hazards.

Chief Engineer Macomb also refused to be bound by any one approach. He respected the value of a West Point education, though he himself was not one of its products, but he appreciated the importance of practical experience. So he sponsored a contest to fashion a machine that could eliminate obstructions to navigation. The winner would receive \$1,000 and a contract to open up the Ohio River. The prize went to John Bruce, who designed a simple device consisting of a double-keeled barge that supported a system of pulleys and levers to extract debris from the river. However, Bruce and Macomb disagreed on the contract terms, and the boats Bruce designed proved to be of limited service. Long suggested that Bruce be replaced by Henry M. Shreve, a man known for his navigation skill on the Mississippi and Ohio rivers and for his pioneering efforts to bring trade and commerce to the Mississippi Valley.

Shreve cared little for hydraulic theory. His attitude was to design whatever it took to get the job done, and he settled on building a revolutionary new boat, a steam-powered snagboat. Put into service in 1829, it became the model for steam snag-

boats on the Ohio, Mississippi, and elsewhere. Like Bruce's boat, it was twin-hulled, joined by an iron beam. Unlike Bruce's effort, however, Shreve's boat ran full-steam into the snags, jarring them loose. The limbs then were hoisted and broken apart on the vessel's deck. "Uncle Sam's toothpullers," Shreve's snagboats came to be called. They were the product of American ingenuity, unlike anything known elsewhere in the world, and they had a dramatic effect. Insurance and shipping rates dropped, and the number of steamboats increased significantly on the Mississippi and Ohio rivers. By 1834 Engineer Lieutenant Alexander Hamilton Bowman was able to report that "high-water navigation is rendered comparatively safe and easy. Boats run with security at night, where, a few years since, it was hazardous to attempt a passage even in daylight."³

The Corps' work on the Mississippi and Ohio rivers was considered of paramount importance by western entrepreneurs, but Engineer projects farther east attracted equal enthusiasm and support. By the end of the 1820s, both topographers and Engineer officers were occupied in improving and surveying rivers and harbors from one end of the country to the other. From 1826 to 1838, annual rivers and harbors acts expanded the number of projects and appropriated more money for ongoing work.

There were never enough Engineer officers of either description to handle the work. Each year many petitions for surveys went unanswered. Congress also turned down pleas for increases in the number of topographers and Engineers from Secretary of War James Barbour in 1825 and from the topographers themselves two years later.

Although additional positions were not approved, the topographers did win representation on the Board of Engineers for Internal Improvements. Major John J. Abert, the senior man after the January 1829 death of Major Roberdeau, was appointed to the board that year. The victory did not amount to much, however, because the board itself was about to be abolished. Its usefulness had diminished once its responsibility for identifying locations for engineering work was completed. Besides, by that time, Congress, rather than the board, was dictating surveying

³ Quoted in Louis C. Hunter, *Steamboats on the Western Rivers, An Economic and Technological History* (New York: Octagon Books), p. ZOO.

requirements to the Army. So when General Bernard left the board in August 1831 to return to France, the Board of Engineers for Internal Improvements was terminated.