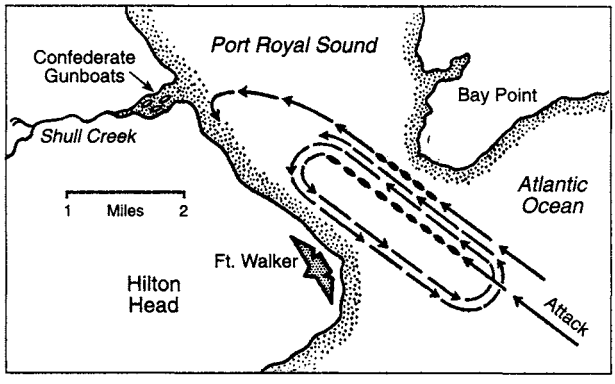
Gaussian mechanics and U.S. naval warfighting



Captain Charles Henry Davis, Bache's chief assistant at the U.S. Coast and Geodetic Survey, was a leading collaborator of Carl F. Gauss; Davis translated Gauss's seminal work on the calculation of celestial orbits into English. Davis introduced a new principle into warfare which led to a vital Union success early in the Civil War: the capture of Port Royal, South Carolina, in November 1861. Davis, fleet chief of staff under Adm. Samuel F. du Pont, developed an "expanding ellipse formation," which permitted what was then the largest U.S. fleet ever assembled to capture the two forts protecting Port Royal. This reversed the standard theories which held "that one gun on land was equal to four on water." As detailed by David D. Porter in his *Naval History of the Civl War,* this action opened the gateway to the capture of other Rebel cities such as New Orleans.

Admiral du Pont divided his fleet into a main squadron of nine heavy ships and a flanking squadron of gunboats. The two columns passed midway between the forts. The main force turned about in the sound and plied a narrow ellipse between the two forts until their fire was reduced by the naval bombardment. The ellipse was then expanded so as to bring the naval guns closer to the forts, increasing the effect of the artillery.

This was not the only application of Gaussian elliptic functions and celestial mechanics to naval warfighting. Admiral Porter utilized the mathematical hydrodynamics which had been taught to him by Davis's Coast and Geodetic Survey, in his successful navigation and conquest of the Mississippi with General Grant.—*Charles B. Stevens*

for all others. Bache established at Central High the nation's best-equipped astronomical observatory; Central High's astronomer, Sears Walker, quickly taught Bache's magnetic-observatory assistant Chauvenet the most advanced methods of the German astronomers.

In 1842, Commodore James Biddle, brother of Nicholas Biddle, made William Chauvenet head of a school that had been informally established within the Philadelphia Naval Asylum, the elderly seamens' home under Commodore Biddle's command. With Bache's help, the 22-year-old Chauvenet put old and young sailors through sophisticated courses in geometry, astronomy, and other navigational sciences.

In 1843, Bache was appointed head of the United States Coast Survey. He made the survey into a school for geodesy and hydrography for the entire military establishment, and the powerful base through which the federal government recruited and trained scientists. The work on oceanography under Bache (continuing the field developed by Alexander von Humboldt and by Benjamin Franklin), and mapping of the entire coastline, would allow the Union to impose a powerful blockade on the South during the Civil War.

Also in 1843, the U.S. Congress, under Henry Clay's close control, financed the implementation of Samuel F.B. Morse's telegraph (Morse had invented a good code, but only reluctantly conceded that he had not "invented the telegraph"). A.D. Bache and Sears Walker then developed the method of longitude computation by telegraph.

In 1845, Bache and his allies prevailed on the government to move William Chauvenet's naval school from the Philadelphia Asylum to the Army's Fort Severn in Annapolis, Maryland. Navy Secretary George Bancroft appointed Anglophile Cmdr. Franklin Buchanan to be superintendent; Buchanan later joined the Confederacy in the Civil War. But William Chauvenet continued in charge of the school's instruction and overall organization. He taught astronomy, navigation, geometry, and other mathematics; he and the nationalist Commodore Matthew Perry were the school's principal overseers. Before long, the name was changed to the United States Naval Academy.

Anti-nationalists had blocked the Academy's birth since it was proposed by Alexander Hamilton in 1799. But Bache's patriotic *Lazzaroni* scientists were too powerful, even taking over Harvard and Yale. It was also helpful that Bache's uncle, George M. Dallas, was U.S. vice president, and that Treasury Secretary Robert Walker was Bache's brother-in-law.

The Smithsonian Institution was founded in 1846, due principally to John Quincy Adams's fight for it. On Bache's recommendation, physicist Joseph Henry was appointed Smithsonian chief. Henry created the modern weather service, based on reception of reports by telegraph.