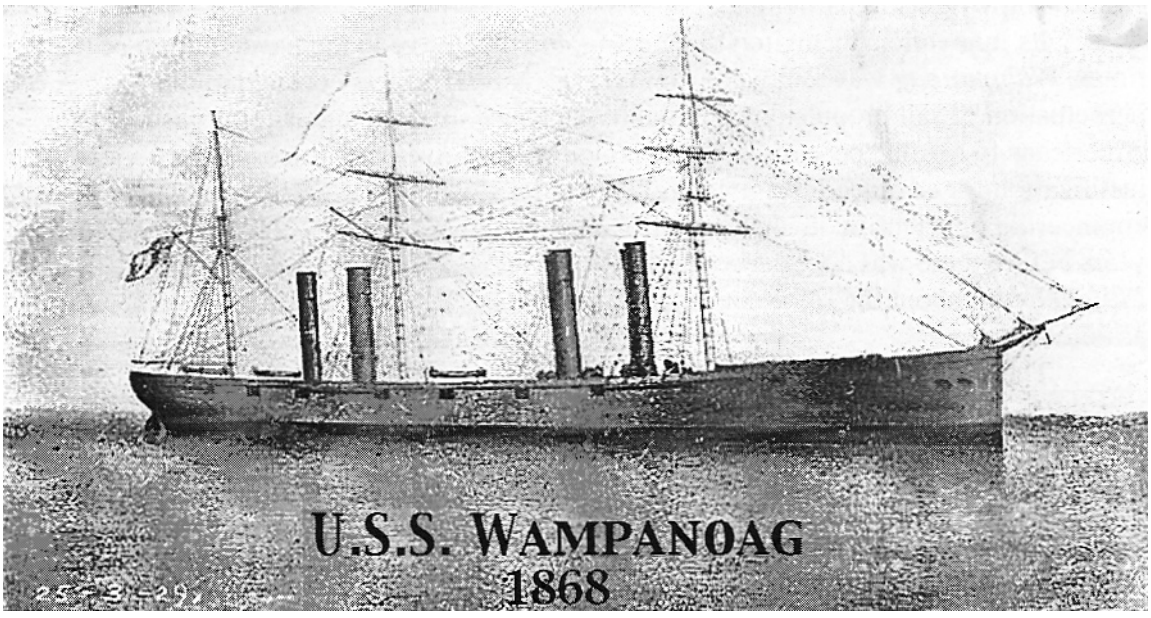
Disruptive Technology

Technology can catalyze transformation, and frequently is a prerequisite for same, but it is rarely sufficient for transformation. In short, it is futile to expect adoption by an armed service of a patently superior new technology absent provisions for easing its impact on service culture. Service cultures are different (and should be), but the Navy is particularly reluctant to embrace disruptive technology.

For the best assessment of the topic of this essay, I nominate Elting Morison's MIT lectures of the 1950's and '60s, and his great uncle's papers, from the 1890s, published one hundred years ago. The younger Morison presented one of the more perceptive commentaries on the interaction of innovative technology with American military institutions,[1] while the elder[2] was, as far as I am aware, one of the first to observe that the more genuinely transformational the new technology, the more it disrupts:

> **" ... In many ways the new epoch must open as an era of destruction ... both in the physical and the intellectual world, of old buildings, and old boundaries and monuments, and furthermore, of customs and ideas, systems of thought and methods of education ... the danger is that the destructive changes will come too fast, and the developments which are to take their place not fast enough. The trouble will lie in the gap between the two. The next two or three centuries may have periods of war, insurrection and other trials, which it would be well if the world could avoid…"**

The more recent Morison was impelled to undertake studies of the impact of disruptive technology by inventions that transformed the U.S. Navy from sail to steam, especially an initial step that he referred to as "the strange history of the steam vessel ***Wampanoag***."



The American Civil War stimulated military applications for advanced technology of the era, e.g., the electric telegraph, balloons, railroad transportation, rifled cannon and breech-loaded firearms. In naval warfare, iron clad and steam propelled vessels were introduced. But few of these could be termed

[1] Morison, E.E. Men, Machines, and Modern Times. MIT Press, Cambridge, 1966.
[2] George Shattuck Morison. Ibid, 13-14

disruptive, in that warfare on both land and sea continued to follow already familiar patterns, albeit facilitated by the adapted technologies. Thus *Monitor* and *Merrimac,* while certainly state of the art for naval architecture of the time, merely initiated a rush to up-armor floating batteries, and to employ ramming tactics within the construct of the Navy's traditional missions of coastal defense and riverine warfare. The Engineer in Chief of the U. S. Navy during the war was Benjamin Franklin Isherwood, who, though unschooled, was a leading authority on maritime steam engines. Up until 1863, he spent most of his energy on installing auxiliary steam power in sailing vessels.[3] In that year however, new threats materialized. The Confederate commerce raider *Alabama,* a frigate capable of a sustained speed of 9 knots, was wreaking havoc among Union merchantmen, and President Lincoln was warned that England, to assure its continued access to Confederate cotton, was likely to use its formidable fleet to drive from the seas both his navy and his merchant marine. Isherwood proposed to Secretary of the Navy Gideon Wells an offensive counter: ships of superior speed, firepower, and endurance that could maraud shipping lanes with impunity, destroying Great Britain's commercial shipping.

The Secretary directed that four contracts be let to construct four prototypes that, in Isherwood's word, "were to be built for business and not for glory. They were solely to attack the enemy's purse, and bring him to tears of repentance in that most tender point." Two were to be built by Isherwood in government shipyards, a third in a private yard by John Ericson, the thorny designer of *Monitor*, and a fourth, also in a private yard, by E.N. Dickerson, a peer competitor and voluble critic of Isherwood. All four ships were laid down in 1863, and though none were finished by the end of the war, the Secretary of the Navy assured that all were eventually completed by early 1868.

Dickerson's *Idaho* in its trials broke down frequently, and never exceeded a sustained speed of 8.27 knots. Erikson's *Madawaska* did better, but never came within 2 knots of her design speed of 15 knots, and was judged difficult to handle at sea. Isherwood's *Wampanoag*, however, was a remarkable success.

Commissioned in 1868, named for the Algonquin tribe of southeastern Massachusetts, *Wampanoag* measured 355 feet on the water line, with a beam of 45.2 feet, displacing 4200 tons. Her sleek iron hull was built around an Isherwood-designed engine of two cylinders, each 100 inches in diameter with a 4-foot stroke. Her drive train used wooden gears shafted to a propeller 19 feet in diameter. In her sea trials in February 1868, she maintained sustained speeds greater than 17 knots —steaming efficiently three knots faster than her design speed, carrying two 100-pound guns, one 60-pounder, ten 8-inch guns, and four howitzers. A board of engineers reported that her records set during the trials could not be equaled "for speed or economy by that of any screw vessel of either the merchant or the naval service of any country." There could be no doubt of her achievement: the fastest ship afloat at that time was a merchantman, the *Adriatic,* which once ran a measured mile in smooth water at a speed of 15 knots. In fact, the Wampanoag's records stood unexcelled for two decades. In short, she put the U.S. Navy a generation ahead of all others.[4]

In 1869, a newly appointed Secretary of the Navy convened a board of naval officers to assess all steam machinery afloat. Their report[5] enumerated several particulars in which *Wampanoag*'s design departed from convention, e.g. the grate surface under her boilers exceeded the area of the immersed midsection; her length would present an immense target for an adversary; her narrow beam would induce much rolling; when she was under way with steam propulsion, no ship in the fleet could keep up with her, yet under sails

[3] Ibid. 103, 107. At the start of the war the U.S. navy had some 90 ships, of which 21 had steam auxiliary power. Isherwood personally directed the addition of 600 steamers to the fleet between 1861 and 1865. Admiral Sampson

[4] Ibid. 111

[5] U.S. Document 1411, 41st Congress, 2d Session, 1869-70, Vol. One, Part One.

alone, she enjoyed no advantage over other cruisers. In their perception, however, the ship's main drawback was that she could not serve the purposes of training. To quote the report further:

> **"Lounging through the watches of a steamer, or acting as firemen and coal heavers, will not produce in a seaman that combination of boldness, strength, and skill which characterized the American sailor of an elder day; and the habitual exercise of an officer, of a command, the execution of which is not under his own eye, is a poor substitute for the school of observation, promptness and command found only on the deck of a sailing vessel."**

Despite reports from observers of her 1868 trials to the contrary, the board believed that so large a vessel would produce "a difficulty in maneuvering either to gain or to maintain a position." The ship, they concluded, was "a sad and signal failure, and utterly unfit to be retained in the service." No modifications could improve her; she was "too much of an abortion," "a happy riddance."

The Secretary sought a second opinion from two other officers who had been favorably impressed with ***Wampanoag'***s "steady," "efficient," and "easy" performance at sea, but these thought she should be substantially modified in that they believed that the Navy no longer had a strategic or tactical requirement for a vessel of such high speed and long range. Still another group of senior officers advised the Secretary against proceeding further with steel and steam, noting that, while ironclads were absolutely necessary for war, they were unnecessary in peacetime, and given the availability of eastern timber to build more sailing vessels, risks could be accepted in the interests of the nation's economy as a whole, and the sustentation of eastern shipyards in particular.

Wampanoag's innovations being altogether too threatening to the naval culture of her era, she, and her sister ship *Amonoosuc* were removed from service. Wampanoag was renamed *Florida*, and stationed as a naval receiving ship at New London, where, several years later, she was sold out of the Navy. The US Navy waited twenty years before there was a vessel comparable to ***Wampanoag*** in the fleet, the USS ***Philadelphia***, about the same size and speed, but less well armed, albeit more heavily armored.

Naval officers of the Civil War era considered the perpetuation of sail propulsion essential to the Navy's future, and, anxious as most Americans to regain "peacetime," they no longer perceived a politico-military justification for such advanced technology. Admiral Sampson, whose squadron defeated the Spanish fleet at Santiago, Cuba, in 1898, firmly believed that "as sail is the primary motive power, it is considered a sufficient concession to admit steam on any terms."

In Morison's view, "The problem is not primarily engineering or scientific in character. It's simply human."