Part I

Far-called, Our Navies

1
The *Tamar*, Troopship Design, and Rapid Technical Change

It was not a very nice day. The "numerous spectators" who had gathered at Samuda's Shipbuilding Yard on Tuesday, 6 January 1863, must have felt relieved that the launching had not been on the previous day.[1] As they gathered during the morning for the 1 p.m. ceremony, the wind had only recently dropped from the winter gale that had blown the previous day and overnight. "Heavy rotary gale with rain" followed by "snowy" is what the daily weather report for Monday, 5 January had noted for London. But even without the wind and snow, Tuesday was a typical English January day: cold at 43°F (6°C) and almost completely overcast with nine-tenths cloud, misty and raining. The wind was force three southerly, so blowing right up Blackwall Reach, on the west shore of which Samuda's yard lay. It would have felt like it was several degrees below freezing to those attending the launching, though the idea of wind-chill was still eighty-three years in the future.[2]

We know these details because in the world of sea-going, as indeed for the world at large, these were practically and intellectually revolutionary times. Revolutionary times of which, in her own rather out of the ordinary way, the *Tamar* was an interesting example.

Only two years before the *Tamar*'s launch, Charles Darwin's old voyaging companion, Captain Robert Fitzroy, had begun the first daily weather reports from the Meteorological Department of the Board of Trade, of which he had become the first Director on its founding in 1854.[3] In doing so, he was using the calibrated weather reporting language in a world still without instruments for accurately measuring wind speeds, which had been introduced into the Royal Navy's Surveying Service by Francis Beaufort, seventeen years previously,[4] itself a landmark in the development of systematic maritime meteorology.

So, for the day when HMS *Tamar* was launched, we have that laconic report, in one brief line of coded data, of what sort of a day it was when she slid down the ways. We also know that another gale had blown in during the rest of the day, bringing with it more rain and snow. It would have been a miserable end to the day as the newly launched ship was towed north, up Blackwall Reach to the East India Dock, where her 500 NHP Ravenhill and Salkeld, two-cylinder engine was to be fitted before she was to be taken onward downriver to Woolwich Dockyard for rigging, arming with her four guns, and fitting out.[5] Though as it happened, that is not quite how things turned out.

The *Tamar* was being launched into a Royal Navy and a maritime world on the cusp of a revolution, not the least of which was the ever-improving knowledge of the world's weather systems. But in 1863, the infant science of weather forecasting was more promise than substance. The focus in the maritime world, and especially its naval fraction, was very much on the major upheavals in technical matters that, whilst still in progress, were well launched and beginning to utterly re-shape the Royal Navy.[6] New building materials, fast-changing naval guns, complete upheaval in propulsion systems, and everything these changes implied for management, training, tactics, strategy, and deployment, meant that over the last half of the nineteenth century and the first decade of the twentieth (a little longer than the span of the career of Henry Keppel, who commanded the corvette *Dido* in the First Opium War and died an Admiral of the Fleet in 1904[7]), the Royal Navy and its ships were utterly transformed.

When the *Tamar* was launched, the new building material — iron — was continuing to pose problems for naval architects.[8] The new means of propulsion — the steam engine — was still in its comparative infancy and could not be relied upon entirely as a prime mover, despite the final triumph of the more efficient propeller over the paddle some fifteen years previously. So, for a shipbuilding tradition that had for centuries built some of the world's finest wooden vessels, the key questions revolved around how to build an iron ship that needed both boilers and steam engines, and a full sailing rig. Should iron just be treated in architectural and engineering terms as if it were wood, with the internal spaces being shuffled around to accommodate the new machinery and its fuel? Or was there a better way? Radical answers to those questions existed already, but in this conservative profession, they would take until the first decade of the twentieth century to be accepted.[9]

Like almost all ships of her epoch, the *Tamar*'s design was a provisional answer that looked as much backwards as it did forwards.

At a casual glance, the *Tamar* looked more like a sailing ship than a steamship. Indeed, to many a subsequent commentator, including a Royal Naval Commander in Hong Kong at the time of her scuttling (who should have known better), it seemed as though she had in fact been built of wood.[10] This is not just because of the dominant masts and yards of her barque rig,[11] but also the elegant clipper bow, the figurehead, the long bowsprit, and the sweet counter stern. These were familiar features of the hulls of the contemporary sailing clippers and packets that still thronged the waterfronts and carried the bulk of passengers and trade in 1863.

The *Tamar*'s hull was manifestly designed to sail as much as it was to steam, possibly more so. This approach was on the cusp of being rapidly overtaken by technical change, but when the *Tamar* was designed and built, this change was yet to come. What we might think of as scientific naval architecture, the product of theory, elegant mathematics, and empirical testing at the time just emerging and still often labelled "naval science", was only to come into its first blossom almost a decade later. For Britain, it was from 1870 to 1890 that the real transformation of ships took place.[12] In fact, this was a period of such marked uncertainty for Royal Navy ship design that D.K. Brown, following Nicholas Rodger's lead, called it the "Dark Ages".[13] It was when naval architecture was fully professionalised, the key problems governing ship design were first fully theorised and tested, the instrumentation vital for doing the necessary calculations to evaluate designs became available, and marine engineering made the great leap forward to high pressure boilers and the triple expansion engine. But the *Tamar* was designed and built before all of this.

It is instructive to compare a photograph of the *Tamar* with that of an Indian troopship like the *Dalhousie* (built just two decades later in 1883 and was still serving in the Second World War) or the *Warren Hastings* (built another ten years on in 1893, just before the *Tamar*'s last voyage, but wrecked on Réunion in 1897). The differences are dramatic — the *Tamar* is a revenant from the age of sail, whereas the *Dalhousie* and the *Warren Hastings* are manifestly steamers. The result for the *Tamar*, not least because of the hard work that the demands for an armed presence throughout the empire required of her, was to be a working life interrupted by two major, and very expensive, refits which involved both re-boilering and re-engining (and one of them re-rigging too), as well as regular routine refits to try not to fall too far behind the pace of change.

The old world of towering sail that had built the foundations of the still growing British Empire and carried its rapidly growing trade was beginning what would prove to be a rapid decline.[14] By the last half of the 1880s, steamships already formed half of the world's tonnage, although it took until the turn of the century for steamships to outnumber sailing ships.[15] So in 1863, the sailing ship was still predominant, especially in the Royal Navy. Traditional prejudices aside — and they have ever been exaggerated — the answer to why this was the case is not hard to find. Early steam machinery was chronically inefficient. Boiler pressures were low, and the steam they inefficiently generated was used only once in moving the engine's pistons. In consequence, they consumed coal at a galloping rate in relation to the horsepower generated. Some quick numbers will make the point.

Boilers in the *Tamar*'s early service operated at pressures less than 30 pounds per square inch and consumed between 2.3 and 3.14 pounds of coal per hour for every horsepower generated — for example, the *Orontes*'s first boilers worked at 25 psi.[16] The *Tamar*'s first boilers will have been much the same, powering an engine that was rated at 1,869 IHP. So we can infer that she consumed between 1.92 and 2.62 long tons of coal per hour of steaming.[17] Her service speed was 10 knots and her bunker capacity about 1,000 tons.[18] From the latter figure, her endurance can be estimated to have been between 380 and 520 hours with a clean bottom in a flat calm, so her range would have been to the order of 3,800 to 5,200 nautical miles in perfect conditions. Allowing for a steadily fouling bottom and the effects of an average sea state, the range for planning purposes was probably around 4,000 nautical miles — enough to cross the Atlantic but not enough to make a round trip and not much more than half of what was needed to reach the extreme of her intended service area, Cape Town.[19]

Given that a ship can only afford so much space for coal if it is to have sufficient space left for its machinery and for serving its fundamental purpose, whether the prosecution of war, or the carriage of people or cargo, and given a prudent policy of always trying to have aboard a reserve of fuel, it followed that steaming ranges in the 1850s were often under 2,000 nautical miles. Even with the technical improvements of which ships of the *Tamar*'s vintage were partial beneficiaries, a working range before refuelling in the 1860s would have been at most 3,000 nautical miles, and a prudent policy would have been, and was, to bunker whenever a reasonable opportunity arose. Indeed, a review of the *Tamar*'s voyages indicates that, unless there were operational reasons for making a fast run with minimum stops, the last useful coaling station would be used to top up before a major ocean crossing (e.g., Europe to the West Indies or Europe to Africa). This is why, for example, Gibraltar, Madeira, and St Vincent in the Cape Verde Islands feature so often in the early stages of the *Tamar*'s westbound and southbound trooping runs. It is also why, when we look at the elegant chartlets that adorned the first four logbooks, we see the ship following seasonal routes recommended for sailing vessels.

There were two ways of dealing with the problem of ensuring that relatively inefficient boilers and engines did not run out of coal. The Royal Navy resorted to both as it began converting to steam and building troopships. One was to have a world girdling network of secure coaling bases where coal of the required quality and volume could be held in readiness.[20] This method was, in its own way, a contributory cause to the imperial expansion in which the *Tamar* was to assist. The other, given that the dictates of geography and politics did not necessarily guarantee that coaling stations were ideally placed or that even when they were they would always be either British-controlled or controlled by a friendly power, gave the new-fangled steamships a fall back means of propulsion. From this came some of the major determinants of *Tamar*'s design, specifically her three masts, dozen or so sails, and thicket of rigging, that elegant bowsprit and that sweet, if rather staid and dowager-like, hull.[21]

Unfortunately, this early auxiliary steamer, like many a compromise, was an indifferent performer. The first logbook is blunt about the ship's sailing qualities, as would be subsequent comments: "The ship sails well off the wind for the quantity of sail she has. On a wind she does but little."[22] Though it goes on to note: "She rolls very easy at all times and without appearently [*sic*] straining." These comments would have come from the ship's Master, Edwin Wise, who was responsible for navigating and handling the ship.[23]

The *Tamar*'s design was a transitional one. In the early 1860s, people in the maritime world were inclined to be conservative, and this was for good reason. Even today, the sea is neither a fully understood nor a fully mastered environment. Thus, in these comparatively early years of the scientific and technological revolution when the *Tamar* was built — with no tank testing and few stability calculations — it was a wise, failsafe strategy to follow what was known to work because it had been the practice for decades or even centuries. The answers, therefore, to how an iron auxiliary steamship should be built and what it should look like were that it should look pretty much like a sailing ship and be built much the same way.[24] The design that resulted was a product of the Admiralty's Chief Constructor's office, run by the Chief Constructor, Isaac Watts, who had been working under Rear Admiral Sir Baldwin Wake Walker, the Controller of the Navy (who until 1859 was called the Surveyor of the Navy) and the official responsible for deciding the basic design requirements for any new class of ship.

Watts, about whom not a great deal is known, was a transitional figure as far as ship design is concerned. He was schooled in Britain's only contemporary "theoretical" school of naval science, the School of Naval Architecture in Portsmouth, but he was trained in the old-fashioned way, working in the "old" world of artisan shipbuilders in the Royal Dockyards from his graduation in 1821 until he was promoted to the Admiralty in 1848 as an assistant surveyor.

At the Admiralty, he was one of two men responsible for the basic design of all Royal Naval vessels culminating in the revolutionary HMS *Warrior*, launched in 1860.[25] As David Brown put it, Watts oversaw three great revolutions in the design of warships — steam, the propeller, and armoured, iron build — but although he was a great designer, his approach was incremental. He accepted new materials and systems but lacked the tools that might have allowed him to approach the design of modern iron steamships with less regard to past practices.[26]

His boss, Wake Walker, had moved on to become Commander-in-Chief of the Cape of Good Hope Station in February 1861 but, from such evidence as there is, it seems probable that he would also have had a hand in the initial planning of the two new ships since the first tenders were invited more or less simultaneously with the end of Walker's tenure.[27] However, fine-tuning those plans as the tenders were submitted will have been the responsibility of Wake Walker's successor, Rear Admiral Robert Spencer Robinson, arguably one of the most influential Controllers and considered one of the cleverest Victorian admirals (though that is admittedly not a particularly high bar to leap).

Although he was a rare enthusiast for steam in the mid-Victorian Royal Navy, Robinson would still have been feeling his way into his new appointment over the balance of 1861.[28] This was the same period when the designs of the two new troopships were out to tender with the shipbuilders — Laird Brothers of Liverpool[29] and Samuda's of Millwall.[30] It is thus unlikely that Robinson's input would have been significant, being that troopship design would not have been his top priority. However, we know he was at least minimally involved because he signed off on at least one of the *Tamar*'s drawings.[31]

The design requirements for the two vessels broadly conformed with those of the *Himalaya*, a liner launched in 1853 and operated by the Peninsula and Orient Steam Navigation Co. (P&O) before being bought for naval service in 1854 in reaction to the Transport Department's difficulties during the Crimean War. The *Himalaya* herself was a curious example of how much ship design at this stage was a matter of intuition and feeling. In this manner, the P&O had felt its way to what was, at least for a few months after its launch in 1853, the world's largest passenger liner. Unfortunately, they had got their sums wrong, and the huge, amply powered steamship promptly proved ruinously expensive to run. So, when the authorities found themselves strapped for tonnage as the Crimean War hotted up, the P&O was delighted to be able first to charter[32] and then to sell their behemoth to the Transport Department for the £130,000 it had cost to build it.[33] This is actually a major hint about the rather out-dated look of both the *Tamar* and her sister ship *Orontes*. If one places pictures of the *Himalaya* and the two new troopships side by side, they are markedly similar, differing only in terms of rig, size (the two new ships were some 20% smaller), engine power, and service speed. Indeed, when the tenders were invited, the two new ships were described as of "the Himalaya Class".[34]

In short, the job of Watt's very small office — "by 1860, the design staff at the Admiralty consisted of only eight souls: one surveyor, two assistants to the controller and five draughtsmen"[35] — had been to produce a set of drawings that would result in a purpose-designed, reduced-size troopship version of an eight-year-old passenger liner. One can also remark in passing, noting the disparity between the volumetrically larger *Himalaya*'s displacement (weight on the scales, as it were) and those of the smaller new vessels (see Table 1.1), that evidently the Royal Navy's requirements were for much more stoutly built and rigged hulls than life in the merchant marine required.

Tenders were invited from eight shipbuilders in early 1861. However, even though one of the first breakthroughs in making the production of ship designs more scientific had been published before the *Tamar* and *Orontes*'s lines were drawn — Frederick Barnes'

Table 1.1: The Three Ships of "the Himalaya Class"

	Himalaya	*Orontes*	*Tamar*
Launched:	4 May 1853	22 November 1862	5 January 1863
Displacement:	4,690 tons	4,857 tons	4,650 tons
Tons burthen:	3,553 BM	2,812 BM	2,812 BM
Length:	340 ft (100 m)	300 ft (91.44 m)	300 ft (91.44 m)
Beam:	46 ft (14 m)	44 ft, 8 in (13.6 m)	44 ft, 7 in (13.59 m)
Propulsion:	2-cylinder, single expansion Single screw	2-cylinder, single expansion Single screw	2-cylinder, single expansion Single screw
HP:	700 NHP; 2,609 IHP	500 NHP; 2,143 IHP	500 NHP; 1,869 IPH
Sail plan:	Full-rigged ship	Barque	Barque
Speed:	14 kts steam 16.5 kts with sail	12.4 kts steam 14 kts with sail	12 kts steam 14 kts with sail
Crew:	213	210	210

Source: Technical details from Winfield (2014), pp. 383–385.

shortened method for stability calculations[36] — it was not until four years after the ship's completion that any such calculations began to be done. The same was true for the more testing problem of knowing how to work out the power necessary for a required design speed for a given hull form. The work of William Froude, encouraged by Isaac Watts's successor, Edward Reed, was not to yield significant results until the late 1860s.[37] Thus, the drawings for the two new troopships would still have been informed by accumulated experience plus a "hunch factor" and backed by the primary motive that had lain behind the production of drawings for the previous two centuries — making sure that the minimum amounts of time and building materials were wasted in order to contain costs.[38] The *Tamar* and *Orontes*, if not exactly the products of a backward-looking naval architectural vernacular, were nonetheless products of an age that was passing.

In the former respect, the existence of a half-model for the *Orontes*,[39] which suggests there had once existed one for the *Tamar* too, is indicative of this transitional stage. For before the developments towards today's computer-generated hull lines, half-models were used by builders to help develop a ship's lines — its underwater shape — from preliminary drawings and specifications. These lines were thus seen and felt to be fair by those with experienced eyes and hands, although by the time the *Tamar* was designed this was a declining practice, and the main use of half-models was to plan the plating scheme.[40]

Looking back with hindsight, it can seem as though the world of nineteenth century shipbuilding was changing very rapidly in response to technical changes in materials and advances in marine engineering and naval architecture. In fact, the changes were comparatively gradual and the shift from what was essentially traditional craft shipbuilding to the modern, industrialised model was quite slow. In this sense, iron ships were built very much as wooden ships had been, with change making only slow inroads. This is excellently illustrated in the pages of what became the fundamental contemporary shipbuilding text in the years after the *Tamar*'s launch, Edward Reed's *Shipbuilding in Iron and Steel* of 1869.[41] Reed was a trained naval architect and, in 1860, was on the ground floor of the creation of the new professional body, the Institute of Naval Architects. He was also the Chief Constructor who succeeded Isaac Watts, rather neatly marking the extent to which the *Tamar* was a ship of an earlier, if transitional, epoch.

Reed's book marvellously illustrates an interesting balance of suck-it-and-see experimentation, post-failure analysis, and empirical testing. For example, he describes three different ways of building a keel with a "best practice" in the process of emerging, but not yet regnant. There were two ways of building a stem (bow), three for a sternpost, three different ways of framing, and four styles of plating with no firm basis of choosing one rather than another. There are unresolved arguments over whether it is best to drill or punch the holes in the ship's plating through which the plates will be riveted. Steel is still a manifestly uncertain material. And although a trend towards standardisation can be discerned, Reed also describes five different processes for the actual business of building a ship depending on where in Britain it was being built, and two systems of rules establishing construction standards for civilian ships — the Lloyd's and Liverpool Rules. The *Tamar* was built in a technical world in flux.

The finalisation of the invitations to tender for the two ships was controversial. As seems to have been usual, the *Army and Navy Gazette* led the charge in the discussions. Criticisms were also reported in the *London Evening Standard* and said that it was hard to explain why Laird's of Birkenhead and Samuda's of Millwall — especially the latter — had been preferred. With some detailed comparisons of quoted costs — £26 per ton for Laird's and £24.5s for Samuda's — the critic argued that either Laird's, which had the lower materials, labour, and rental costs by perhaps £2 per ton, would be making a killing or Samuda's "will have to regret their participation".[42] Somewhat inconsistently, he then went on to argue that he had been informed that four other firms — one in London, one on Merseyside, one on Tyneside, and one in Hull — had all quoted lower prices. This was all by way of a preliminary to hinting at a put up job:

> We can scarcely believe, as several parties have insinuated, that the calling for tenders from eight firms was a mere farce, and that it was predetermined to give the contracts to the two houses already mentioned. It is to be hoped that the government will be afforded an opportunity to explain their conduct in this matter, for as it stands at present it is beyond our comprehension.[43]

The criticism was met by an indifferent silence, although subsequent news about the *Tamar* not being fit for service when launched and the long running saga of the costliness of both ships during their lives, suggests that the critic was not boxing entirely in the dark.

The *Tamar* was slow to be completed, something which also excited some adverse comments in the press. As the influential *Army and Navy Gazette* put it, announcing the *Tamar*'s launch: "Messrs. Samuda have been somewhat behind in carrying out their contract, but have been fortunate enough to escape any mark of displeasure from the Admiralty for their dilatoriness."[44] Why there was a delay is nowhere stated, though the most likely cause would have been the very crowded state of the Samuda's order book.

While the *Tamar* was on the stocks, Samuda's was one of the busiest yards in Britain and certainly the busiest on the Thames. During the *Tamar*'s build period, the yard also had in build two vessels for the Viceroy of Egypt,[45] two liners for the P&O (the *Carnatic* and *Rangoon*), two vessels for the Peruvian government, a new and radical vessel for the Royal Navy to which we shall return, and some smaller ships for the Mediterranean trade — in short, a total of eight large ships and an unknown number of smaller craft.[46]

For all the standard puff in the announcements of the *Tamar*'s launch and the ship's status as one of the first two purpose-designed Royal Naval troopships ever to slide down the ways, the *Tamar* would not seem to have been the cynosure of new construction or considered to be breaking sufficient new ground for the Royal Navy to warrant any major presence at the launch or for the launch to invite any sort of public fanfare. Far from some great dignitary or Royal Naval Pooh-Bah's wife or daughter blessing the ship,[47] the champagne bottle was swung by Miss Ada Bertha D'Aguilar Samuda, the daughter of Joseph D'Aguilar Samuda, the survivor of the two founding brothers of Samuda's Shipbuilding Yard.[48] But if the ship Miss Samuda was launching was an elegant vessel, she was obsolescent almost as soon as she entered service. As a splenetic article in the *Army and Navy Gazette* put it a few months later, the Admiralty "were pursuing a wrong course in constructing a vessel … [that] has been … a perpetual source of trouble and expense".[49] They were prophetic words. By 1888, after the *Tamar* had undergone the biggest refit of her service life, her £133,000 cost had been trebled by the £289,000 that had been spent on refitting her.[50]

Indeed, no sooner had she been launched than her entry into service was promptly delayed while the designed accommodation was expanded. Rather than the original design's capacity of 900 troops and 80 officers, or perhaps markedly less — numbers typical for a peacetime regiment — she would be able to carry the same unit at its wartime establishment of 1,078. It needs to be noted at this point that such figures for military units are notoriously hard to pin down, there often being a marked difference between a unit's establishment (how many personnel it was in theory intended to have) and its strength (how many personnel it actually had from time to time). Worse, the purely military number made no allowances for dependents who, as we shall see, could quite easily add two hundred or so to a full battalion's numbers.[51] This need for upgrading to accommodate fluctuating passenger numbers was to be a constant feature of the ship's long and hard-working life.

The Royal Navy's technical focus was in fact elsewhere. As one contemporary newspaper reported, the world's largest navy, anxious to maintain that status, would be launching fourteen other ships in 1863, including four powerful 50-gun armoured screw frigates (all developments of the *Warrior*), five 34-gun armoured screw frigates (some of them smaller, cheaper *Warriors* in naval eyes), a 22-gun frigate, and the experimental "shield ship", the *Enterprise*.[52] This was part of the rolling response to the geostrategic challenges of empire, culminating in the Naval Defence Act of 1889 that enshrined in law what was called the "two power standard" — an almost perfect expression of the crippling destiny of a massive seaborne empire.

When the *Tamar* was laid down, the Royal Navy was at the beginning of a see-saw experimental period that had begun with the launch of the revolutionary HMS *Warrior* on 29 December 1860, and was to end, after not quite two generations of frenetic development in hull and machinery design as well as in naval artillery, with the launch of the even more revolutionary HMS *Dreadnought* in 1906.[53] The marker for a stage in this process that was contemporary with the *Tamar* and being built alongside her at Samuda's was the first of a new and experimental design that was very much a pointer to the future. This was the armour-plated screw cupola ship *Prince Albert*, designed by the radical (and eventually tragic) Captain Cowper Phipps Coles.

Coles was to die with nearly 500 of his ship's company when HMS *Captain*, his radical, masted, turret ship design, capsized in a squall in the Bay of Biscay in September 1870.[54] Well-connected and influential when the *Tamar* was being built, Coles had made his name during the Crimean War with a shoal draft raft used in bombardment, the *Lady Nancy*. Promoted to Captain and on half-pay when the Crimean War ended, he had turned his mind to the use of gun turrets on ships, possibly inspired by a suggestion from Marc Brunel, and filed his first revolving turret patent in March 1859. In fact, his advocacy led to the installation of a turret in an existing ironclad, floating battery, HMS *Trusty*, in 1861. Coles also managed to convince Queen Victoria's consort, Prince Albert, that ships with turrets were a coming thing. With the Prince's endorsement, the Admiralty agreed to go ahead with the design, though they still trusted the hull to the Chief Constructor, Isaac Watts, leaving only the four turrets for Coles to work on. The result was the *Prince Albert*. Although she was odd-looking, experimental, and only a coast defence ship, the *Prince Albert* was the future.

It has therefore been easy, when the focus in this period was rapid innovation in the worlds of naval architecture, marine engineering, shipbuilding, and warships, to miss the small side creek of British naval policy that, for all its fascination, turned out to lead nowhere — namely, designing, building, and operating troopships. Curiously, this novel departure has not attracted the interest of any naval historians for all the interesting questions that it poses. Dominant amongst them is the obvious one — how and why did this shift of policy happen?