Introduction

Re-inventing the Ship in the Long Nineteenth Century

Don Leggett and Richard Dunn

> In every vessel there is a great combination of scientific skill; and never before in history has such marvellous complexity been brought together for the protection and prosperity of the human race.
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> In 1911, the ship owner and Member of Parliament Walter Runciman praises members of the Institution of Naval Architects for their part in Britain's maritime and national successes.[1]

Between 1800 and 1914, Britain's ships were re-invented. The vessels Britain relied on for protection and prosperity altered in fundamental ways, from material and reliability to the methods in which they operated and in which sailors and non-sailors made sense of them. This volume examines these ships as objects of science and maritime culture, utilising a variety of analytical approaches to revisit historiographical debates concerning technological change and open new avenues of research within the history of maritime technology. This rich diversity of essays adds to the field of maritime studies and the emerging cultural history of the navy. Historians of science and technology will also find discussions of experiment, skill, expertise and machine users situated in the spaces and cultural contexts that have made these themes so important in studies of the long nineteenth century.

The authors share a common interest: to deepen our understanding of how the ship, in its many re-inventions, features in the history of the peoples, cultures, ideas and objects that surrounded and influenced it. We regard the ship as a practical and symbolic object, and so wish to explore dimensions that deserve greater attention in the social and cultural history of the maritime world. We unravel some key moments when the ship became an increasingly complex socio-technological system. We also examine how a wide range of actors negotiated traditions, expectations and myths that surrounded this seemingly familiar object. We explore how the agents who constructed and culturally shaped the ship were 'empire builders', inseparable from the ways their 'inventions' were deployed and

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[1] [Walter Runciman], 'Speeches following the Banquet at the Connaught Rooms, July 6, 1911', *Transactions of the Institution of Naval Architects*, 53 (1911): pp. 353–62, at p. 354.

used.[2] We consider how historians in these fields can examine the ship to develop fresh insights into existing historiographical debates and raise new questions.

The essays in this volume represent a departure from existing models of scholarship on the ship within maritime and naval history. Many previous histories separate the ship – and particularly its design and construction – from the context in which it found form and meaning. This is evident in technical histories of the navy, popular with specialist maritime history publishers. David K. Brown's Warrior *to* Dreadnought*: Warship Development, 1860–1905* (1997) is one such volume, rich in information and technical explanations, but light on context and historicist analysis of how technical changes gained authority and successive transformations in the British warship were commissioned.[3] Such technical histories tend to isolate the engineering behind ships from the cultural, political and social dimensions of maritime and naval history.

A division between engineering and history is also drawn by accounts that explore the *matériel* of naval power. C.I. Hamilton, who examines a number of the important transformations of the mid-nineteenth-century warship in his *Anglo-French Naval Rivalry, 1840–1870* (1993), mentions a wide range of individuals and institutions connected to naval architecture and marine engineering, but not their work.[4] Instead, the focus is on the Admiralty officials who oversaw the work of engineers, such as the successive First Sea Lords and Controllers of the Navy. This focus provides Hamilton with a group of actors engaged in politics, administration and shipbuilding policy, yet the internal dimensions of engineering culture and practice are absent. Jon Tetsuro Sumida's *In Defence of Naval Supremacy: Finance, Technology and British Naval Policy, 1889–1914* (1989) also follows this pattern, with its focus on technology as a component of Admiralty financial and strategic considerations.[5] Such analysis does not contribute to our understanding of how new ship designs were formed and gained acceptance in the Admiralty beyond the level of administrative politics.

Similar approaches are to be found in maritime history. Freda Harcourt, for example, opens *Flagships of Imperialism: The P&O Company and the Politics of Empire from its Origins to 1867* (2006) by stating that, 'Once long-distance steam navigation became a technological possibility, in the second quarter of the

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[2] See Ben Marsden and Crosbie Smith, *Engineering Empires: A Cultural History of Engineering in Nineteenth-Century Britain* (Basingstoke, 2005), pp. 1–11, the approach of which contrasts that of technological 'factors' and 'impacts' employed in John Beeler, *Birth of the Battleship: British Capital Ship Design 1870–1881* (Chatham, 2001).

[3] David K. Brown, Warrior *to* Dreadnought*: Warship Design and Development, 1860–1905* (London, 1997).

[4] C.I. Hamilton, *Anglo-French Naval Rivalry, 1840–1870* (Oxford, 1993), pp. 220–25.

[5] Jon Tetsuro Sumida, *In Defence of Naval Supremacy: Finance, Technology and British Naval Policy, 1889–1914* (Boston, 1989).

nineteenth century, there was widespread pressure to develop it.'[6] In similar vein, J. Forbes Munro's study of the British India Steam Navigation Company places a causal emphasis on technology: 'the technological lead which the pioneering development of the iron- and steel-hulled steamship, together with successive innovations in marine engines … gave to British shipowners and managers [underlies] the growth of the mercantile marine'.[7] Such faith in steam, argue historians of technology, was not as forthcoming as maritime historians believe. It took considerable inducements and experimentation to make steam credible.[8]

Moving away from these approaches raises a number of questions. Who drove the material changes to the ship that characterised navies in the long nineteenth century, and why? To what extent can engineers and projectors be integrated into existing narratives of maritime and naval history in the long nineteenth century? How entwined were naval officers and the ships that were attached to their 'greatness'? How did actors interested in the re-invention of the ship negotiate the strong cultural conservatism surrounding naval aesthetics? How did ships of the nineteenth century differ from other social spaces, and how has that shaped the maritime world?[9] Addressing these issues underpins the contribution of this volume to the fields of maritime studies, naval history and the history of technology. As contributors, we have aimed to develop new approaches to the ship within the history of merchant shipping, naval culture, scientific discovery, ship operations and British literature, and offer ways of situating its re-invention and increasing complexity.

One way to proceed is by investigating specific spaces where the re-invention of the ship took place. Richard Biddle begins this geographical survey in the dockyard, with his chapter on the occupational health of labourers, unravelling the relationship between their bodies and the ships they built. Through dockyard records and contemporary testimony, Biddle shows how the changing nature of ship construction made the dockyard a more (and differently) dangerous working environment, in need of greater regulation and healthcare provisions. Moving the focus to the spatial structure of the ship at sea, Anne-Flore Laloë explores the ship in one of its most important re-inventions – as a vessel of marine investigation. Through her account of the non-discovery of *Bathybius haeckelii*, Laloë describes some of the lesser-known activities that took place on board HM ships in the nineteenth century, locating them within fierce debates about their role in the

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[6] Freda Harcourt, *Flagships of Imperialism: The P&O Company and the Politics of Empire from its Origins to 1867* (Manchester, 2006), p. 1.

[7] J. Forbes Munro, *Maritime Enterprise and Empire: Sir William Mackinnon and his Business Network, 1823–1893* (Woodbridge, 2003), p. 8, quoted in Marsden and Smith, *Engineering Empires*, p. ix.

[8] Marsden and Smith, *Engineering Empires*, pp. 88–128.

[9] For recent scholarly attention to the geography of the ship, see David Lambert, Lucianna Martins and Miles Ogborn, 'Currents, Visions and Voyages: Historical Geographies of the Sea', *Journal of Historical Geography*, 32 (2006): pp. 479–93.

production of knowledge about the oceans. Still in the Royal Navy, but this time on the level of fleet movements, Duncan Redford investigates the Admiralty's attempts to integrate the submarine with the surface fleet. Redford reveals the potency of the Navy's corporate culture, and in particular its dedication to Mahanite principles and fleetwork, which were largely incompatible with the role many officers in the Royal Navy desired for the submarine. Taken together, these chapters show Britain's ships not as ready-made objects, but sites where human labour and controversy surrounded their final deployment into maritime and naval service.

In examining its re-invention we cannot ignore the important ways in which the ship also became a site for the interventions of industrial engineering and naval science. Many of the chapters examine the networks of engineers that played a major role in the re-invention of Britain's ships. While much contemporary maritime and naval scholarship elevates the traditional 'heroes' of exploration and naval combat, for many Victorians the engineer could also be heroic. Christine MacLeod has written on the posthumous honour bestowed on James Watt as the emerging hero of the industrial classes. Watt became a symbol of the 'ingenuity and enterprise of its [Britain's] "industrious citizens"' as early Victorian reformers elevated peace and prosperity as national and personal aims.[10] Engineers including the Stephensons and Brunels became celebrated in their own lifetimes, while others, like the naval architect John Scott Russell, took on an increasingly public role in endeavours such as the Royal Society of Arts and the Great Exhibition. These individuals became central to an aspiring middle-class, liberal – even Liberal – model of heroism offering an alternative to the more aristocratic, military model.

Engineers have taken the focus for a number of chapters in this volume, not because of their heroic deeds in invention, but because the labours of their enterprising art and science have become celebrated components of Britain's maritime past.[11] Yet alongside engineers, a cast of actors including admirals, sailors, shipping companies, projectors and scientists, to name but a few, deployed the resources of industrial society to reshape the maritime technological systems that had once been familiar to all. In his chapter, Christopher Harvie employs a range of literary tracings to explore the re-invention of the symbolic ship in industrial Britain as a link in the chains of transportation, trade and war. Don Leggett similarly draws attention to the imagery surrounding the ship, examining it as a site of political debate, professional controversy (fuelled by the continuing professionalisation of naval architects and marine engineers during the Royal Navy's transition from wood to iron) and social disputes over engineering and naval aesthetics. Through historicist readings such as these we may reconstruct the

[10] Christine MacLeod, *Heroes of Invention: Technology, Liberalism and British Identity, 1750–1914* (Cambridge, 2007), pp. 1–3.

[11] Christopher Harvie, *A Floating Commonwealth: Politics, Culture, and Technology on Britain's Atlantic Coast, 1860–1930* (Oxford, 2008), pp. 86–110.

cultural contexts and social networks through which the re-invention of the ship was understood within Britain's maritime community.

Fine-grained historicism, such as is presented in this volume, is central to contesting the three dominant models of technological change in maritime studies: the heroic inventor, the evolution of technology and technological determinism. Specific consideration of how these models operate will hopefully lead to fresh consideration of their continued application.

In the heroic inventor model of technological change a single individual is claimed to makes great leaps in innovation, seemingly apart from contemporaries, constraining institutions or the requirements of those who use technologies.[12] Stories about how Watt invented the steam engine, or Isambard Kingdom Brunel invented the transport infrastructure of Victorian Britain, hold little authority among academic historians of technology, who argue that 'invention' and 'authorship' are spread widely across social networks, that technical innovations are culturally contingent and that successes and failures must be publicly constructed.[13] Nevertheless, heroic stories remain powerful cultural narratives in the commemoration of technology, where the single authorship of objects can be easier to understand and celebrate than the work of a complicated and expansive social network, within which authority, intention and identity are 'constructed' and transmitted.

The second model weaves technological change into the fabric of maritime history without reflexive consideration, by shrouding the agency of actors and the cultural specificity of technical decision making. This evolutionary model – which is charged with extra meaning when writing about the nineteenth century – suggests that technical developments follow a progressive course largely independent of cultural or political influences, and that these developments affect societies in ways that are materially dependent, rather than socially conditioned. S.C. Gilfillan's classic *Inventing the Ship*, an account of invention that belonged to the 1930s Chicago school of sociology, was among the first studies to express such a model of *why* and *how* naval technologies altered.[14] Gilfillan focused on the invention of specific technologies – from rudders to propellers – to provide a 'rational' explanation for technological change that remains powerful in many

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[12] MacLeod, *Heroes of Invention*; John M. Staudenmaier, *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge, Mass., 1985).

[13] Mario Biagioli and Peter Galison, 'Introduction', in Mario Biagioli and Peter Galison (eds), *Scientific Authorship: Credit and Intellectual Property in Science* (New York, 2003), pp. 1–9; Crosbie Smith and Anne Scott, '"Trust in Providence": Building Confidence into the Cunard Line of Steamers', *Technology and Culture*, 48 (2007): pp. 471–96; Ben Marsden, 'Blowing Hot and Cold: Reports and Retorts on the Status of the Air-engine as Success or Failure, 1830–1855', *History of Science*, 36 (1998): pp. 373–420.

[14] S.C. Gilfillan, *Inventing the Ship: A Study of the Inventions Made in her History between Floating Log and Rotorship* (Chicago, 1935).

historical analyses.[15] Gilfillan's account of 'form[s] of evolution so obvious, simple and uneventful, that they would seem to demand hardly any inventive ability' maintains a hold on scholarship, although this articulation of the model may be unfamiliar to those who employ it.[16]

Still more pervasive in maritime studies is the notion of technological determinism: the reduction of technology to that of a 'factor' determining the grand narratives of maritime expansion and naval supremacy; for example, the onset of steam engineering as a determinant of Britain's global expansion. Inherent in this model is the assertion that technology, and its intrinsic characteristics, affect change in an inevitable way that necessitates action in the surrounding world, often reducing the complexities in a group's interaction with technology. Too few historians will be familiar with the debates and concerns regarding determinism that take place within the history of technology. Indeed, reflexive practitioners such as John Staudenmaier believe that the marginalisation of history of technology from the 'mainstream' has much to do with its sensitivity to soft determinism. Tracing in detail the social and technical constructions of technologies that are treated among mainstream historians as 'finished' objects may, Staudenmaier writes, 'offer dull fare to outsiders. They fail to excite interest precisely because their study seems too neat, too enclosed and abstracted from history's turbulence'.[17]

Models of technological determinism actively marginalise technology as an uncomplicated agent of change, assigning it to the function of a mere 'factor' in the explanation of political, social, cultural and economic transformation.[18] A deterministic account offers an appealing way for historians to build technology into other narratives, as a factor that enabled change, without examining the deeper questions on which the construction and authority of that technology depended.[19] Considerable insights can be gained, however, by examining the settings, spaces and contexts in which technological changes were fostered and subsequently transformed into reforms. Oliver Carpenter employs notions of trust to explore the function of civic conduct, religious outlook and public imagery in the shipowning practices of the Robinson Line (later Stag Line). Carpenter demonstrates how shipping companies – and particularly the much overlooked tramp companies that formed the backbone of the British mercantile empire – developed layered networks of trust to gain credibility for their maritime business.

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[15] For a critique of rational explanations and cultural norms, see Peter Burke, *What is Cultural History?* (Cambridge, 2004), p. 2.

[16] Gilfillan, *Inventing the Ship*, p. 17.

[17] John M. Staudenmaier, 'Rationality versus Contingency in the History of Technology', in Merrit Roe Smith and Leo Marx (eds), *Does Technology Drive History?* (Cambridge, MA, 1994), pp. 259–73, at p. 261.

[18] See Leo Marx and Merritt Roe Smith, 'Introduction', in Smith and Marx, *Does Technology Drive History?*, pp. ix–xv.

[19] See, for example, Daniel Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (Oxford, 1981).

In the same vein, important insights can be gleaned by investigating the vital and yet so often compartmentalised engineering practices needed to see the plans of shipowners realised. Crosbie Smith examines the relationships between Admiralty master shipwrights, shipyard naval architects and company directors in the Royal Mail Steam Packet Company's ambitious plan to build a fleet of 14 steamers. Smith specifically draws attention to the spatial distinctions and dynamics between 'sites of political, social and economic action' to demonstrate how the authority to alter ship designs shifts during the shipbuilding process. Similarly interested in engineering practices, Richard Dunn reveals in his study of William Thomson's (later Lord Kelvin's) magnetic compass and mechanical depth sounder how the changing use of these instruments and their onboard location reveal much about the development of ship operations. The transformation of the ship into an increasingly complex technological system was a product of engineers, sailors and Admiralty officials interacting together with scientific instruments. Taken together, these case studies demonstrate that the engineering practices at the heart of technological systems can reveal important ways in which actors sought to take control of ship design and operations.

In the penultimate chapter of this volume, technological change in the navy is placed within the national cultural context through the comparison of British shipbuilding with American exceptionalism. William M. McBride presents a selection of episodes in Anglo-American technical relations to highlight the unique cultural, historic and strategic dimensions of their respective approaches to ship design. Finally, in his epilogue, Andrew Lambert reflects on the themes developed in the volume to explore how responses to science and technology destabilised long-held attitudes and ideas in the maritime world. From the changing depiction of the ship in marine paintings to the politics of ship design, Lambert pursues nineteenth-century perceptions of maritime and naval technology to uncover the role of history and tradition in how Britons understood technological changes. 'The link between science, technology, ships and engines, and art, culture, history and politics is hard to define,' Lambert notes, 'and lacks the predictable linearity of histories constrained by a qualifying prefix, but it promises far richer insights.'

Thus the chapters in this volume seek to move debates about science and technology in the Royal and merchant navies away from 'factors', 'impacts' and 'evolutions'. We make this transition by changing the nature of the discussion and recasting technical questions that warrant consideration more appropriately as social, spatial and cultural ones. Instead of debating 'factors', this volume's contributors promote discussions about the culture of science and technology in the maritime world that aspire to integrate technical and material issues with political and social ones. And instead of exploring the material 'evolution' of technology, we examine how the peculiarities of Britain's maritime cultures shaped technology. In pursuing these threads, this collection deliberately avoids prescribing a single, controlling perspective on technological change, providing instead a range of approaches with which historians might integrate technologies that otherwise seem to be 'mere cogs' into a broader framework of maritime and naval studies.