

Fuelling mobility: coal and Britain's naval power, c. 1870–1914

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Abstract

This article considers the introduction of steam powered warships to the Royal Navy to show how oceanic mobility in the late nineteenth and early twentieth centuries was contingent on the global availability, and consequently mobility, of coal. Whilst the introduction of steam technology may have freed warships from the vagaries of wind and tides, the navy was now chained not just to coaling stations, but also to the wider infrastructure which guaranteed coal's movement to these stations around the globe. Thus, the ability to control both the source of the fuel and its movement was crucial to the mobility of British naval vessels tasked with protecting British interests worldwide, and was, therefore, central to British global power. This article explores how the navy ensured the availability of high quality steam-coal at British overseas stations, analysing the processes involved in sourcing high quality coal for naval ships and its transportation overseas. It also shows how the admiralty sought to make such arrangements more professional, and to guarantee the highest quality of coal at every station. It explores how these changes ensured that the infrastructure remained remarkably robust, despite its complex nature. It then assesses how Britain's rivals failed to achieve the same control over fuelling in the age of the coal ship, offering Britain a huge advantage in the wider world. Finally, the paper considers the ramifications of Britain losing this advantage when it switched to oil. Overall, it argues that, although generally ignored, fuel, and particularly the ability to control its global movement, is crucial to understanding naval mobility. This, of course, is true not just in terms of the navy, but also applicable to other significant geopolitical contexts and processes.

Keywords: Mobility, Fuel, Coal, Oil, Royal Navy, British Empire, Contingent mobilities

Abbreviated title: Fuelling mobility

In the last fifteen years scholars have become increasingly interested in shifting seas and oceans ‘from the margins to the centre of academic vision’.¹ Such a focus has produced many interesting avenues of research, showing how an oceanic framework can reveal previously hidden networks, connections and experiences. Perhaps unsurprisingly, many of these have assessed imperial themes.² Furthermore, new concepts and ideas about mobility have also taken a watery turn, and arguments have been made for the importance of understanding the processes of mobility within the framework of the oceans.³ In terms of the age of steam, work by Frances Steel, Valeska Huber, and Anya Anim-Addo has brought oceanic mobility in the nineteenth century to the attention of scholars.⁴ Yet whilst this work has added enormously to our understandings of imperial networks, more-than-human geographies of the sea and circulations, little of this new focus on mobilities has been aimed at state power in the nineteenth century, particularly through the navy.

Scholarship which does focus on the steam navy has often been concerned with the effect that new technology had on the speed, convenience, and efficiency of ship movement, and especially those movements which allowed the imposition of power. This is perhaps understandable. One only needs to think about ‘gunboat diplomacy’ to understand the effect that technology could have in achieving Britain’s imperial aims. Furthermore, the navy was key to Britain’s comprehensive command of shipping routes

¹ K. Wigen and J. Harland-Jacobs, Guest editors' introduction, *Geographical Review* 89 (1999) ii. See also, P. Steinberg, *The Social Construction of the Ocean*, Cambridge, 2001; D. Lambert, L. Martins and M. Ogborn, Currents, visions and voyages: historical geographies of the sea, *Journal of Historical Geography* 32 (2006) 479–493; K. Peters, Future promises for contemporary social and cultural geographies of the sea, *Geography Compass* 4 (2010) 1260–1272; J. Anderson and K. Peters (Eds), *Water Worlds: Human Geographies of the Ocean*, Farnham, 2014.

² For an introduction to the ‘mobility turn’ and ‘the new mobilities paradigm’, see J. Urry, *Mobilities*, Cambridge, 2007. For Atlantic histories, see D. Armitage and M. Braddick, *The British Atlantic World, 1500–1800*, Basingstoke, 2002; J. Greene and P. Morgan (Eds), *Atlantic History: A Critical Appraisal*, Oxford, 2009; B. Bailyn and P. Denault (Eds), *Soundings in Atlantic History: Latent Structures and Intellectual Currents, 1500–1830*, Cambridge, MA, DATE??.

³ See, for example Anderson and Peters (Eds), *Water Worlds*; A. Anim-Addo, W. Hasty and K. Peters (Eds), *The Mobility of Ships*, London, 2015.

⁴ F. Steel, *Oceania Under Steam: Sea Transport and the Cultures of Colonialism, c. 1870–1914*, Manchester, 2011; V. Huber, *Channelling Mobilities*, Cambridge, 2013; A. Anim-Addo, “With perfect regularity throughout”: Hybrid Geographies of the Royal Mail Steam Packet Company, in Anderson and Peters, *Water Worlds*, 163–176. Interestingly, studies of military mobilities have tended to concentrate on air and land forces, see, for example, C. Kaplan, Mobility and War: The Cosmic View of US ‘Air Power’, *Environment and Planning A* 38 (2006) 395–407.

worldwide, the lifeblood of its power in the late nineteenth and early twentieth centuries. Yet little consideration has been given to the factors which allowed these ships to be mobile. In most histories of the navy, it is the advantages of perpetually improving ship technology, alongside huge increases in ship numbers, which have attracted the most attention, assessing the effects of the technological evolution of warships without ever considering the enormity of the infrastructure required for these ships to function, particularly abroad.⁵ Daniel Headrick's *Power over People* contains an entire chapter on steamboat imperialism, yet there is no mention of coal, the fuel which allowed the ships to move. Instead it deals with the effects of the technological evolution of warships without ever considering the actors, processes and mobilities required for these ships to function abroad.⁶ Yet, the importance of the navy to the security of British trade and other imperial interests means that naval coaling infrastructure was, in fact, integral to Britain, empire and the world in the nineteenth century. The 'centrality of coal and coal depots to nineteenth-century imperial defence' means this lack of understanding of the fuelling infrastructure of the navy is also a gap in our understanding of nineteenth-century imperialism.⁷ Indeed, coal has also been largely ignored in imperial history. The volume of the *Oxford History of the British Empire* covering the nineteenth century has more references to coconuts and coffee than to coal, which only has three mentions.⁸

However, as this article will show, fuel powered steam ships made oceanic mobilities more

⁵ See, for instance, P.G. Halpern, *A Naval History of World War I*, London, 1994. For a prominent exception to this dearth of studies of late nineteenth-century infrastructure, see A. Lambert, Economic Power, Technological Advantage, and Imperial Strength: Britain as a Unique Global Power, 1860-1890, *International Journal of Naval History*, 5, no. 2 (2006). The period up to 1879 has been covered in R. Wilson, *Fuelling the steam navy: naval coal supplies from Comet to the Carnarvon commission*, unpublished MA dissertation, Exeter University, 2010.

⁶ D.R. Headrick, *Power Over Peoples: Technology, Environments, and Western Imperialism, 1400 to the Present*, Princeton, NJ, 2010, 177–217.

⁷ J. Beeler, Steam strategy and Schurman, in: G. Kennedy, K. Neilson and D.M. Schurman (Eds), *Far-Flung Lines: Essays on Imperial Defence in Honour of Donald Mackenzie Schurman*, London, 1996, 27.

⁸ See A.N. Porter (Ed.), *The Oxford History of the British Empire. Volume. 2: The Nineteenth Century*, Oxford, 1999. Some work has been done on the shift from coal to oil, for example N.L. Madureira, Oil in the age of steam, *Journal of Global History* 5 (2010) 75–94; W. Brown, The Royal Navy's fuel supplies, 1898–1939: the transition from coal to oil, unpublished PhD thesis, King's College London, 2003; E.J. Dahl, Naval innovation: from coal to oil, *Joint Force Quarterly* XXVII (2001) 50–56; M. Gibson, British strategy and oil, 1914–1923, unpublished PhD thesis, University of Glasgow, 2012. Whilst coal has increasingly come into focus within geography, especially in looking at ecological issues, there is little connection between the period of imperialism, mobilities, the military and fuel.

complex in the nineteenth century. More than ever, ships relied on infrastructure – particularly coaling facilities – without which even a fleet as large and powerful as Britain’s would be rendered impotent. Yet it is too simplistic to see the movement of steamships as dependent on a static network of coaling stations. Fuel did not simply appear at stations across the globe, but was subject to multiple movements before arriving. It needed to be sourced, moved to ports, shipped, and unloaded. There is, therefore, a need to recognise that ships relied on the separate flows and networks of fuel. The reliance of ships on these discrete movements of coal meant their movement was a part of what I term ‘contingent mobilities’; that the mobility of the navy across the world relied on the transoceanic and global mobility of fuel. If the movement of coal was interrupted or terminated, those ships dependent on the affected stations would have remained immobile. As the full protection of Britain’s trade could only be assured by the presence and movement of the British fleet across the oceans, a guaranteed availability of quality coal at stations, through its regular, timely and uninterrupted movement, was crucial to the empire.

This article therefore furthers the argument of those, such as Jon Anderson and Kim Peters, who have suggested that the sea is highly significant in the movement of resources globally, by showing how many of these mobilities are themselves contingent on the separate oceanic movement of fuel.⁹ Just as scholars have questioned the ‘freedom’ that the automobile brought by not being limited by rails, or by timetables, this article questions the free mobility of naval ships, since they are limited by the movement of fuel and the presence of infrastructure. Furthermore, it questions the perceived immobility of the constituent parts of coaling infrastructure, showing that in fact they were conduits for the mobility of fuel, without which the more visible mobilities of ships would be impossible. Although focusing on the ecological issues with carbon-based mobilities, Matthew Paterson is right to question how the issue of fuel shapes ‘a whole range of physical mobilities’.¹⁰ In fact, we can see the movement of coal as one of John Urry’s ‘systems’ which ‘make possible movement’ and ‘permit predictable and relatively risk-free

⁹ Anderson and Peters (Eds), *Water Worlds*.

¹⁰ M. Paterson, Governing mobilities, mobilising carbon, *Mobilities* 9 (2014) 570–584.

repetition of the movement in question'.¹¹ In this way, we may see the movement required of a Royal Navy steam ship to be a contingent mobility, utterly dependent on the distinct flows and networks associated with moving fuel across vast oceanic spaces. Thus, this article argues that, although often ignored, Britain's ability to provide its fleet with a supply of high quality coal throughout its empire was crucial to the oceanic power it held in the late nineteenth and early twentieth centuries.¹² In doing so, it invites consideration of how many large mobile networks, and their effective functioning, are in fact contingent on other quotidian, hidden or supposedly 'uninteresting' systems of movement.

THE COAL QUESTION

The development of steam technology in the nineteenth century instigated a revolution in ship design. The transfer from a sail to a steam navy was gradual in the Royal Navy. As long as early steam engines lacked sufficient power and efficiency, steamships remained marginal. Thus, even though steamships had been used in the Opium Wars, and the Battle of Navarino in 1827 was the last to be fought entirely with sailing ships, it was the actions of the Crimean War that marked the beginning of the end for wooden sailing ships in the Royal Navy.¹³ The Battle of Sinop, in November 1853, between Russian and Turkish fleets, showed the susceptibility of wooden hulls to exploding shells. Steam propulsion enabled the use of iron and, later, steel in hull design, offering protection from new projectile technologies. Steam power also ended a vessel's dependence on wind and current, allowing ships' routes to be more direct, and their speed to be increased. The change was marked, transforming the Royal Navy to the extent that by 1864 it had become 'unrecognisable' from that of a decade before.¹⁴ Yet, until 1871's HMS *Devastation*, vessels

¹¹ Urry, *Mobilities*, 13.

¹² The importance of quality as well as adequacy of supply chimes with the arguments of N. Clark and K. Yusoff, *Combustion and society: a fire-centred history of energy use*, *Theory, Culture and Society* 31 (2014) 203—226 that it is not just the fuel, but the combustion itself which gives us the power. There has also been wider work in geography on the importance of fuel resources, especially with regard to ecological issue. See, for example, Paterson, *Governing mobilities*.

¹³ Wilson, *Fuelling the steam navy*, 14.

¹⁴ R. Willock, *Bulwark of Empire: Bermuda's Fortified Naval Base, 1860—1920*, Bermuda, 1988, 7; A. Lambert,

were hybrid, powered by both sail and steam, as engines were not yet efficient enough to solely steam between stations.¹⁵ The compound engines of the new ships of the 1870s solved the earlier issues of poor power and limited range, offering an efficiency improvement of one hundred per cent.¹⁶ Without sails, ships could have more efficient and effective placing of armaments, as well as saving weight, making them far more formidable in battle. The last Royal Navy sailing ship was launched in 1875, and every subsequent ship was thus wedded to the coaling station, and to the mobilities of coal.¹⁷

This revolution in ship architecture had ramifications that were felt far and wide. Robert Kubicek has argued that no change was 'more significant than the steamship' allowing power projection on a whole new level, enabling ships to travel quickly on a global scale.¹⁸ It not only allowed warships to pass existing defences designed for action against sailing ships, but also facilitated both the bombardment of enemy forts and arsenals and the transportation of large numbers of invading troops. Furthermore, as land based powers could not hope to successfully defend entire seaboards, Britain could use its navy both as a deterrent against attacks on British interests and as a 'bargaining chip and lever' to benefit its commerce.¹⁹ The shift profoundly altered the strategic balance between land and sea, which enhanced Britain's ability, as the foremost maritime power, to become a world superpower. The success of this shift to steam is perhaps best shown in Britain's ability to avoid major maritime warfare until 1914.²⁰

Although it offered clear advantages to Britain, the emergence of a steam-powered navy in the

Battleships in Transition: The Creation of The Steam Battlefleet, 1815—1860, London, 1984, 53—55.

¹⁵ Although discussing steam ships on commercial lines, some similar points about sail and steam are made in J. Stafford, A sea view: perceptions of maritime space and landscape in accounts of nineteenth-century colonial steamship travel, *Journal of Historical Geography* 55 (2017) 69—81.

¹⁶ R. Parkinson, *The Late Victorian Navy: The Pre-Dreadnought Era and the Origins of the First World War*, Woodbridge, 2008, 29.

¹⁷ Q. Hughes, *Britain in the Mediterranean and the Defence of Her Naval Stations*, Liverpool, 1981, 136.

¹⁸ R. Kubicek, British expansion, empire, and technological change, in: Porter (Ed.), *The Oxford History of the British Empire. Volume. 2: The Nineteenth Century*, 249.

¹⁹ A. Lambert, Economic power, technological advantage, and imperial strength: Britain as a unique global power, 1860—1890, *International Journal of Naval History* 5 (2006) PAGE NUMBERS; The use of the navy to obtain compliance can be seen in Peru in 1857 and Chile in 1863, see K. Neilson and E.J. Errington, Introduction, in: K. Neilson and E.J. Errington (Eds), *Navies and Global Defense: Theories and Strategy*, London, 1995, 2; A. Lambert, Under the heel of Britannia: the bombardment of Sweaborg, August 1855, in: P. Hore (Ed.), *Seapower Ashore*, London, 2000, 124.

²⁰ Lambert, Economic power.

second half of the nineteenth century also came with its own problems.²¹ Most notable of these was that steam engines were fuel hungry, which meant that coal was necessary for a navy to perform any of its duties. This required the Royal Navy to ensure its ships sufficient coaling infrastructure, to test potential fuels and to formalise the distribution of coal. Not only did naval steam engines require coal, and lots of it, but they also required steam-coal of a high quality, which could provide the maximum amount of energy per ton, would not deteriorate badly when stored, and burnt cleanly to avoid clogging up warship engines. Further to this, as naval steamships required a degree of stealth in battle, they needed a fuel that did not produce black smoke, making them visible for miles around. Thus, selecting the correct coals for the navy was crucial to the effectiveness of warships in carrying out their duties. That this quality coal was required to be available around the empire in ever increasing quantities exacerbated the difficulties experienced by the admiralty, and responses to this created networks and infrastructures of mobility that became progressively more complex and robust.

Coal was required at stations for ships to perform even the most straightforward operations, and thus huge amounts of coal were required to be present at strategic points and dockyards.²² Thus, an infrastructure had to exist to facilitate its movement and storage.²³ With huge shipbuilding programmes launched in the 1880s and 1890s, this issue became even more acute as demand for coal was increased by higher numbers of larger, more fuel hungry ships. A need for a constant supply of coal at these stations meant that it became the key global strategic resource, and the control and maintenance of its infrastructure was imperative in ensuring Britain's global power. Thus, although we often think of coaling stations as static nodes that facilitated movement, mobility was intrinsic to the basic functions of this coaling infrastructure. These stations were parts of separate networks, with their own separate mobilities, processes and actors. For coal to be present at an overseas station it had to be extracted from

²¹ In many ways, this article argues against simplistic ideas of technology annihilating space and time by showing the complexity of these changes. For the uneven and chaotic development of railways, see R. White, *Railroaded: The Transcontinentals and the Making of Modern America*, New York, 2011, xxix.

²² Wilson, *Fuelling the steam navy*, 16.

²³ D. Evans, *Building the Steam Navy: Dockyards, Technology and the Creation of the Victorian Battle Fleet, 1830—1906*, London, 2004, 170.

underground, brought to the surface, inspected, transferred onto trains, transported to the port, moved onto a ship, moved across the ocean and then unloaded and stored. If any of these processes or movements was disturbed, delayed or stopped the mobility of those ships at the stations needing supply would be profoundly reduced, or even ceased entirely. As such, steamship mobility was entirely contingent on the mobilities of coal supply.

Although largely ignored by modern scholars, contemporaries were aware of the value of coal to the navy, state and empire. So central was this fuel to British power that lumps of steam-coal were called 'black diamonds'.²⁴ Without it the Royal Navy would be unable to fulfil its global role as the primary defence of British commerce and possessions, and so, to Britain, its worth was immeasurable. As one commentator put it, 'the black diamond really sways the destinies of Empires'.²⁵ This importance also led to the nickname King Coal: 'the source of [Britain's] commercial prosperity and the secret of our naval supremacy ... coal is the first requisite of empire'.²⁶ Contemporaries pointed out that 'a country may have the most powerful navy in the world, but if it be without coal it will be in the position of a man with a pipe and matches and no tobacco'.²⁷ Or, as Ralph Waldo Emerson suggested, in 'every basket [of coal] is power and civilisation'.²⁸ Britain's ability to control the mobility of these 'black diamonds' was crucial to its naval, and therefore global, power.

BRITAIN'S COALING INFRASTRUCTURE

Understanding the mobility of coal means understanding more than just 'the pivotal role of transnational networks'. It also requires analysis of the development and maintenance of those infrastructures, highlighting that they were not 'straightforward processes, but were characterised by ambiguities and

²⁴ 'Masker', The China station in other days, *The Naval Review* 25 (1937) 522—533; C. McKee, *Sober Men and True: Sailor Lives in the Royal Navy, 1900—1945*, Cambridge, MA, 2002, 119—122.

²⁵ King Coal, *Western Mail*, 9 November 1898.

²⁶ A.S. Hurd, Coal, trade, and the empire, *The Nineteenth Century*, November 1898.

²⁷ Hurd, Coal, trade, and the empire.

²⁸ R.W. Emerson, *The Conduct of Life*, Boston, 1860, 2.

tensions'.²⁹ Thus it is important to recognise, as Erik Dahl has suggested, that 'providing the fleet with coal was the greatest logistical headache of the age', which involved multiple actors, mobilities and processes.³⁰

The lack of modern histories of how coal was supplied to the navy may seem peculiar considering the value that contemporaries placed upon it, notwithstanding the fact that coal is 'utterly lacking in glamour'.³¹ Yet this in itself is testament to the success with which the admiralty managed the navy's coal supply. The *New York Times* in 1892 described British naval coaling as an 'enormous system under ... splendid control'. In Bruno Latour's terms it was 'black boxed', largely 'made invisible by its own success'.³² As Nigel Thrift and Stephen Graham have argued, it is often only when infrastructure falters or fails that it becomes obvious, and thus by largely maintaining its robustness throughout the period, naval coaling's importance has gone unnoticed.³³ Yet this invisibility should not detract from how extraordinarily resilient this enormous and complex system was. Britain's oceanic role was on a global scale, and fuel was required for a huge number of naval ships, but Britain suffered none of the serious disruptions or disasters that its rivals did because of a lack of fuel. This was no coincidence, but was a result of Britain's ability to utilise its superior infrastructure and resources, and to deny its rivals the same privilege. This capability was crucial to Britain's oceanic hegemony in this period.

The system's robustness was largely based on the admiralty's ability to exploit the numerous advantages granted by both Britain and its empire, formal and informal. The requirement for coal supply necessitated a global chain of coaling stations to service the Royal Navy's needs, yet Britain in fact needed

²⁹ E. van der Vleuten and A. Kaijser, Introduction, in: E. van der Vleuten and A. Kaijser (Eds), *Networking Europe: Transnational Infrastructures and the Shaping of Europe, 1850—2000*, Cambridge, 2006, 3—7.

³⁰ Dahl, *Naval innovation*, 51.

³¹ B. Freese, *Coal: A Human History*, Oxford, 2003, 2, 13.

³² *New York Times*, 6 March 1892; B. Latour, *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge, MA, 1999, 304. See also S. Graham, *Disrupted Cities: When Infrastructure Fails*, London, 2009.

³³ The maintenance and breakdown of infrastructure has been explored for the recent past in Graham, *Disrupted Cities* and S. Graham and N. Thrift, Out of order: understanding repair and maintenance, *Theory, Culture and Society* 24 (2007) 1—25. On the robustness of the coaling infrastructure in the face of industrial action see, for example, The Naval Manœuvres abandoned, *Standard*, 20 June 1898; Welsh coal for the navy, *Isle of Man Times*, 10 September 1898; Letter from R.C. Webster, *Morning Post*, 8 April 1898.

few new strategic spaces, building their systems into spaces already under British national, imperial or commercial control. The empire, the informal empire, and territory possessed by its allies provided it with a plethora of places where it could store coal (See Figure 1). Many of these were gained as spoils of war in the previous century, and had been previously strategic sites for the sailing navy.³⁴ Just as important, though, were commercial ports under British control or influence, where coal was stored exclusively for admiralty use. Thus, although coal changed their strategic purpose, and made previously unimportant stations acquire a new significance, few new sites were attained to facilitate the supply of coal the navy.

Figure 1: British coaling stations used by the Royal Navy, 1870–1914.

In supplying these stations, Britain again also utilised existing systems. The huge global commercial demand for British coal, and the predominance of British commercial steam shipping, meant that Britain possessed a world-leading coal export infrastructure, both at home and globally. This allowed the admiralty to utilise commercial coaling networks to both hold stores for navy ships and to supply its own coaling stations. Moreover, it could rely on the existing mail and telegraphic networks which serviced these sites to allow swift communication, particularly important for such strategically important nodes.³⁵

It was not just in terms of infrastructure that Britain held an inbuilt advantage which the navy could exploit – Britain also possessed the best fuel. Welsh coal, or more precisely steam-coal, was universally agreed to be of the highest quality for steam engines. No other coal with equivalent qualities within easy reach of a seaport was available until the discovery of New Zealand Westport coal in the 1880s, and this was also under British control. This provided Britain with a second source of high-quality coal on the other side of the globe, albeit in much smaller amounts. These factors not only gave Britain the ability to maintain the high performance of its navy worldwide, but, with few other sources of high-quality coal and no other commercial networks approaching the global reach of that of Britain, it was able

³⁴ B. Gough, *Pax Britannica: Ruling the Waves and Keeping the Peace before Armageddon*, Basingstoke, 2014.

³⁵ J. Beeler, *Birth of the Battleship: British Capital Ship Design, 1870–1881*, London, 2001, 52.

to deny its rivals the same advantage, should it so wish.

The navy was thus able to rely on contractors to fulfil its fuelling needs. Commercial collieries provided the coal, commercial agents arranged and managed contracts to supply and transport coal around the world, and commercial tramp ships delivered the coal to the stations. This reliance on private enterprise was nothing new. As part of a 'contractor state' the eighteenth-century admiralty had utilised existing commercial infrastructure to supply the navy, acting largely as an overseer.³⁶ Such a relationship adds another layer of complexity to understanding how naval mobilities were possible in the later nineteenth and early twentieth centuries. Not only were they contingent on the separate mobility of fuel, but these mobilities were also largely controlled by private enterprise and not by the state.

This reliance brought with it issues of conflict of interest, not least because British coal was being sold to Britain's rivals during war scares. Yet, although this seemed dangerous to an alarmed press, it would prove to Britain's advantage. Should a war break out, supply would cease, and an enemy would have to find an alternative, inferior, source of fuel. More serious was that the predominance of Welsh coal in fuelling the navy meant that large-scale and long-term strikes in the Welsh coalfields had the potential to become disastrous, causing huge supply issues and the paralysis of the fleet. Yet serious problems were alleviated by careful planning and swift action. Even the worst strike, in 1898, did not significantly affect naval capacity, despite a lock out which lasted some twenty-one weeks and five days.³⁷ Restrictions on coal use, alternative suppliers, and emergency contracts meant that, despite some embarrassment for the admiralty and a strain on naval coal supplies, the strike largely proved the durability and versatility of the infrastructure.³⁸

Although the number of organisations involved, and the fact that most were commercial interests,

³⁶ See R. Knight and M. Wilcox, *Sustaining the Fleet, 1793—1815: War, the British Navy and the Contractor State*, Woodbridge, 2010.

³⁷ The coal strike, *Daily News*, 8 April 1898; Letter from R.C. Webster, *Morning Post*, 8 April 1898; Imperial parliament, *Morning Post*, 25 June 1898; Appropriation bill, House of Commons debate, *Hansard*, 12 August 1898, volume 65, columns 15—29; *Royal Commission on Coal Supplies. Second Report of the Royal Commission on Coal Supplies. Volume II. Minutes of Evidence and Appendices*, British Parliamentary Papers, 1904, Command 1991, 143—155.

³⁸ The Admiralty was able to withdraw the limitations on Welsh coal use almost immediately after the strike ended. Welsh coal for the navy, *Isle of Man Times*, 10 September 1898.

added to the complexity of supply, it helped the navy both keep supply effective and of a high quality, and to receive value for money. Tendering for contracts allowed the admiralty to ensure the best price, to easily remove any suppliers or contractors who failed to adequately meet naval needs, and, should any disruptions occur, to easily find new suppliers to fill any gap. Notwithstanding industrial action, in general this relationship between state and private enterprise appears to have been largely unproblematic, yet it does highlight how state power was very much contingent on commercial mobilities and infrastructure, necessarily underpinned by networks of trust and security.

FROM PIT TO STATION

To fully understand the range of mobilities and processes that the movement of warships were contingent upon it is pertinent to explore the journey from pit to station. This was far from straightforward, and required a number of actors, processes, mobilities and networks. The first of these processes was the selection of coal. Deciding which fuels were suitable for use in warships was especially important, and arguably the only part of the process which the admiralty completely controlled. As the Royal Commission on Coal suggested in 1904:

A ship of war must be supplied, and must be kept supplied with a coal which will ensure the highest rate of speed and maintain the required radius of action. If you use a coal that burns quicker, without producing the same calorific effects and power, you would burn out the coal sooner than you otherwise would, and the consequence would be that a ship instead of running her 10,000 knots at a certain speed, would be reduced probably to 8,000 or 9,000 knots.³⁹

To avoid problems with poor-quality fuel the admiralty performed at least twenty-one trials of domestic

³⁹ *Royal Commission on Coal Supplies*, 143—155.

coal between 1847 and 1879, in addition to tests on coal from all over the world.⁴⁰ To differentiate those collieries deemed to produce coal of a sufficient quality there was an Admiralty List, which was in place by the 1840s.⁴¹

Although the admiralty chose which coals were of good enough quality for the navy, and theoretical control remained in London, supervision of the exports of coal was undertaken by a naval captain stationed in the admiralty office in Cardiff, the main coal export port. Further supervision was provided by the admiralty buyer of coals, who assessed whether the coal was fit for purpose.⁴² Although supervised by the navy, most of the processes were arranged by agents.

Colliery companies were responsible for all processes up to and including delivering the coal on board the cargo ship, and were accountable for the costs of transporting the coal from the colliery to the docks, the loading and handling fees incurred at the port, but nothing else. Arranging the ships in which the cargo was to be carried and all other costs incurred in transporting the shipment from the port of loading to the port of delivery was left in the hands of the Cardiff agents employed by the admiralty. They were even responsible for using admiralty funds to purchase the coals.⁴³ The admiralty relied on the expertise of the agents to negotiate any difficulties, and to deliver efficiency and value even during war or strikes. This helped to nullify, or at least navigate, the multiple potential choke points, processes and disruptions inherent to such a complex series of mobilities.⁴⁴

The ships used to deliver naval coal were mostly chartered, and were engaged by the admiralty's agents.⁴⁵ The sourcing and movement of naval coal was often complicated by the number of different bodies involved, as agreements had to be reached with colliery agents, shippers and bunker owners. To confuse matters further, due to the huge amount of coal required by the admiralty, as well as the

⁴⁰ Twenty-one are recorded in parliamentary reports, see Wilson, *Fuelling the steam navy*, 31.

⁴¹ J. Morris and L. Williams, *South Wales Coal Industry, 1841—1875*, Cardiff, 1958, 29.

⁴² *Kelly's Directory of Monmouthshire and South Wales*, London, 1906.

⁴³ Instructions to the admiralty agents in south Wales for shipping coal, The National Archives, Kew [hereafter TNA], ADM 116/903.

⁴⁴ See, for example, T. Mitchell, *Carbon Democracy: Political Power in the Age of Oil*, London, 2011, 38.

⁴⁵ *Royal Commission on Coal Supplies*, 143—155.

multitude of destinations that it needed to be sent to, naval coal was often purchased from several collieries in one year.⁴⁶ As coal was a low value, bulk cargo it was generally exported as part of wider trade patterns to bring greater profit, whether in Europe or further afield. With no great import trade to Cardiff, shipping agents looked to subsidise the cost of exporting coal by involving the ships in wider trade movements across networks which relied on naval protection.⁴⁷ Somewhat ironically, even in the twentieth century the coal for most naval stations was shipped by sail, as it was cheaper and speed was less important for low value trade.⁴⁸ Even as late as 1901, sailing ships were habitually used to send coal to naval stores at Esquimalt (Vancouver), Coquimbo (Chile), Simon's Town (Cape Colony) and Trincomalee (Ceylon).⁴⁹ Thus, steamship mobilities were nearly always contingent on the mobilities of the outdated sailing ships they had replaced in the navy. Slower mobilities enabled – in time – the faster mobilities of the steam vessel.⁵⁰

BRITISH RESPONSES TO RIVAL CHALLENGE

The admiralty thus inherited many advantages and utilised the private sector to ensure that the navy had adequate coal supply worldwide. Yet, perhaps because of the success of this light touch approach to management, it was only when Britain's hegemony began to be challenged in the last decades of the nineteenth century that there was serious consideration of how best to ensure that the fleet received quality fuel wherever in the world it was, in peace or war. Part of this was an assessment of how to guarantee the safety of coaling stations, and how they fitted into a wider imperial defence strategy, but

⁴⁶ R. Walters, *The Economic and Business History of the South Wales Steam Coal Industry, 1840–1914*, New York, 1977, 313.

⁴⁷ M. Daunton, *Coal Metropolis: Cardiff, 1870–1914*, Leicester, 1977, 66.

⁴⁸ *South Wales Coal Annual*, Cardiff, 1903, 77–130; Army coal transport, House of Commons debate, 12 May 1896, *Hansard*, volume 40, columns 1129–1130.

⁴⁹ Instructions for the admiralty agents in south Wales for shipping coal, 1 July 1901, TNA, ADM 125/56.

⁵⁰ This suggests another dimension of 'speed' in mobility. See T. Creswell, Politics of mobility, *Environment and Planning D: Society and Space* 28 (DATE??) 17–31.

it also included improvements in managing the mobilities of coal across the world.⁵¹ In particular, the admiralty began to more closely control the selection, transportation and stock levels of coal at overseas stations.

A need for warships to perform at full capacity at any given time meant that a fuel's performance was especially important and thus cost was usurped by quality as the primary criterion for naval coal. As the admiralty stated in 1903, 'irrespective of expense, [Britain] could not go below the minimum standard of requirements special to the Naval Service'.⁵² Despite all their testing, the admiralty largely reduced itself to relying on south Wales and Westport coal. The reason for this was given by First Lord of the Admiralty Lord Hamilton in 1889, who suggested that practical experience had proven that Welsh coal was the only suitable domestic fuel for the navy, due to the 'special duty and work which the Navy is called upon to perform'.⁵³ This is a crucial point. Commercial shipping demanded regularity, order and efficiency, but the movement of naval ships, particularly in moments of geopolitical tension, primarily required speed, range and a global scope.⁵⁴ It was precisely these issues that made the supply of coal to the navy both so crucial and so complex. The admiralty required a fuel that could offer it the highest possible speed, as well as being efficient enough to give it the global range it needed. Furthermore, it needed to ensure sufficient supply at all stations, whilst avoiding wastage through deterioration. This required coal to be regularly transported to stations, as well as careful monitoring at stations themselves. Sourcing fuel from just two areas made the organisation of shipments somewhat simpler, but it meant that the coal had to be transported enormous distances. Indeed, even in 1914 Welsh coal was being sent to places as far away as Vancouver, some 14,300 nautical miles away.⁵⁵

⁵¹ See, for example, S. Gray, Carnarvon, coal consciousness, and the end of Liberal imperial indifference?, *Trafalgar Chronicle* 23 (2013) 213–228; W.C.B. Tunstall, Imperial defence, 1870–1897, in J.H. Rose, A.P. Newton, E.A. Benians and H. Dodwell (Eds), *The Cambridge History of the British Empire. Volume. 3: The Empire–Commonwealth*, Cambridge, 1959, 232–234; D. Schurman and J. Beeler, *Imperial Defence, 1868–1887*, London, 2000, 86.

⁵² *Royal Commission on Coal Supplies*, 143–155.

⁵³ Welsh versus north country coal, *Western Mail*, 16 May 1889.

⁵⁴ For work on the 'regularity' of steam shipping, see a. Anim-Addo, 'With perfect regularity throughout'. GIVE FULL REFERENCE

⁵⁵ C.E. Evans, *Hints to Coal Buyers*, Cardiff, 1909, 63.

In addition to measures to ensure the quality of the coal supplied to the navy, the perceived threat to Britain's oceanic supremacy in the 1880s also pushed the admiralty to consider the way it controlled the supply of fuel. As part of wider developments in imperial and naval defence, Britain sought to ensure that its growing navy could be confident in its supply of quality fuel by controlling its mobility more closely. Although the navy had committed itself to coal power at least two decades before, reliance on commercial agents meant that Whitehall appeared to know little about how the navy was obtaining coal, particularly at distant stations.⁵⁶ It was only by gaining a knowledge of the existing coaling infrastructure and mobilities that the admiralty could exert more control. 1880 saw the most important step towards improving and professionalising the supply of coal to foreign stations with the introduction of the perpetual collection of data about coaling stations and the type and amount of fuel they held. In August 1880 the naval secretary, Robert Hall, sent

a proposal to obtain and tabulate exact particulars, as far as possible, of the quantity, quality, price etc. of the coal likely to be available at any time at all ports abroad. The advantages of the possession of this information, whether in peace or war, especially if it is carefully gathered and periodically revised, are obvious, and my Lords have been pleased to approve the proposal.⁵⁷

Disseminated to all naval ships and stations, it not only allowed the admiralty the knowledge to advise stations as to best naval coaling purchase, storage and management practices, but also gave crucial information on the coaling facilities available across the world to ships' commanders, something especially important for atypical voyages. The admiralty also standardised the administrative forms sent from the stations and the contracts it made with private companies, allowing control of supply to be more uniform and efficient.⁵⁸ Although simple, these measures streamlined the naval coaling infrastructure,

⁵⁶ See, for example, the types of questions asked in, Letter from Evan MacGregor, 1 August 1884, TNA, ADM 123/110.

⁵⁷ Letter from Robert Hall, Naval Secretary, August 1880, TNA, ADM 123/110.

⁵⁸ E.F. Stevens, *Shipping Practice*, London, 1931, 40–54; Daunton, *Coal Metropolis*, 58.

making coal purchase more straightforward and export amounts more accurate. This allowed the admiralty to better control the movement of fuel, and therefore the navy, around the world. In doing so it maintained the most robust coaling infrastructure of any power throughout this period. This robustness granted Britain hegemony of the oceans, thus allowing it to preserve its place as the preeminent global naval power.

Changes to processes were not only designed to ensure that the navy could perform its peacetime role, but also included contingency plans for coal supply in war, enabling the mobility of adequate fuel to most stations at short notice. Alongside wider efforts for swift mobilisation of naval forces, this allowed the admiralty to be able to react quickly and efficiently to crises without having a hugely detrimental effect on the performance of the Royal Navy.⁵⁹ Again, we see an understanding from the admiralty of the crucial place that the mobilities of coal had for the nation in war. Britain's ability to mobilise in a war scare was tested through naval manoeuvres beginning in the 1880s, but it was not until the twentieth century that arrangements for the continuity of supply of coal in an extended naval war were finalised, with the threat of a major war looming large.

In 1900 arrangements were outlined should Britain be involved in a naval war. 'Instructions to the Admiralty Agents' shows how the government planned to provide the navy with coal at short notice. 'Special arrangements' were made with Welsh collieries to provide coal in emergencies, with railway companies to dispatch the coal to port, and docks instructed 'to give preference in loading to all colliers taken up on admiralty account'. The Cardiff-based agents were also instructed to nominate representatives in the other south Wales ports to make arrangements for mobilisation there. Although they were responsible to the Director of Navy Contracts, mobilisation would effectively be carried out by private businesses.⁶⁰ These arrangements show the complexity of the processes and movements on which naval mobility was contingent. Even when not being shipped across oceans to stations, coal still needed to be mined, loaded onto railways and transported to ports. There were also direct results of this

⁵⁹ See, for example: Instructions to the admiralty agents, TNA, ADM 116/903.

⁶⁰ Instructions to the admiralty agents, TNA, ADM 116/903.

awareness in the creation of other infrastructures. The need for the swift movement of Welsh coal to dockyards shaped the development of the railways of south Wales and southern England, including the construction of the Severn Tunnel, completed in 1886.⁶¹

An example of this mobilisation in practice occurred during a war scare in 1911. Fearing a naval war with Germany in the North Sea, the admiralty coordinated the movement of Welsh coal, by ship and railway, to the northeast of England and Scotland.⁶² These preparations meant that at the outbreak of the First World War the admiralty could swiftly implement strategies for coaling in war. Transport arrangements were already in place, including 'Jellicoe Special' trains, which took coal to Grangemouth for the fleet at Scapa Flow, and the admiralty could order collieries to retain coal stocks in the event of the navy needing more supplies.⁶³ The success of these actions reflects how a realisation at government level of the importance of fuelling infrastructure to the mobility of the navy enabled effective operations on the ground. That issues of supply were paramount to mobilisation strategies shows government recognition that warship mobility was contingent on the movement of coal.

FAILURES OF FOREIGN COALING INFRASTRUCTURE

The robustness of British coaling infrastructure and the effectiveness of the admiralty measures are particularly apparent when compared to the failings of other nations' arrangements. Numerous examples of disruption and disaster point to an important consideration in terms of fuel and its role in military mobilities and immobilities. The inability of Britain's rivals to control their own fuelling abilities highlights the importance of coal and its associated mobilities to naval power. Furthermore, by controlling many of the elements of coaling networks, and the best fuel which moved through it, Britain had the ability to immobilise its rivals, should it so wish, by disrupting their access to the same fuel and infrastructure, or

⁶¹ J.D. Davies, *Britannia's Dragon: A Naval History of Wales*, Stroud, 2013, 168.

⁶² Coal for the navy, *The Times*, 12 September 1911.

⁶³ Davies, *Britannia's Dragon*, 195; *Border Watch (South Australia)*, 1 August 1914.

denying them fuel completely. In other words, then, much of its rivals' naval mobility was contingent on fuel mobilities controlled by Britain.

Perhaps the most famous example of a failure of naval infrastructure concerns the Russian Baltic fleet in 1905, which was steaming to join the Russo-Japanese war in the Far East.⁶⁴ Forced to steam via the Cape when Britain refused the use of the Suez Canal, around 3,000 nautical miles further, the Russians were also denied fuelling opportunities, delaying their movement and causing vast inconvenience (see Figure 2).

Figure 2: The route taken by the Russian Baltic Fleet, 1905.

The engineer-in-chief to the squadron, Eugene Politovsky, was quick to recognise the value of coal in his diary: 'Coal! It is our weak spot. Our comings, our goings, our voyage, and even our success depend on coal'. A. Novikoff-Priboy, who also served on the fleet, similarly remarked that 'coal had developed into an idol, to which we sacrificed strength, health, and comfort. We thought only in terms of coal, which had become a sort of black veil hiding all else, as if the business of the squadron had been, not to fight, but simply to get to Japan'.⁶⁵

Britain weakened the Russian fleet through both the control of the mobility of its own coal and by exploiting Russia's lack of infrastructure outside its own waters. Although the Russians made use of some French coaling infrastructure, this was not without difficulty. In some places 'the French local authorities, to begin with, gave [the fleet] permission to coal ship. Then, afraid of protests from the Japanese and the British, they revoked their consent'. At others, 'under British and Japanese pressure, the French authorities had selected for us a much less convenient spot', causing coaling to be slower and more dangerous. The Russians found some support from Germany, coaling from German colliers in Great Fish Bay in Portuguese Angola, despite Portuguese protests, and Angra Pequena, in German South-West

⁶⁴ K. Pleshakov, *The Tsar's Last Armada: The Epic Journey to the Battle of Tsushima*, New York, 2002.

⁶⁵ A. Novikoff-Priboy, *Tsushima*, translated by Eden and Cedar Paul, New York, 1937, 90.

Africa, but German infrastructure was far poorer than Britain's.⁶⁶

Furthermore, they constantly encountered British ships, and were escorted by British ships around the Iberian coast.⁶⁷ The presence of Royal Navy ships, fuelled from their plethora of coaling stations, caused one Russian to remark 'how were we to continue when there was not a single port on our route where we could coal or revictual unmolested?'⁶⁸ With delays mounting, the precarious situation the fleet faced was fully realised. Politovsky remarked that 'the coaling question is the question of life'. His diary constantly laments Russia's lack of coaling infrastructure, particularly as it meant that each ship had to take on enormous amounts of coal where it could, which had to be stored outside the bunkers, making life uncomfortable for the sailors and severely hampering the fighting and sailing ability of the ships.⁶⁹

When the fleet arrived in Japanese waters it was beleaguered from an eighteen thousand mile journey that had offered little chance for maintenance, and was therefore heavily fouled, reducing its speed significantly.⁷⁰ The subsequent battle was a disaster for Russia, which lost all of its battleships and 4,380 sailors, with 5,917 more captured, including two admirals. The power held by Britain through its control of the mobility of a large proportion of quality coal worldwide was clear. Able to deny its rivals a sure supply of fuel, Britain reduced the Russian fleet's mobility and, indeed, at points, made it immobile. Furthermore, the ability to refuel across the world allowed British ships to intimidate neutral powers, stopping them from providing fuel to the Russians. Such power allowed Britain to inconvenience heavily, if not critically damage, a potential enemy's navy without having to engage in battle at all.

By 1907 Britain's naval dominance across the world was waning, illustrated by the fact that it had been forced to form alliances with Japan amongst others in order to concentrate its forces in European waters. Conversely, the US Navy had swiftly grown from a fleet of largely wooden vessels to one with

⁶⁶ Novikoff-Priboy, *Tsushima*, 48, 59 and 53.

⁶⁷ E.S. Politovsky, *From Libau to Tsushima: A Narrative of the Voyage of Admiral Rojdestvensky's fleet*, translated by Major F.R. Godfrey, London, 1906, 257.

⁶⁸ Novikoff-Priboy, *Tsushima*, 48.

⁶⁹ Politovsky, *From Libau to Tsushima*, 257.

⁷⁰ R. Forczyk, *Russian Battleship Vs Japanese Battleship: Yellow Sea 1904—05*, Oxford, 2009, 32.

many ultra-modern steel warships. Moreover, victory in the Spanish-American War at the turn of the twentieth century had announced the United States as a major global power. This change in geopolitical outlook was summed up by Theodore Roosevelt's claim that 'the United States had "no choice" as to whether it would "play a great part in the world"'.⁷¹

However, the mobility of the fuel that the US Navy relied on outside its own waters was still largely controlled by Britain, meaning that its global mobility was often at the whim of the British. This was highlighted by a circumnavigation of the world by sixteen American battleships between 1907 and 1909. Known as the 'Great White Fleet', because of their bright white hulls, the tour aimed to foster goodwill, but also to announce the US as a major naval power with global reach. Yet, although it offered useful experience, and showed that the warships were capable of long distance operations, it also exposed weaknesses in their ability to project power across the world. Crucially, it exposed the fact that ship numbers and technology mattered little without coaling infrastructure. The United States only had eight colliers and poor port facilities, so during the cruise it used one Austro-Hungarian, seven Norwegian and forty-one British colliers. Even in Honolulu, the fleet relied on a British collier to bring them coal. To make up for this, like the Russians, the fleet took on more coal than the ships were designed for, with coal stored on the upper decks, leaving the men nowhere to fall in.⁷²

Yet, this minor embarrassment was nothing compared to the humiliation that came when the fleet arrived in Australia. There, the arrangements of the Bureau of Equipment were tested to their maximum, and failed spectacularly. Failing to allow for sufficient lead time, twenty-five thousand tons of coal failed to arrive. Although blamed on a British will to deny the fleet coal – the coal was carried in British colliers – the fault lay with the hurried and negligent planning of a state unused to having to supply fuel far beyond its own shores.⁷³ These problems caused 'great embarrassment' to Admiral Sperry – in charge of the exercise – 'for it illustrated how easily Great Britain could control the fleet's behaviour,

⁷¹ J.R. Reckner, *Teddy Roosevelt's Great White Fleet*, Annapolis, 1988, x.

⁷² Reckner, *Teddy Roosevelt's Great White Fleet*, 89 and 147.

⁷³ Reckner, *Teddy Roosevelt's Great White Fleet*, 105 and 160.

stranding it halfway round the world, should the need arise, and causing it to be a “laughing stock”. Britain refused to supply coal from its own admiralty stacks, as was standard practice, and Sperry spent much of his time negotiating for Australian coal – generally of poor grade – at Auckland, Sydney, Melbourne and Albany. A similar situation occurred at Port Said, where the admiral spent most of his time arguing with coal dealers.⁷⁴ Not only was this humiliating for such an impressive fleet, but it also delayed progress, with the poor quality Australian coal forcing some ships to cruise at the most economical speed, as well as producing thick smoke (see Figure 3). Delays also occurred at Apia, Samoa, where there was no coal on arrival. Contemporary reports reveal the level of uncertainty on board: ‘days went by ... days of anxiety ... and still no coal’. With the fleet arriving on 20 September, enough coal for four cruisers only arrived on 4 October, with the remaining cruisers stranded until 7 October.⁷⁵

Figure 3: USS Georgia (BB-15), flagship of the 2nd Division of the Great White Fleet in Auckland. Courtesy of U.S. Naval Institute Archives.

This hugely embarrassing situation, precipitated by a lack of control over the infrastructure for coaling the ships, severely undermined the imagined effect of the fleet on those who witnessed it. Despite setting several world records, there was a feeling in America that ‘it had been unwise to display the nation’s inability to coal and supply its own fleets’.⁷⁶ It was concluded that ‘had war broken out while the fleet was in distant waters, it would have been immobilised by lack of logistical support’.⁷⁷ Senator Hale was particularly embarrassed that ‘the greatest fleet of formidable ships that the world has ever seen’ had to

⁷⁴ R.A. Hart, *The Great White Fleet: Its Voyage Around the World, 1907—1909*, Boston, 1965, 198, 274. A good summary of some of Sperry’s ingenuity in sourcing this coal can be found in Reckner, *Teddy Roosevelt’s Great White Fleet*, 103—104.

⁷⁵ Hart, *The Great White Fleet*, 201 and 214.

⁷⁶ Hart, *The Great White Fleet*, 300.

⁷⁷ Reckner, *Teddy Roosevelt’s Great White Fleet*, 161.

depend on 'the indulgence of foreign powers'.⁷⁸ Of these foreign powers, Britain dominated all others by possessing both the best steam-coal in the world, and controlling the mobilities which allowed it to be available to Royal Navy ships worldwide. Even the subsequent 1909 US naval programme, designed to remedy this situation, did little. At the outbreak of war in 1914 the United States owned just seven colliers. The problem of fuelling far from their own waters was not solved until age of oil.⁷⁹

This situation stood Britain in good stead in the event of a global war. Its extensive coaling facilities meant it did not have to rely on neutral powers, whereas any potential enemy would be forced to if they were to operate globally. In theory, the Treaty of Paris of 1856 made this impossible, as, if one assumes coal to be contraband of war Britain's enemies could not be supplied by a neutral power. Yet, as the definition of 'contraband' was deliberately omitted, the British assumed that these 'rules ... would not prevent a belligerent ship from obtaining a full supply of coal in a neutral port'.⁸⁰ Even if this was the case, Britain was still in a commanding position. Whilst Welsh coal merchants freely traded with foreign navies in peacetime, this would be prevented in war. Thus, any enemy would lose their primary source of high-quality coal, and any in storage would soon degrade, forcing a move to substandard fuel. Moreover, as we have seen, even in peacetime Britain's control of the global mobility of naval coal, and of the stations themselves, allowed it to slow, delay or even immobilise its rivals. In war, it could further disrupt its enemies' supplies through fuel denial by its allies (such as Portugal, and its possessions) and even neutral countries (particularly in the informal empire) where it could exert economic pressure to prevent enemies being fuelled in those ports. This gave Britain a huge advantage in the wider world, despite its waning global power.

THE ADVENT OF OIL

⁷⁸ Hart, *The Great White Fleet*, 33 and 55.

⁷⁹ Reckner, *Teddy Roosevelt's Great White Fleet*, 161; F.W. Rüstow, *The War for the Rhine Frontier 1870; Its Political and Military History*, translated by J.L. Needham, Edinburgh, 1871, Volume 3, 1872. IS THIS A PAGE NUMBER??

⁸⁰ Rüstow, *The War for the Rhine Frontier*, 80.

Less than twenty years later, however, the roles had been reversed, and it was Britain that relied on the US for naval fuel.⁸¹ Experimentation with oil by the Italian navy in the late nineteenth century, subsequently followed by trials by the US Navy, led Britain to commit to an oil powered navy, amidst fears it would be left behind.⁸² However, unlike the US, then the world's largest producer of oil, Britain did not have its own source of oil domestically or in its empire, at least not one that had been discovered as viable.⁸³ Instead, in order to free the Royal Navy from its reliance on the foreign owned Standard Oil and Royal Dutch Shell oil companies, in 1914 Britain purchased a fifty-one per cent stake in Anglo-Persian oil, with wells in Iran, which included a secret contract to supply the admiralty for twenty years. Even so, as Britain did not have seashore storage facilities or a network of bunker stations, it no longer controlled its fuel to the extent it had done with a coal powered navy. As such, it was widely recognised at the time that adopting oil under such circumstances represented a huge risk, not least because Britain was abandoning its control of quality coal and its export infrastructure to adopt oil.⁸⁴

Despite this, if we take a technocentric view, as many have done before, this change made an enormous amount of sense. This new technology allowed ships to reach higher speeds than those powered by coal, and, unlike coal, oil did not require huge amounts of manpower to load. It also allowed ships to be refuelled at sea, meaning that fleets did not lose ships to fuelling stations whilst on operations. Oil power meant that ships could increase both the speed and flexibility of their mobility, offering them crucial advantages in what was fast seeming like an inevitable war with Germany. Moreover, it meant that Britain could no longer be held to ransom by coal strikes. Finally, with Britain already facing relative decline as a world power and involved in a furiously-paced arms race, the admiralty were unsurprisingly keen to invest in cutting edge technology. These changes were not instantaneous, but were largely limited to new ships. In time honoured fashion, new, oil powered ships were first seen in European fleets, before slowly

⁸¹ This change is explored in J. Goldrick, Coal and the Advent of the First World War at sea, *War in History* 21 (2014) 322—337.

⁸² Madureira, Oil in the age of steam, 75—94.

⁸³ Gibson, British Strategy and oil.

⁸⁴ Madureira, Oil in the age of steam, 89—90.

filtering out into further flung stations. This meant that coal powered ships could still be found in naval service in the 1930s.

Although it had been assumed that there would be a race to adopt oil, this did not materialise, and by 1914 only the US and Britain had done so. Despite fears that Germany would use oil in its warships, it did not use it as a fuel until after the First World War, largely because it had no secure access to oil supplies.⁸⁵ Despite this, oil did not seem to be a deciding factor in the war, and fluctuation in oil prices meant that coal still represented a less economically risky option.⁸⁶ Even so, oil powered ships offered great advantages and, regardless, Britain had set upon a course that was irreversible. The move to oil has been seen as one of several crucial changes which allowed Britain to remain a global naval power beyond the turn of the twentieth century, and for this Jacky Fisher, First Sea Lord from 1904 to 1910, and Winston Churchill have been seen as the saviours of British naval power. Although more recently the idea of a ‘Fisher Revolution’ has been questioned, the decision to switch to oil remains largely uncritically praised.⁸⁷ Yet some studies have shown that this narrow understanding does not sufficiently explain the multiple issues which a switch to oil caused.⁸⁸ It is not within the scope of this article to examine the major effects in detail – in particular, how Britain secured oil for its navy, nor to show its role in future troubles in the Middle East.⁸⁹ What is possible is to use a wider understanding of the effects of this change to understand how, in losing control of the mobility of its fuel, Britain imperilled the mobility of its navy in far-flung waters which was contingent upon it. To do so it will draw parallels with the United States, and others, in the age of coal.

In his own memoirs, *The World Crisis 1911-1918*, Churchill himself admitted to the drawbacks as well as the advantages of oil. He described the shift as ‘a formidable decision’ as ‘the oil supplies of the

⁸⁵ Madureira, *Oil in the age of steam*, 88.

⁸⁶ Dahl, *Naval innovation*, 54–55 and Madureira, *Oil in the age of steam*, 86.

⁸⁷ For a concise study of the current debate, see D. Morgan-Owen, *A revolution in naval affairs? Technology, strategy and British naval policy in the ‘Fisher era’*, *Journal of Strategic Studies* 38 (2015) 944–965.

⁸⁸ See, for example, Dahl, *Naval innovation*, 50–56; Gibson, *British strategy and oil*; Brown, *The Royal Navy's fuel supplies*.

⁸⁹ For an in-depth study of the effects of the change to oil on the Middle East, see Gibson, *British strategy and oil*. For a study of the transformation of oil into a geostrategic commodity, see Madureira, *Oil in the age of steam*.

world were in the hands of vast oil trusts under foreign control. To commit the Navy irrevocably to oil was indeed “to take arms against a sea of troubles”. Thus, in moving the navy from coal to oil, Britain had created new problems for itself. The most obvious of these was that Britain now needed oil, and lots of it, to fuel the ships responsible for protecting its increasingly weak geopolitical situation, and that oil could only be found outside of British control.⁹⁰ Britain now faced the same issues as its rivals had with coal: that the size and technology of its navy mattered little if it could not control its fuel supply. Britain still possessed the largest navy, but it no longer possessed the resources for its mobility. No longer able to supply its navy on its own, Britain faced the complex negotiations involved in sourcing the fuel that made the movement of its ships possible.

It did not take long for the wisdom of using oil to be questioned. In 1917 Britain faced a major oil crisis as ships transporting oil were regularly sunk by German U-Boats. The colonial secretary, Walter Long, recognised the serious peril the navy faced: ‘You may have men, munitions, and money, but if you do not have oil, which is today the greatest motive power that you use, all your other advantages would be of comparatively little value’. Similarly, the shipping comptroller argued that ‘it is obvious that we are entirely dependant on the United States for the mobility of our Navy’.⁹¹ There are obvious echoes here of Senator Hales’ comments about the difficulties the US Navy faced in obtaining quality coal, highlighting the importance of controlling fuel for the fleet. Rationing of oil was successful for a time, but merely delayed the issue. Indeed, later that year the shortage became so acute that many considered using coal again. Plans were made for a coherent government policy to ensure supplies, but the immediate shortage had to be resolved by the American company Standard Oil and Royal Dutch Shell, commercial suppliers in foreign hands.

The issue of foreign controlled oil did not disappear, even after the war. On 24 April 1928, Winston Churchill, then chancellor of the exchequer, made his budget speech. In it he proclaimed:

⁹⁰ Madureira, *Oil in the age of steam*, 90.

⁹¹ Maclay to Hankey, 13 August 1917, TNA, ADM 116/1804. Cited in Brown, *The Royal Navy's fuel supplies*, 246.

During the 19th century the industrial power of our country rested upon the basis of its wonderful coalfields; the 20th century has seen us become increasingly dependent upon imported liquid fuel, scarcely any of which is found inside the British Empire. We paid last year for oil supplies of every kind almost as much as we received for our export of coal. We used to be a source of fuel; we are increasingly becoming a sink. These supplies of foreign liquid fuel are no doubt vital to our industry, but our ever-increasing dependence upon them ought to arouse serious and timely reflection.⁹²

When we put these problems into the context of the 1930s, where a depression-struck Britain faced a resurgent Germany, it is understandable why, following Churchill's lead, some high profile naval men and a handful of MPs were becoming concerned about the admiralty's reliance on foreign oil.⁹³

Key amongst these was Captain Bernard Acworth, a retired naval officer who took to writing about the state of the Royal Navy. Much of this was a direct attack on Jacky Fisher, including criticisms of air power, torpedoes, radios and submarines, amongst other modern technologies. He was, therefore, often dismissed as a man with an axe to grind rather than a valid point to make.⁹⁴ Yet Acworth also raised some pertinent questions. Echoing concerns at the time of the change from coal to oil, he suggested that Britain was in real danger in a future war because it could not guarantee its own fuel supply for the navy. Along with a variety of high-ranking officers, and men of some political clout, he formed the 'Back to Coal' movement. This group contained a first sea lord, four admirals, a vice admiral, a rear admiral, several MPs, a colliery owner and a shipping magnate. Many of these were either within, or had close connections with, the top echelons of power. Considerable money was invested in the campaign, and Acworth had several professional plans drawn by the Naval Construction Works of Vickers Armstrongs which showed how coal fired engines would be incorporated into the cutting-edge warships of the early 1930s. Thus, this was not

⁹² Imported oils duty, House of Commons debate, 24 April 1928, *Hansard*, volume 216, columns 854—860.

⁹³ For a wider study of 'back to coal' movements, see Brown, *The Royal Navy's fuel supplies*, 244—268.

⁹⁴ Brown, *The Royal Navy's fuel supplies*, 254. For the most blatant of these attacks, see B. Acworth, *Navies of Today and Tomorrow*, London, 1930.

simply a nostalgic call to fall back on the outdated technologies of a more glorious age, but an effort to develop the capacity to use Britain's own fuel supplies to power a thoroughly modern fleet. The 'Back to Coal' movement understood that controlling the source and mobility of naval fuel was central to British naval power.

The campaign precipitated several debates in parliament, and appears to have reached its peak with a petition presented to Stanley Baldwin, which was promised consideration by the cabinet, although the lack of further correspondence, nor forward action by the government, suggests that the idea was never seen as viable.⁹⁵ However informed their case was, there are good reasons why it fell on deaf ears. Firstly, it is unlikely that coal fired ships would ever satisfactorily challenge oil fuelled ships, which were faster and easier to fuel, and that by adopting such a plan the Royal Navy would be significantly weakened. Secondly, such a change would incur an enormous amount of investment, in terms of capital, but also in providing the coaling infrastructure required for supporting such coal-powered ships around the world. As such, it is unsurprising that the campaign came to nothing.

Yet, although the 'Back to Coal' movement was an unsuccessful campaign that has since faded from memory, it raises important questions about how states ensure the mobility of their naval forces, especially in an industrial age. Indeed, the campaign's message about the importance of controlling fuel, its infrastructure and its global mobility has been shown here to be central to Britain's ability to mobilise its navy worldwide in the nineteenth century.

CONCLUSIONS

The first of the six constituent parts of mobility laid out by Tim Cresswell is 'motive force'.⁹⁶ This article has shown that in the industrial age this force was and is often contingent on other mobilities. Although

⁹⁵ Davies, *Britannia's Dragon*, 170. Much of the correspondence, ships plans and newspaper articles can be found in Richard Burton Archives, Swansea University, 2012/18.

⁹⁶ Cresswell, *Towards a politics of mobility*, 17.

it has only provided an overview of one example, that of the steam navy, it has shown that complex separate machinations and mobilities were involved in ensuring that warships could obtain the fuel necessary for the Royal Navy to fulfil its global role. The idea of contingent mobilities highlights the importance of understanding how mobility is often reliant on processes, infrastructure, historical agents and commodities which are frequently considered marginal or ignored. Indeed, when we consider the start and end point of naval coaling in conjunction with the processes, actors and infrastructural elements in between a far more complex view of 'motive force' emerges.

Moreover, it becomes clear that the effectiveness of the navy was not solely reliant on the actions of those in Whitehall. In fact, it was heavily dependent on state and non-state infrastructures, networks and mobilities working together. Supplying the navy with coal involved many actors and processes – coal did not simply appear at a foreign station. These networks were considerable physical entities with their own separate mobilities – including mines, railways, ships and stations – which spanned huge distances and served the interests of international commerce, the Royal Navy and many rival navies. Whilst Britain was largely able to establish networks of trust with these elements and mobilities, which were almost all in its possession, the fact that the mobility of its primary defence was contingent on these mattered little. As the *New York Times* suggested, Britain's was an 'enormous system under ... splendid control'.

Yet where these mobilities and infrastructures were controlled by other nations, or indeed rivals, naval mobility could be inconvenienced, slowed or indeed stopped. As such, Britain's ability to deny the same advantages to its rivals through their control of fuelling infrastructure was an important geopolitical advantage, meaning that it could largely control each part of their mobilities – their velocity, rhythm, route and experience – through the frustrations of delays and immobility.⁹⁷ Indeed, the examples of Russian and American struggles when negotiating a fuelling infrastructure dominated by Britain highlight the fact, recognised by contemporaries, that ship numbers and technology mattered little without a reliable source of quality coal. Or, put another way, potential mobility and naval power could be made

⁹⁷ Cresswell, *Towards a politics of mobility*.

irrelevant if the mobilities it was contingent on were insecure or uncontrollable. This of course has serious geopolitical consequences, and, for example, Russian or American designs to extend their sphere of naval influence were severely hampered by an inability to control the mobility of the fuel needed to do so.

We see this again when analysing the effects of Britain's decision to move from a coal to an oil-powered navy. Despite the many advantages oil gave, the loss of control of its fuel supply and infrastructure put the Royal Navy at a disadvantage which had ramifications for naval strategy. Whilst it would be an overstatement to suggest that the change to oil gave rise to American naval power, and the simultaneous decline of British global power, fuel, and its associated infrastructure and mobilities, is an important consideration when trying to understand why Britain could maintain its naval supremacy for so long, yet lose it so quickly. Although coal is often seen as unimportant and unglamorous, this article has revealed that Britain's control of its infrastructure and mobility was of vital importance to its own security and that of its empire in the period 1870–1914.

By exploring the idea of contingent mobilities this paper also points to the significance of those often-ignored processes and actors which facilitated the availability of fuel to naval ships, and shows that the complexity of achieving global mobility should not be overlooked. Yet current scholarship rarely considers this fact. Instead, as Madureira has suggested, by just concentrating on 'such an innovation-centric view [previous studies] tend to undermine the contribution made by time, technological mixes, and local resources'. Instead, as this article argues, 'the role and scope of technological systems can not be assessed without taking into account ... [the] infrastructures for maintenance and repair ... and the abundance and relative costs of the resources required to make the technology work'.⁹⁸ As such, this article posits that we must consider the idea of contingent mobilities more widely, as we cannot just see movement in terms of start and end points, or naval power in terms of numbers and technology, but must also acknowledge the processes and materials which enable movement to occur, as well as the actors and functions which facilitated them. Although this article has concentrated on the mobility of fuel, it is equally

⁹⁸ Madureira, *Oil in the age of steam*, 76.

correct to argue that naval (and other) mobilities are also contingent on the mobilities of labour, supply vehicles between source and port, stock orders and admiralty funds, among many other things. Indeed, in beginning to consider the numerous contingent mobilities present in a wide variety of seemingly simple movements we can reveal complex webs of movement, infrastructure, actors and processes.