

INFRASTRUCTURAL GLOBALIZATION: LIGHTING THE CHINA COAST, 1860s–1930s

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ABSTRACT. *This article calls for attention to be paid to the infrastructures that underpinned nineteenth-century globalization, and the use of better-known technological developments and global patterns of professional migration. It does so by outlining the work of the Marine Department of the Chinese Maritime Customs Service after 1868, focusing on its development of a network of lighthouses along the coast of China in its political and comparative contexts. These lights were at once local sites and nodes within a developing national and global system, and evolving practices around circulation of data and best practice, accepted international standards, technology transfer, and maritime safety. The Customs Service was a Chinese government agency, albeit within the British orbit of influence, but acted as a buffer between China and foreign interests and pressures.*

Scholars of China's modernity are very fond of 'LIGHT, HEAT, POWER', the words on the flashing neon sign which lights up the opening pages of writer Mao Dun's 1933 novel *Ziye* (*Midnight*) (and which stand out in capitalized English in the original Chinese text). They use it to highlight perceptions and representations of urban colonial modernity in industrializing treaty port Shanghai.¹ They are taken, too, as Chinese cinema was in the 1930s, with the city's neon-lit Nanjing road, its department stores and their modernities, their elevators and their other modern tricks and trips which aimed to dazzle the consuming crowd, and with the ready Chinese acceptance of neon illumination.² Shanghai and other cities tend to dazzle scholars in turn, and their commercialized vibrancy, and the ease of their archives and prominence in memoir and politics, grab

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¹ It provides the opening quotation and discussion in Leo Lee's *Shanghai modern: the flowering of a new urban culture in China, 1930–1945* (Cambridge, MA, 1999), pp. 3–5. The ready acceptance of electric lighting is outlined in Frank Dikotter, *Things modern: material culture and everyday life in China* (London, 2007), pp. 133–44.

² See the opening credits of *Malu tianshi* (Street Angel) (dir. Yuan Muzhi, 1937), for a collage of street scenes in which light plays a key role. Scholars: Sherman Cochran, ed., *Inventing Nanjing road: commercial culture in Shanghai, 1900–1945* (Ithaca, NY, 2000).

attention. Scholarship has just about abandoned the countryside as it has just about abandoned the Chinese revolution. It has never been much interested in the coasts.³ In between these bright, exciting modern points, it sometimes seems, all else was darkness.

But in between was lit. There were numerous modern sites, lighthouses perched on rocks, marooned on islands or anchored fast in Chinese waters, tied to each other and the world, and tying China more and more tightly into global networks. On some stretches shipping would see the next light before the last dimmed. In 1948, there were 329 lights, beacons, light vessels, and light boats, and another 1,400 other beacons and markers fixed or anchored along the Chinese coast, and along its major rivers. This network was developed over the preceding eighty years by the Marine Department of the Chinese Maritime Customs Service (CMCS), and formed a vital tool in the development of China's coastal and international communications.⁴ This article will outline the history of the development of this system, and place it in the wider context of the work of the Marine Department and the Customs overall, and the wider global development of coast lighting systems. The work of the Marine Department is under-explored, even though Victorian anglophone culture lionized engineers, loved lighthouses, and awarded prizes to China's.⁵ The department's hydrographic and meteorological work, and the lights project, were clearly part of the process of infrastructural development which underpinned China's integration into evolving regional and international systems and practices. Such developments involved a number of intertwined strands that we might consider more broadly: the functioning of British nationals in key positions in foreign employ; technology transfer; the generation, circulation, and exchange of data; synchronization with existing or developing global norms; formal participation in international and transnational organizations and treaties. The process involved people, data, things, law, language, and it even involved changing time itself. All these are recognized elements in the process of globalization, and the lights initiative overall was designed to underpin China's integration within that process, described by A. G. Hopkins as 'the extension, intensification and quickening velocity of flows of people, products and ideas that shape the world. It integrates regions and continents; it compresses time and space; it prompts

³ Recent exceptions include Micah S. Muscolino, *Fishing wars and environmental change in late imperial and modern China* (Cambridge, MA, 2009), and Sigrid Schmalzer, 'Fishing and fishers in Penghu, Taiwan, 1895–1970', *East Asian History*, 23 (2002), pp. 109–28.

⁴ The main published source is T. Roger Banister, *The coastwise lights of China: an illustrated account of the Chinese Maritime Customs lights service* (Shanghai, 1932). In general, there is very little academic work on lighthouses, although see the works cited below as well as Vincent Guigueno's 'Des phares-étoiles aux feux-éclairs: les paradigmes de la signalisation maritime française au XIX^e siècle', *Réseaux*, 19 (2001), pp. 95–112. A good popular introduction is Bella Bathurst, *The lighthouse Stevensons* (London, 1999).

⁵ Christine MacLeod, *Heroes of invention: technology, liberalism and British identity, 1750–1914* (Cambridge, 2007).

imitation and resistance.⁶ This is a useful definition, but these developments all depend on (as well as, in turn, shape and define) the creation of new physical foundations: an infrastructure for globalization.

This process of infrastructural globalization has received less attention than it warrants and less than in cognate processes such as in European integration, or state formation.⁷ Interest has been patchy: the telegraph and the steamship are well-covered areas – but mostly in the context of the history of technology and maritime history – and flows of institutional and individuals' finance have been mapped. Professional circulation has been steadily better explored. But other aspects of the developing global infrastructures which underpinned trade and migration are far less well understood.⁸ And while some professions have secured attention – medicine for example – others remain conspicuously infra dig: engineers not least of all.⁹ Port cities stand out as a topic now receiving increasing interest (though often mainly as intercultural sites, even when conceptualized as 'portals'), and so too press networks, but the maritime terrain between these mainly urban points remains largely unmapped.¹⁰ While some interesting work has explored maritime voyages in and of themselves as an imperial or a British space, for example, analysis of the maritime world more widely has too often been assumed mainly to be of technical interest, and so of limited interest to scholarship more widely.¹¹

This article aims to locate the development of the lighthouse network in China within its global, globalizing, and local contexts, as an infrastructure which served many purposes, for different actors, and which facilitated the physical incorporation of China into wider networks and circuits as well as its alignment with developing international norms, such as temporal practices and perceptions. It shows too how these lighthouses were local structures, with a

⁶ A. G. Hopkins, 'Introduction', in A. G. Hopkins, ed., *Global history: interactions between the universal and the local* (Basingstoke, 2006), p. 3. See also his edited volume, *Globalization in world history* (London, 2002).

⁷ Thomas J. Misa and Johan Schot, 'Introduction', to 'Inventing Europe: technology and the hidden integration of Europe', *History and Technology*, 21 (2005), pp. 1–19.

⁸ Amongst others: Daniel R. Headrick, *The tools of empire: technology and European imperialism in the nineteenth century* (Oxford, 1981), and his *The invisible weapon: telecommunications and international politics, 1851–1945* (Oxford, 1991); Gary B. Magee and Andrew S. Thompson, *Empire and globalization: networks of people, goods and capital in the British world, c. 1850–1914* (Cambridge, 2010). Relevant work with a China focus includes Erik Baark, *Lightning wires: the telegraph and China's technological modernization, 1860–1890* (Westport, CT, 1997), and David R. Meyer, *Hong Kong as a global metropolis* (Cambridge, 2000).

⁹ Although see MacLeod, *Heroes of invention*, and R. A. Buchanan, *The engineers: a history of the engineering profession in Britain, 1750–1914* (London, 1989).

¹⁰ Mathias Middell and Katja Naumann, 'Global history and the spatial turn: from the impact of area studies to the study of critical junctures of globalization', *Journal of Global History*, 5 (2010), p. 162.

¹¹ Tamson Pietsch, 'A British sea: making sense of global space in the late nineteenth century', *Journal of Global History*, 5 (2010), pp. 423–46. See also Glen O'Hara, *Britain and the sea since 1600* (Basingstoke, 2010).

local impact. It argues that we need to put infrastructure at the heart of understanding this phase of global development. From the recent literature we have learnt a great deal about *métissage* and hybridity within colonial sites, but neither achieves any critical mass without encounter, and there are fewer encounters without effective infrastructures that can sustain systematic flows of people and ideas in high volumes. Maritime history more broadly needs to be better situated within the mainstream of imperial and global histories. And in addition, it needs to be a maritime history very broadly conceived, for it was, of course, never simply a history of the sea.

I

We do not need to agree that maritime lighting was ‘coercive’ to accept that the lights system grafted on to China’s coast was deliberately intrusive, aiming to ease physical access, with a view to making China predictably safe for foreign trade. The steamship had made (increasingly) rapid and programmable communication possible, while the opening of the Suez Canal physically breached a barrier between Europe and Asia. In the fifty years after 1860, coast lights programmes lit maritime Southeast Asian coasts, and Japan.¹² The maritime highway to China was open, and development of the Chinese treaty ports with their attendant infrastructure was under development. Foreign traders and officials knew what they (and ‘China’) needed there – bunds, streets, warehouses, systems, expertise, information, law. The treaties laid out an overall framework. Consuls negotiated local detail with Qing officials, and promulgated regulations. With committees of foreign traders (which became councils) they began to develop infrastructures – roads and jetties – to facilitate the growing presence. P&O secured mail contracts, and new technologies were deployed: the telegraph arrived in 1869.¹³ After 1854, the Foreign Inspectorate of the Maritime Customs Service itself provided predictable and efficient systems for revenue assessment (the treaties also enforced a predictable and low tariff regime). When Ulster native Robert Hart, the long-serving inspector-general of the CMCS, outlined the task facing the Customs as it embarked on its plans to

¹² Eric Tagliacozzo, ‘The lit archipelago: coast lighting and the imperial optic in insular southeast Asia, 1860–1910’, *Technology and Culture*, 46 (2005), pp. 306–28, at p. 328; Olive Checkland, ‘Richard Henry Brunton and the Japan lights, 1868–1876, a brilliant and abrasive engineer’, *Transactions of the Newcomen Society*, 63 (1992), pp. 217–28; Richard Henry Brunton, with an introduction by Hugh Cortazzi, *Building Japan 1868–1876* (Folkestone, 1995).

¹³ Two accounts of different aspects of the process: Kerrie L. MacPherson, *A wilderness of marshes: the origins of public health in Shanghai, 1843–1893* (Hong Kong, 1987); Robert Bickers, ‘Ordering Shanghai: policing a treaty port, 1854–1900’, in David Killingray, Margarette Lincoln, and Nigel Rigby, eds., *Maritime empires: British imperial maritime trade in the nineteenth century* (Woodbridge, 2004), pp. 173–94. Mail: Freda Harcourt, *Flagships of imperialism: the P & O Company and the politics of empire from its origins to 1867* (Manchester, 2006), pp. 86–113; telegraph: Baark, *Lightning wires*.

'facilitate navigation along the Chinese seaboard' in 1868, his reasoning followed a ship into port:

In the interests of ships travelling to and along the coast of China, the real requirements, in general terms, are as follows:- on the voyage, warning to be given of dangers, i.e. lights ought to be placed where necessary; in nearing a port, assistance to be given by experts acquainted with local peculiarities, tides, currents, & c., i.e. efficient pilots ought to be provided; in the waters of the port, spots to be avoided to be marked, i.e. there ought to be a proper supply of buoys and beacons; in the anchorage, order and regularity to be ensured, for the convenience of business and the preventing of accidents, i.e. there ought to be Harbour Masters.¹⁴

This article will concentrate on the first of these requirements, but it should be borne in mind that all were interconnected, in Hart's thinking, and as well as in the passage of any vessel into any open Chinese port.¹⁵

The CMCS, whose prime function was revenue assessment, was not precisely the logical agency to undertake this work, but in this as in other areas its functions and activities far exceeded its central role. Hart quipped privately in 1867 that he could logically become 'Inspector General of Everything' at the rate the Service was acquiring new responsibilities including language schools, arsenals, and quasi-diplomatic functions.¹⁶ While such activity often stemmed from Hart's own agenda (publication of a series of *Customs Medical Reports*, for example, to add to the store of universal knowledge), such activities were also often in fact assigned to it by the Chinese state. In one sense, it functioned as an executive agency of the Zongli Yamen, the Qing body which co-ordinated foreign matters after 1861.¹⁷ The Customs provided reserves of useful

¹⁴ IG Circular No. 10, 25 Apr. 1868, in *Inspector general's circulars: first series: 1861-1875* (Shanghai, 1879), p. 138. Formally, Hart served as inspector-general from Nov. 1863 until 1911, although he was already in charge of the service by 1861.

¹⁵ On pilotage, see George Philip, *The log of the Shanghai pilot service 1831-1932* (Shanghai, 1932).

¹⁶ Queen's University Belfast, Special Collections (QUB), MS 15/1/9, Hart journal, 5 Aug. 1867. There is actually less on the history of the Customs generally than might be imagined, and less still on its operational history, as opposed to its political history, or the history of the tariff and its implications. Useful introductions and surveys with very different rationales are Stanley F. Wright, *Hart and the Chinese Customs* (Belfast, 1950); Hamashita Takeshi, *Chugoku kindai keizaishi kenkyu: shinmatsu kaikan zaisei to kaikoujou shijouken* (Economic history of modern China: Maritime Customs finance and open port market zones in late Qing China) (Tokyo, 1989); Chen Shiqi, *Zhongguo jindai haiguan shi* (History of the modern Chinese Customs) (Beijing, 2002); Thomas P. Lyons, *China Maritime Customs and China's trade statistics, 1859-1948* (Trumansburg, NY, 2003); Donna Brunero, *Britain's imperial cornerstone in China: the Chinese Maritime Customs Service, 1854-1949* (London, 2006). Two recent sets of papers make use of the recently reopened archives of the Service: Hans van de Ven, ed., 'Robert Hart and the Chinese Maritime Customs Service', *Modern Asian Studies*, 40 (2006), pp. 545-736; Robert Bickers, ed., 'Revisiting the Chinese Maritime Customs Service, 1854-1950', *Journal of Imperial and Commonwealth History*, 36 (2008), pp. 221-311.

¹⁷ Richard S. Horowitz, 'Central power and state making: the Zongli Yamen and self-strengthening in China, 1860-1880' (Ph.D. thesis, Harvard, 1998); Jennifer Rudolph, *Negotiated power in late imperial China: the Zongli Yamen and the politics of reform* (Ithaca, NY,

foreigners, expertise, or contacts. When Japan undertook development of a lights system as agreed in the 1866 Tariff Convention, it outsourced the operation to a private British engineer.¹⁸ As the Qing already had the Customs to hand, it could be entrusted to develop such initiatives directly itself. Again and again over the following decades local and central administrations would ask the CMCS to undertake specific hydrographic or related projects, alongside others. Such incremental extension of its de facto functions would nonetheless eventually cause frictions as other Chinese state agencies were developed (the Communications and Navy ministries for example), but in the nineteenth century the CMCS had a capacity that was relied on in the first instance, and as a matter of habit by the Chinese state at all levels. The Customs and its supporters made much of this.¹⁹

Robert Hart started active development of his lights programme early in 1867, and it was to the British envoy in Beijing, the minister Sir Rutherford Alcock, that he first sent a 'Coast Light Memorandum' that he had drafted by 31 January 1867.²⁰ The 1858 Sino-British Tianjin treaty implied that China was expected to develop navigation aids, but without much firm detail, certainly not enough to thump any Chinese tables over and secure results. Tonnage dues had been collected on shipping since 1843, however, and by 1866 this had become a point of contention that Hart was encountering in his discussions with diplomats in Peking.²¹ Ad hoc initiatives had seen the development of a number of navigational aids, and the Maritime Customs began to be involved in developing or maintaining these.²² Hart was already lobbying for support for a more systematic programme, discussing it formally with the American minister, seeking out details from the governor of Hong Kong about lights there, and presenting his final proposal formally to the Zongli Yamen in July that year.²³ The imperative was not the 1858 treaty, but the situation facing those managing the developing communications infrastructure, especially in the more settled

2008). The Zongli Yamen was as close as the Qing state got to creating a foreign ministry before 1901. It was in fact an office for dealing with foreign states, as well as foreign things and foreign matters generally.

¹⁸ Checkland, 'Richard Henry Brunton and the Japan lights, 1868–1876', and Brunton, *Building Japan*.

¹⁹ *Times*, 1 Sept. 1906, p. 10.

²⁰ QUB, MS 15/1/9, Hart journal, 31 Jan. 1867. This was later circulated as Appendix A in Circular No. 25/1870, 31 Dec. 1870, see *Inspector general's circulars: first series: 1861–1875*, pp. 325–30.

²¹ Article xxxii states that 'The Consuls and Superintendents of Customs shall consult together regarding the erection of Beacons or Lighthouses, and the distribution of Buoys and Light-ships, as occasion may demand'; see also Wright, *Hart and the Chinese Customs*, p. 294. On the history of this revenue, see Stanley F. Wright, *China's Customs revenue since the revolution of 1911* (3rd edn, revised ... with the assistance of John H. Cubbon, Shanghai, 1935), pp. 34–7.

²² Banister, *Coastwise lights of China*, pp. 3–4.

²³ QUB, MS 15/1/9, Hart journal, 1867: 19 Mar. (Burlingame), 19 Apr. (Hong Kong), 22 July (Zongli Yamen). He had already written to Forbes about his plans: 4 July.

aftermath of the destructive Taiping rebellion which had finally been suppressed in 1864.

Establishing safe navigation was a priority for those forcing East Asia 'open' for trade. Although the Admiralty ran its own surveying programme, it had no need to lobby through the Sino-British treaties, for example, for China to develop aids to navigation at critical points. The Customs buffered China in that regard as Hart noted in his journal in 1867.²⁴ Contrastingly, development of a lights system had been forced on Japan, in Article XI of the June 1866 Tariff Convention with Britain, France, the Netherlands, and the US. Sir Harry Parkes, the British minister there, had pushed hard for the Convention, and insisted in November 1866 that the provision be attended to by the Japanese. The Bakufu lodged £11,000 with the Bank of England, and the British Board of Trade was then asked to supply an engineer to develop a coastal network. Richard Henry Brunton arrived in 1868, and oversaw construction of a network of twenty-six lighthouses over the next eight years.²⁵ Parkes remained closely concerned with this enterprise. Brunton's first survey of potential sites on the Japanese coast was undertaken in a Royal Naval vessel, which was put at his service for two months from November 1868 at the British minister's request. The close interest was one of the reasons behind Brunton's failure to see himself as a Japanese government employee, and it was this that eventually led to his dismissal in 1876. Instead, he perceived himself as having full powers over the nascent Lighthouse establishment, and had recourse to the continuing interest and diplomatic weight of Sir Harry Parkes whenever he met, or created, difficulties.²⁶ A specifically British initiative, using British technology and expertise, and working in parallel to Admiralty hydrographic surveying programmes, had thereby begun the task of linking Japan to the global network of surveyed and lit sea lanes. Foreign pressure had also led to the development of coast lighting in the Ottoman empire. The initial initiative had come as a result of French disquiet at the lack of navigation aids and the impact on its aid to Turkey during the Crimean war. Napoleon III had lobbied swiftly for quick action, and the installation of a French naval officer as director of lighthouses in the empire in 1855.²⁷

²⁴ QUB, MS 15/1/9, Hart journal, 12 July 1867.

²⁵ The treaty is in J. H. Gubbins, *The progress of Japan, 1853–1871* (Oxford, 1911), pp. 298–304, article XI at p. 304; the evolution of the Convention is detailed in Michael R. Auslin, *Negotiating with imperialism: the unequal treaties and the culture of Japanese diplomacy* (Cambridge, MA, 2004), pp. 129–35; Brunton, *Building Japan, 1868–1876*; Checkland, 'Richard Henry Brunton and the Japan lights'. The wider context of the work of these early foreign experts in Japan is explored in H. J. Jones, *Live machines: hired foreigners and Meiji Japan* (Tenterden, 1980).

²⁶ Checkland, 'Richard Henry Brunton and the Japan lights', pp. 220–3.

²⁷ Jacques Thobie, *L'administration générale des phares de l'empire Ottoman et la société Collas et Michel, 1860–1960* (Paris, 2004). Thobie's *Phares ottomans et emprunts turcs, 1904–1961: un type de règlement financier international dans le cadre des traités* (Paris, 1972) mainly looks at the later financial history of the concession.

The contrasts with the contemporaneous programme undertaken in China by Hart, his first marine commissioner Captain C. S. Forbes, and David Marr Henderson, chief coast lights engineer from January 1869, are telling. There seems to have been no specific national-level pressure from foreign consuls or traders, although criticism of inaction on this and other infrastructural issues can certainly be found in the treaty port press editorials and reports of chamber of commerce meetings.²⁸ This was entirely in line with wider trends, notably the lobbying activities of British metropolitan and colonial chambers of commerce, for whom maritime safety (and so marine insurance rates, for example) was a critical and contentious issue.²⁹ At Shanghai, Commissioner G. H. Fitz-Roy had launched a number of local projects as a result of local criticism.³⁰ Hart drew up a lengthy resumé on the subject of Ship Money in a memorandum in 1871 defending his service and its masters. The Qing had had a rebellion to fight, he noted, and moreover did not share the Western assumption that tonnage dues ought to be hypothecated for a specific purpose. But his masters had allowed Hart to build up a reserve from this source from January 1865 onwards, and this was increased from one tenth to seven tenths of the monies received in early 1868.³¹ He, and they, had moved as fast as finance and contingent circumstance allowed. A need for lights at specific sites was identified in some of the petitions submitted by British treaty port residents outlining their proposals for revision of the Tianjin treaty at its tenth anniversary.³² Hart's 1867 paper actually downplayed the dangers faced by China coast shipping, although British traders were not so sanguine.³³ Royal Navy surveying had exposed most dangers, Hart claimed, but certainly 'convenience' would be gained from a lights system, and this was no less a public good. Once lit, he cheerily claimed (to the derision of local commentators), navigating the coast would be 'as easy ... as would be a walk down Regent Street when the gas is lit'.³⁴ Hart believed that the lights initiative, amongst others, 'come[s] from me, and I have only been able to get them by showing them [Zongli Yamen officials] that they had either to do those things, or to submit to something that would be much worse'.³⁵

²⁸ For example, *North China Herald (NCH)*, 17 June 1869, p. 315.

²⁹ A. R. Ileric, *Parliament of commerce: the story of the association of British chambers of commerce, 1860–1960* (London, 1960), pp. 117–22. On the networking activities and concerns of British colonial chambers, see Magee and Thompson, *Empire and globalization*, pp. 145–7.

³⁰ Defence: *NCH*, 31 Oct. 1868, p. 528.

³¹ 'Tonnage Dues Memo', IG Circular No. 25, 1871, 31 Dec. 1870, in *Inspector general's circulars: first series: 1861–1875*.

³² *NCH*, 29 Dec. 1866, p. 207, 16, 30 May 1868, p. 247; petitions: *NCH*, Tianjin, 9 Dec. 1867, p. 401.

³³ See, for example, comment from Niuzhuang after the lightship commenced operation: *NCH*, 23 Nov. 1867, p. 370.

³⁴ The phrase was toned down when the 31 Jan. 1867 'Coast Light Memorandum' was published as a circular: *Inspector general's circulars: first series: 1861–1875*, p. 327. It was, however, publicly known from the private circulation of the proposal: *NCH*, 22 Apr. 1869, p. 199, 17 June 1869, p. 315.

³⁵ QUB, MS 15/1/9, Hart journal, 12 July 1867.

Hart was given the go-ahead. Despite securing the Ship Money revenues, as with all such initiatives, the funding available was never sufficient. Even in Britain, financial prudence triumphed repeatedly in debates about lights modernization, as in other areas of government.³⁶

Hart's Circular No. 10 of 25 April 1868 outlined the rationale for the establishment of a Marine Department (under a 'marine commissioner' until 1870, re-established and as known after 1881 as the coast inspector), its organization and its responsibilities. Two months later, Circular No. 20/1868 sketched out a six-year development plan.³⁷ Information and expertise was sought locally and internationally to support the initiative. Former Lay-Osborn flotilla officer, Capt. Charles Stewart Forbes, formally appointed marine commissioner in 1869, liaised before he left for China with the British lighthouse authorities and Admirals Sir Henry Kellett and Sir Richard Collinson, who had been closely involved in early surveys of the Chinese coast in 1840–6.³⁸ China coast ships' masters were surveyed for their opinions about where lights were needed, while harbour masters and newly appointed Marine Department officials made rough surveys.³⁹ Forbes then used this data in consultations with Kellett and Collinson to decide on sites for lights and other navigational aids, forming a team of engineers, including David Marr Henderson, chief coast lights engineer from January 1869 (later engineer-in-chief), who was to spend almost thirty years in the Customs. Henderson had previously worked for Chance Brothers, the Birmingham firm which had steadily secured a central role in British lights manufacturing after 1850.⁴⁰ His later successor was Lance Tweedie-Stodart, who joined as an engineer in 1907, having trained and worked with the Stevensons, then with the Admiralty on dockyard work in London and Gibraltar, and having applied for a position in South America.⁴¹ It was important for all the foreign China coast enterprises to make themselves visible and attractive to the professionals – doctors, engineers, and others – whose expertise and skills was vital to the plans that developed. As professionals circulated globally through and across the worlds of British

³⁶ Roy M. MacLeod, 'Science and government in Victorian England: lighthouse illumination and the Board of Trade, 1866–1886', *Isis*, 60 (1969), pp. 4–38; Tagliacozzo, 'The lit archipelago', *passim*.

³⁷ IG Circular No. 10, 25 Apr. 1868, No. 20, 22 June 1868, in *Inspector general's circulars: first series*, pp. 137–42, 162–3.

³⁸ Wright, *Hart and the Chinese Customs*, p. 298. On Forbes's varied life and experiences, see *Documents illustrative of the origin, development and activities of the Chinese Maritime Customs Service* (7 vols., Shanghai, 1937–40), vii, p. 88.

³⁹ One such return is in Tianjin No. 38, 15 Aug. 1867, Second Historical Archives of China (SHAC), 679(2), 1928.

⁴⁰ There is no history of the firm, but see James Frederick Chance, *The lighthouse work of Sir James Chance, baronet* (London, 1902). Forbes resigned in Dec. 1870.

⁴¹ Wright, *Hart and the Chinese Customs*, p. 298. Wright's book was based on the Customs Archives, which he established in the 1930s, and contains a well-informed survey of the Marine Department's lights activities, pp. 295–304. L. Tweedie-Stodart, 'Statement of training and experience' (1906), Tweedie-Stodart papers, private collection.

empire and anglophone and other fields of opportunity, China started to become a routine destination for part or the whole of a career.⁴² To have such key posts as Hart's in foreign hands was important, but even more so in practical terms if there was technical expertise in post as well. The informal global networking of engineers was critical.⁴³

The first tasks Hart's team undertook involved lighting the entrances to the Yangzi and Shanghai. The foreign commissioners of Customs undertook negotiations for sites with their Chinese superintendents and the local authorities.⁴⁴ On 1 August 1870, the Marine Department issued 'Notice to Mariners' A No. 63, detailing the programme and proposed timetable – seven first order lights by January 1872, as well as numbers of smaller beacons and lights.⁴⁵ It took two years longer than that to construct and light these seven, but by 1875 there were fifty-nine lights, eight of the first order – that is the largest of the eleven sizes of Fresnel lens, with the greatest reach and brightest illumination – and smaller river lights in the Yangzi, Huangpu, and 'Canton River' that had been completed (Figure 1).⁴⁶ Some lightships came from Europe, but latterly they were built in Shanghai. Most of the instruments and related equipment (metal towers) installed over the next eighty years came from Chance Brothers or from Barbier et Fenestre (later Barbier Bénard et Turenne) in Paris.⁴⁷ Lights for Shantung Promontory and Dodd Island actually first shone out over Birmingham, when they were tested there at Chance's works in November 1920.⁴⁸

Foreign engineers were needed in China, and so were foreign mechanics. These firms also supplied or procured some of the Customs staff at this level. Edward Silk, who had worked as a mechanic in Mauritius and Bombay, was recruited through them in 1874. W. A. 'Bill' Scott had already worked for

⁴² The most notable Customs example was Sir Patrick Manson, who founded the discipline of tropical medicine, and who served as a Customs surgeon: Douglas M. Haynes, *Imperial medicine: Patrick Manson and the conquest of tropical disease, 1844–1923* (Philadelphia, PA, 2001). On the issue of professional circulation, see David Lambert and Alan Lester, eds., *Colonial lives across the British empire: imperial careering in the long nineteenth century* (Cambridge, 2006).

⁴³ On engineers and empire, see Buchanan, *The engineers*, pp. 148–57.

⁴⁴ The foreign inspectorate assessed duties payable, under Maritime Customs commissioners in each open port, and the parallel office of (Chinese) superintendent and his staff collected them. This division of responsibility underpinned the structure of the Service until 1912.

⁴⁵ Progress can be followed through the pages of *Notices to mariners: first issue, 1862–1882* (Shanghai, 1883). A detailed survey up to 1901 is J. Reginald Harding, 'The Chinese Lighthouse Service', reprinted in *Documents illustrative of the origin, development and activities of the Chinese Customs Service*, vi, pp. 637–60.

⁴⁶ Orders 1–3 are coastline lenses, 4–6 harbour lights. On the Fresnel lens, see Julia Elton, 'A light to lighten our darkness: lighthouse optics and the later development of Fresnel's revolutionary refracting lens, 1780–1900', *International Journal for the History of Engineering and Technology*, 79 (2009), pp. 183–244.

⁴⁷ On the Paris firm, see Vincent Guigueno, *Au service des phares: la signalisation maritime en France XIX^e–XX^e siècles* (Rennes, 2001).

⁴⁸ *Times*, 30 Nov. 1920, p. 11.

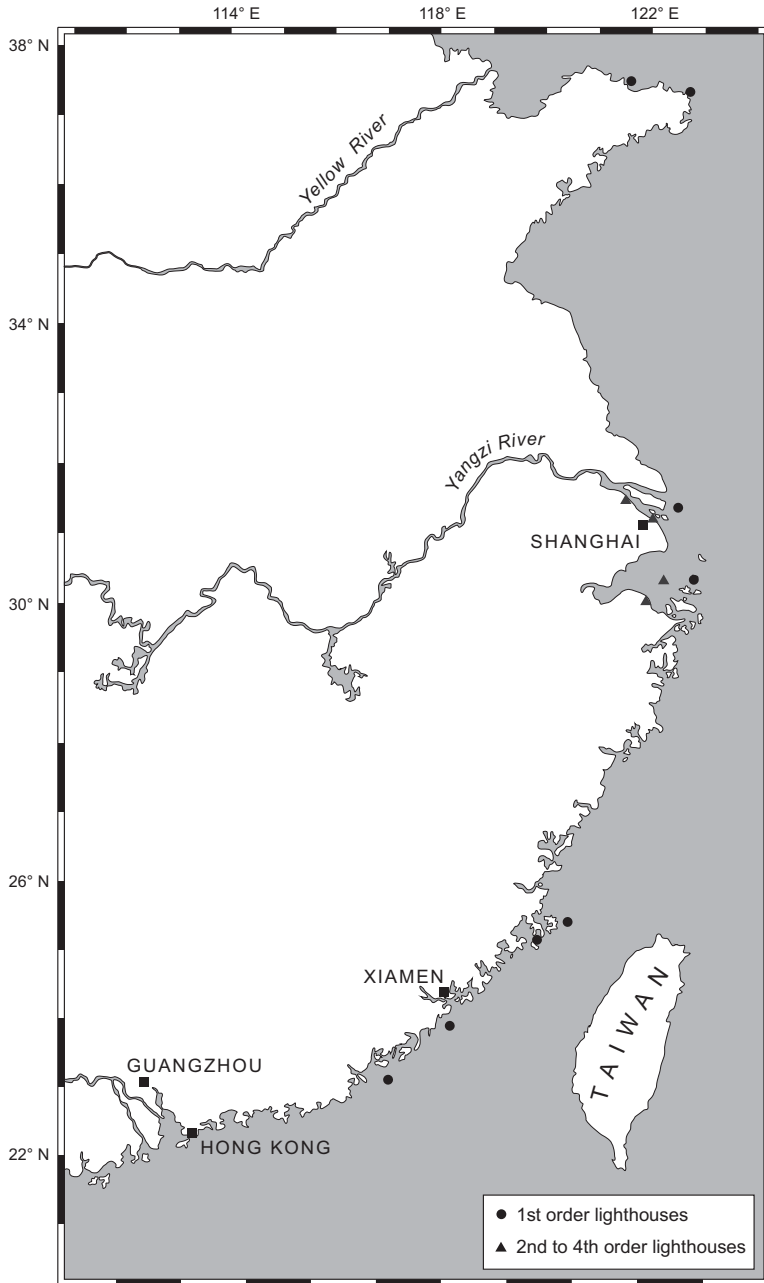


Fig. 1. Major lighthouses built by Chinese Maritime Customs by 1875.
 Source: List of the Chinese lighthouses ... 1874 (corrected to 1st December, 1874) (Shanghai, 1875).

Chance Brothers in Mauritius and in South Africa, before being recruited into the Service as a lights mechanic.⁴⁹ Procuring and shipping material from Europe out to China, and then to the remote sites for erection and installation, was a major undertaking, but it was an utterly routine one, as both firms supplied equipment internationally. Catalogues issued by the firms offer a visual global tour of the lighthouses they had built, Chile alternating with India, China, or France, the global reach offering credibility.⁵⁰ The resulting stations were constructed from building materials sourced elsewhere in China and shipped in, or sometimes locally, and they housed equipment manufactured in Paris or Birmingham. The towers were built in Europe, then disassembled and shipped out to China (Figures 2–3). The catalogues sometimes show them in Paris, and then in situ. Supplies to maintain them (notably vegetable oil, and latterly paraffin then kerosene) were also imported from the manufacturers. The engineers and mechanics of the Marine Department developed their own sense of what could be adapted if necessary with their own resources; all through the decades of the foreign inspectorate the key equipment was imported from Europe.⁵¹

This was not simply or by design a British initiative. Part of Hart's success as Customs inspector-general lay in his balancing of foreign and Chinese demands and interests, and the competing and often intense pressures on him from the British and other foreign powers. While the Customs worked mainly in an anglophone political and cultural orbit (it had an office in London and operated in English and Chinese), it was deliberately cosmopolitan in its hiring strategy, employing continental European and American staff, and later Japanese officers. And while Hart and his advisers often instinctively resorted in the first instance to the anglophone networks they knew and trusted best, the Customs was also involved in French-led and staffed operations, such as the Fuzhou arsenal and naval yard, and a variety of initiatives in north China were later co-ordinated by the powerful Customs commissioner there, the German Gustav Detring.⁵² Efficiency, not representativeness, was his philosophy, and this was explicitly restated in his 1867 'Coast Light Memorandum'.⁵³ The lights

⁴⁹ Campbell to Hart, No.105, 23 Oct. 1874, Chen Xiafei and Han Rongfang, eds. in chief, *Archives of China's Imperial Maritime Customs* (Beijing, 1990), 1; Ed Gould, *The lighthouse philosopher: the adventures of Bill Scott* (Saanichton, 1976).

⁵⁰ Barbier Bénard and Turenne, *Album de Photographures* (Paris, n.d., c. 1910s); *BBT catalogue general* (Paris, n.d., c. 1930s), both in Tweedie-Stodart papers, private collection.

⁵¹ Electricity was not a viable power source for this dispersed and isolated network, but even in Europe, it was only slowly adopted in lighthouse systems: Michael Brian Schiffer, 'The electric lighthouse in the nineteenth-century: aids to navigation and political technology', *Technology and Culture*, 46 (2005), pp. 275–305.

⁵² Catherine Ladds, *Empire careers: working for the Chinese Customs Service, 1854–1949* (Manchester, 2013); Steven A. Leibo, *Transferring technology to China: Prosper Giquel and the self-strengthening movement* (Berkeley, CA, 1985); Hans van de Ven, 'Robert Hart and Gustav Detring during the Boxer rebellion', *Modern Asian Studies*, 40 (2006), pp. 631–62.

⁵³ *Inspector general's circulars: first series: 1861–1875*, p. 330.



Fig. 2. Peiyüshan Lighthouse, under construction at Barbier Bénard and Turenne yard, Paris, c. 1894/5.

Source: *Album de photogravures* (Paris: Barbier Bénard et Turenne, c. 1900).

initiative therefore drew on French technology, and as we shall see meteorological operations were essentially farmed out to continental European scientific expertise through the Jesuit Zikawei (Xujiahui) Observatory in Shanghai. For such reasons, Hart was routinely criticized by Britons for having apparently lost all sight of proper national and ‘racial’ loyalties.⁵⁴ The multinational political space in which the Customs operated meant that it had to develop a genuinely cosmopolitan mode of practice, and the antipathy of his fellow nationals suggests that to an extent Hart was successful in this aim.

A second intense wave of lighthouse construction, the drive to complete ‘the outer line of lights’, commenced in the early 1880s.⁵⁵ By 1883, there were four

⁵⁴ Robert Bickers, *The Scramble for China: foreign devils in the Qing empire, 1832–1914* (London, 2011), p. 199.

⁵⁵ Hart to Campbell, 24 Jan. 1881, letter 313, *IG in Peking*, p. 355.



Fig. 3. Peiyüshan Lighthouse in situ, c. 1932.

Source: T. Roger Banister, *The coastwise lights of China: an illustrated account of the Chinese Maritime Customs lights service* (Shanghai: Statistical Department, 1932), p. 131.

new major light stations making a cumulative total of seventy-seven lights (including fourteen stations).⁵⁶ By 1886, this establishment employed 58 foreign and 144 Chinese lightkeepers.⁵⁷ After another lull, important new lights were built, but the main activity in the 1890s became the modernization of the existing system. In particular, many lamps were upgraded, paraffin and kerosene being more widely introduced, and the power of many important lights increased. Later technical innovations in 1909–13, and the early 1920s, greatly enhanced the power and visibility of the lamps, although it proved realistic to settle for less advanced or site-appropriate technology in many instances, due to the practical difficulties of supplying the system.⁵⁸ As China lost territory to the rapacious high imperialism that followed the Sino-Japanese war, the Customs lost lights to Russian, German, Japanese, and British control. The appointment of W. F. Tyler as coast inspector in 1901 inaugurated a new modernization and construction programme. By 1904, Tyler considered that only one more first order light was needed, and by the end of 1912, an ‘almost continuous chain of lights’ along the Chinese coast had been completed (Figure 4).⁵⁹ Shipping could now more clearly navigate the sea lanes and

⁵⁶ ‘Joint report by the coast inspector and the engineer-in-chief on a four years’ programme for lighthouse work’ [1904], SHAC, 679(1) 1044, ‘Joint reports by engineer-in-charge and coast inspector on investigation of lighthouses on the islands along coast 1877–1905’.

⁵⁷ ‘History of the Pingching’, in MacRobert to Sabel, 26 Mar. 1941, SHAC, 679(1) 684 eastern commander to coast inspector (CI), 1940–7.

⁵⁸ Banister, *Coastwise lights of China*, pp. 15–16, 19.

⁵⁹ *Ibid.*, p. 15.



Fig. 4. Major lighthouses built by Chinese Maritime Customs by 1912.
 Source: List of lighthouses . . . on the coast and rivers of China 1912 (corrected to 1st December, 1911) (Shanghai, 1912).

riverine routes. Ships still foundered, but the routine risks once run by China coast shipping were reduced.

Siting lights involved more than propriety, and lights served more than maritime purposes. The initiative of building a light at South Cape, on the southern tip of Taiwan, was driven by the Qing state's need to reassert its sovereignty over the island after a Japanese military incursion in May–December 1874.⁶⁰ This was not an unusual use of the Maritime Customs Service by the Qing, for it was used in other ways to assert Chinese sovereignty, even late into the twentieth century being used for this purpose in Xinjiang. Competing maritime territorial claims were also an issue. Practical difficulties in the case of the Pratas reef (Dongsha qundao) left another gap in the planned chain, although eventually the imperative of confirming sovereignty led to the establishment of a light in 1926.⁶¹ The Paracels (Xisha qundao) also became a subject of Chinese concerns after 1909, again in the face of Japanese incursions, but although the Customs was discussing a light from 1912 onwards the practical issues were forbidding, and it was not until 1947, when Chinese sovereignty was reasserted over the group, that a Customs light was established there.⁶²

The Qing used the Customs Service and its lights to delineate precisely zones of control and borders. Foreign threats, seizures, or acquisitions through treaty, as well as taxation regimes (such as the free trade status of British colonial Hong Kong and German-controlled Qingdao), made it imperative that they did so. A new territorial loss generally required a compromise Customs arrangement, or new stations on a new border. The Customs Service could operate within new *de facto* realities, where the state formally could not without according recognition (at Qingdao especially, after it was seized by the German navy in 1897). To an extent, the Customs was a key agency in the wider delineation of the state as its pre-1842 integrity was impaired. This provides a very fair fit with recent models of nineteenth-century de-territorialization and re-territorialization, with the difference being that it was agents of the impaired state – albeit foreign nationals – who fixed the Qing's degraded borders. Their shared cultural or professional backgrounds certainly made for easier communication. A Briton in Chinese employ generally also remained a loyal Briton, but Customs

⁶⁰ Bickers, *Scramble for China*, pp. 254–5, 264–70.

⁶¹ Edward M. Rhoads, *China's republican revolution: the case of Kwangtung, 1895–1913* (Cambridge, MA, 1975), pp. 140–1; *Documents illustrative of the origin, development and activities of the Chinese Customs Service*, iv, p. 58; 'Pratas Island', *North China Daily News*, 14 Oct. 1934, in SHAC, 691(1), 3693. Some of the wider context is covered in Ulises Granados, 'China meets the southern sea frontier: ocean identity in the making, 1902–1937', *Pacific Affairs*, 78 (2005), pp. 443–61.

⁶² *NCH*, 5 June 1909, pp. 566–7; Stein Tønnesson, 'The South China Sea in the age of European decline', *Modern Asian Studies*, 40 (2006), pp. 1–57; SHAC, 679(1), 20967, 'Questions of establishment of light on Paracels Reef'; Chinese Maritime Customs, *List of lighthouses, light-vessels, buoys, beacons, etc., on the coast and rivers of China, 1948* (Shanghai, 1948), p. 8; CI comments on general letter No. 1573, 15 Aug. 1935, SHAC, 679(1), 3711.

officials could also and rightly madden their fellow nationals by acting as they were pledged and paid to act, that is as Chinese state employees, furthering or protecting the interests of their masters.⁶³ While the focus here is on infrastructural globalization, this is not simply a European or colonial story.⁶⁴ For clearly if the history of technology can provide a ‘hidden history’ of European integration, as has been argued, it can also provide a cognate history of the emergence of the modern Chinese state, through railways for example, and through the coast lights initiative and allied activities of the Chinese Maritime Customs and its Marine and Statistical Departments.⁶⁵

II

Lighthouses stand out, that is their function, but the China coast lights stand out further as foreign sites interpolated into Chinese landscapes, and equipped with materials brought in from outside, with instruments brought from Europe, with foreign men and women, night-time illuminations and sonic interruptions that could be heard far, far away from the compounds themselves. From a passing ship these were lights by night (each with a recognizable signature);⁶⁶ and they were fixed points for navigation by day, but they were also sites. They had neighbours, and had an impact on the landscape and on soundscapes too.

Building a lighthouse required sometimes a re-carving of the site to accommodate light tower, ancillary buildings, and staff quarters. Usually, a wall surrounded the buildings, marking out a clear compound under Customs control. The contrast between building and immediate landscape, and between the site and any local village buildings, was very sharp. Design was driven by function, and by the need to accommodate the lights’ instruments that were imported from Europe. Attention was paid to the grounds, and to preventing or retarding erosion. At Lamko, ‘years of determined effort’ underpinned the development of ‘soil of a sort’ on a ‘sterile and desolate’ peninsula.⁶⁷ The contrast at Breaker Point between the ‘neat paths, turf, and green cultivation of the station’ and the wasteland surrounding them was ‘unforgettably vivid’. Sugar Loaf’s compound was ‘undoubtedly the prettiest in China. It resembles in fact a beautiful private garden, with lawns and beds of flowers and vegetables.’ The site for Bonham Island light had to be levelled. Soil was imported after the construction was completed, and the keeper was ‘given grass seed, as well as pine cones and the seeds of eucalyptus plants’.⁶⁸ As well as the visual impact of

⁶³ On loyalties and identities, see Ladds, *Empire careers*.

⁶⁴ David Arnold, ‘Europe, technology, and colonialism in the twentieth century’, *History and Technology*, 21 (2005), pp. 85–106.

⁶⁵ Misa and Schot, ‘Introduction’.

⁶⁶ In 1948: Lamko: a white flash every twenty seconds; Cape Cami: two white flashes every twenty seconds; Chilang: three white flashes; Breaker Point: one followed by two, etc. *List of lighthouses, light-vessels, buoys, beacons, etc., on the coast and rivers of China, 1948*.

⁶⁷ Banister, *Coastwise Lights of China*, pp. 31–2. For more on Banister’s volume, see below.

⁶⁸ *Ibid.*, pp. 57, 65, 150.

the buildings themselves, we might remember how exotic and out of place the European flower gardens and landscaping will have looked.

We should also remember sound. Lighthouses could be noisy. Fog signals were fired from stations by iron cannons, in response to ships' horns, and buoys were used which whistled as they rode waves. Automatic gas guns were eventually used at many stations. The air sound signals issued by compressed air sirens at four stations were 'among the most powerful sound signals in the world'.⁶⁹ We lack in general histories of sound and noise.⁷⁰ But colonialism affected Chinese soundscapes as much as it did landscapes and builtscapes. Police whistles, marching troops, brass bands, funeral volleys, church bells, ships' horns, and, out on the coast and in the river estuaries, the lightship sirens – these were new sounds for a new global order.

The construction of lights was very occasionally the cause of controversy and violent local resistance. An early light on an island at the mouth of Xiamen harbour was destroyed by the local Chinese pilots, as they feared it would harm their livelihoods. Surveying and constructing teams could, and did, call on state administrators and troops, if they encountered hostility, shipping them in on Customs' vessels.⁷¹ Sometimes, the presence of Qing officials was needed to persuade local inhabitants that these foreigners were bona fide state employees. More commonly, the acquisition of land or foreshore over which common rights to, for example, gather seaweed had traditionally been exercised was a source of disturbance.⁷² T. Roger Banister's 1932 record of the lights routinely notes which stations had 'unruly' neighbours. But the arrival of teams to reconnoitre sites also seems to have led to suggestions that long-standing assumptions about the hostility of local populations – recorded in the Admiralty's *China Sea Directory* for example – ought to be revised. 'We found them very civil', recorded Henderson of one set of islanders, not at all 'piractical' as claimed.⁷³ Civility, of course, was a likely pragmatic response to power. For local residents, lights provided opportunities: for employment, for provision of services and supplies, and for theft. Lights stations saw the arrival in isolated coastal localities of foreigners, Chinese from outside the district, foreign goods, and new employment opportunities.

⁶⁹ *Ibid.*, p. xvii.

⁷⁰ For explorations of the issue more widely, see Alain Corbin, *Village bells: sound and meaning in the nineteenth-century French countryside*, trans. Martin Thom (New York, NY, 1998); Richard Cullen Rath, *How early America sounded* (Ithaca, NY, 2003); see also Peter Coates, 'The strange stillness of the past: toward an environmental history of sound and noise', *Environmental History*, 10 (2005), pp. 636–65. A partial exception in the China case is Jeffrey N. Wasserstrom, 'A Big Ben with Chinese characteristics: the Customs House as urban icon in old and new Shanghai', *Urban History*, 33 (2006), pp. 65–83, although this is mainly architectural in focus.

⁷¹ *NCH*, 30 Nov. 1867, p. 382; Banister, *Coastwise lights of China*, pp. 88–91, 115.

⁷² 'Inspection report by the engineer in chief on the southern lighthouses, October and November 1887', SHAC 679(2), 66; Banister, *Coastwise lights of China*, pp. 94–7, 158.

⁷³ 'Report by the engineer-in-chief and coast inspector on the proposed lighthouse for Lao tai tou, Lao tieh Shan promontory, Kwantung peninsular', 5 Aug. 1891, in SHAC 679(1), 1044.

Lights developed other functions. They were outposts of the Chinese state locally as well as strategically, in places where the state's remit was often but feebly felt, and were sometimes used by local communities as safe havens at moments of crisis. Lighthouse keepers found themselves required to organize the burial of bodies washed ashore, the high numbers of which at Cape Cami were reported as being a 'peculiarity' of the station.⁷⁴ The keepers at S. E. Promontory tended the cemetery in which were buried the German navy victims of the 1896 *Illis* disaster.⁷⁵ Lighthouse visitors' books, poignant survivors in the archives in Nanjing, record other arrivals at stations. There are hunting parties caught out in bad weather ('received every consideration and much kindness ... Cleanest house seen in China'), and passing officials, foreign and Chinese; 'Very satisfactory', noted Reginald Fleming Johnston in the same *Chaopeitsui* volume two years later.⁷⁶ Caught in one volume in their scrawling scripts are the signatures of every pupil at the China Inland Mission boarding school for foreign children at Chefoo who had hiked out there. The lights had become part of the landscape, fixed points of reference and resort, literally and metaphorically.

Staffing of the lights, the subject of a separate essay, was an ongoing problem for the Customs. A raced structure was evolved early and effectively remained in place, with some exceptions, until almost the end of the foreign presence in the CMCS in 1949–50. European lightkeepers were in charge of each light, supported by local Chinese lightkeepers – rural folk from nearby communities – who entered employment as 'Station coolies'. The Europeans were mostly rotated from station to station. The Chinese staff never moved from their home light. While the Chinese staff were mostly uneducated men, the Europeans were generally the least-well-educated foreign servants of the Chinese state. And although some stayed for decades, most moved on quickly. Ongoing tensions of status, sex, race, and nationality can regularly be encountered in the Service files. These were complicated by formal or informal relationships between Europeans, Eurasians, and Asians, and by relations between families, servants, and staff. What I have concluded was a 'culture of sullen violence' seems to have predominated on the lights. European lightkeepers often had recourse to the supervisory tools of their peers in other similar positions in the treaty ports or the wider world of empires, that is to their fists or their feet. Tensions between staff (and their families and servants) could be ongoing on the lights, sometimes exploding into fatally violent incidents, but incipient conflict could also develop with local communities. These latter could be disrupted by the establishment of these installations, and especially by the arrival of foreigners

⁷⁴ Banister, *Coastwise lights of China*, p. 43.

⁷⁵ SHAC, 679(1), 23820, 'Wreck of German gunboat *Illis*, 1896: questions concerning "Illis cemetery" and visitors book presented to S. E. Promontory Light Station by the survivors, 1932–1937'.

⁷⁶ 20 Sept. 1904, 1 Dec. 1906, 'Chaopeitsui Lighthouse visitors book, 1892–1936', SHAC 679(1) 4173.

and extra-provincial Chinese staff. Lights needed to get on well with the communities, but the business of living (notably food, livelihood, respect, sex) could lead to problems between lights and their neighbours. A light was a difficult place, and the human stories involved often contrast sharply with the technological modernity the system demonstrated. Lights were local sites, as well as national and global ones, with local histories and impacts reshaping landscapes and communities.

III

The lights programme welded onto the Chinese coast a physical structure, as well as processes, that linked China firmly to the world of the British Admiralty's *China Sea Directory* (later *Pilot*), the standard guide after 1867 for shipping sailing in east and Southeast Asian waters. It tamed the coast as keepers tamed their compounds. Forbes began by seeking advice from British naval surveyors, and the project built on strategic knowledge and planning. But it needed local knowledge, and sought it. On investigative trips the planners called together local residents or sojourning fishermen to ask them to point out any 'hidden dangers'. Coast Inspector T.J. Eldridge's memoir has a chapter entitled, 'How I found the Lorne Rock', off the coast of Hainan, but it was a fisherman who told him where it was.⁷⁷ Local knowledge could prove the Admiralty's charters wrong, about topography, or about the local inhabitants. The Admiralty conducted surveys from 1840 until the First World War, as part of its global programme of hydrographic surveys.⁷⁸ Hart had argued that hydrography had already tamed the coasts and seas, excepting the South China Sea reefs. The navy's China Station had certainly tamed piracy, most of it resulting from the disorder caused by the Anglo-Chinese wars, or the Taiping rebellion.⁷⁹ As Eric Tagliacozzo has noted, it is too easy to overestimate the effectiveness and comprehensive of such projects which required far greater resource than ever the parsimonious state would allot them, but even so, rough confidence could be placed in the results and the ambition is clear: a global empire needed as much data as it could secure.⁸⁰

⁷⁷ See, for example, 'Report by the coast inspector and the engineer-in-chief on the proposed lighthouses and buoys for the Hainan Strait', 2 Dec. 1890, SHAC, 679(1), 1044; T.J. Eldridge, *Knots in a sailor's life* (Bournemouth, 1937), pp. 117–19.

⁷⁸ Summaries of the work were published annually in *Proceedings of the Royal Geographical Society* from at least 1878 to 1911. The 1878–9 report includes descriptive notes of Admiralty work in the Magellan Straits, Madagascar, Cyprus, China (Wenzhou approaches, Hong Kong to Shanghai seaboard, Hainan Straits), west coast of Japan, Jamaica, Australia, Fiji, as well as British waters: F.J. O. Evans, 'Admiralty surveys for the year 1878–1879', *Proceedings of the Royal Geographical Society and Monthly Record of Geography*, New Monthly Series, 1, 6 (1879), pp. 369–72.

⁷⁹ Gerald S. Graham, *The China station: war and diplomacy, 1850–1860* (Oxford, 1978).

⁸⁰ Eric Tagliacozzo, 'Hydrography, technology, coercion: mapping the sea in south-east Asian imperialism, 1850–1900', in Killingray, Lincoln, and Rigby, eds., *Maritime empires*,

The Customs initially used and systematically added data to such surveys. (Having ‘discovered’ the Lorne Rock, Eldridge promptly informed the Admiralty.)⁸¹ From 1886 onwards, Hart instructed the Service to start supporting its navigation aids programme with its own surveying efforts, and up to 1928 it was the only Chinese state agency doing this work. Surveys were published from 1911 as additions to the *Notices to mariners* Customs publication series, and from 1915 these were available separately for sale to the public as Customs publications.⁸² When the Chinese naval ministry began preparing to develop its own Hydrographic Department, staff were initially seconded for training to the Customs, and then Customs staff were seconded in return to the new department to help establish it after 1922. Hart and his staff were attentive to sovereignty issues (although clearly attention could lapse), and had for some time presented the initiative the Marine Department took in developing its hydrographic programme as a measure to obviate the need for the Royal Navy in particular to continue its work in Chinese waters.⁸³ Such surveys generated data which became an international resource, but they also contributed to the modern mapping of China for the Qing state and its successors, aiding the centre to visualize its peripheries. In so doing, they could also give shape to the state for local people. Coast Inspector Eldridge also narrates an encounter with a woman near Chunlan, on Hainan Island, when he was surveying the harbour in 1898. The woman had tried to run away when she saw him, and there was evident fear of French activity in the area: “We do not know who you are”, she told him, “Surely you know that my vessel flies the Chinese flag?” But these people did not know what the Chinese flag looked like, and no wonder – for they had never seen one.⁸⁴ This is familiar as foreign rhetoric, but it is also a credible description of the visibility of the Qing state on its maritime borders.

This infrastructure’s geography was an asset in other ways, and it needs to be remembered that there was always more to it than lights. From the start, Hart saw his new network as a source of data, and instructed J. D. Campbell in London to advertise it as a resource. The prime additional function was meteorological, but he also encouraged other initiatives, including ethnographic ones.⁸⁵ In Circular No. 28 in 1869, Hart had notified his commissioners that he would be establishing meteorological stations at each Customs

pp. 142–58. For earlier British activity, see Andrew S. Cook, ‘Establishing the sea routes to India and China: stages in the development of hydrographical knowledge’, in Huw V. Bowen, Margarette Lincoln, and Nigel Rigby, eds., *The worlds of the East India Company* (Woodbridge, 2002), pp. 119–36.

⁸¹ Eldridge, *Knots in a sailor’s life*, pp. 117–19.

⁸² *Ibid.*, pp. 97–8.

⁸³ This paragraph is mostly derived from a 1930 survey: ‘Coast inspector’s comments on Kuan-wu Shu despatch No. 3, 530’, enclosed in CI S/O to IG No. 663, 13 Oct. 1930, SHAC: 679(1),3847.

⁸⁴ Banister, *Coastwise lights of China*, p. 15; Eldridge, *Knots in a sailor’s life*, p. 116. Tyler also left a memoir: *Pulling strings in China* (London, 1929).

⁸⁵ Bickers, *Scramble for China*, pp. 272–4; Glen Dudbridge, ed., *Aborigines of South Taiwan in the 1880s* (Taipei, 1999).

office, and asked them to consider how their offices would undertake the work. The geographical extent of the Customs, and the robustness of its organization, meant that the additional work would not be great, but the rewards could be large. The rewards were scientific:

The worth of such observations to the scientific world, and the practical value they may be made to have for seafaring men and others on these Eastern Seas, will in due time be appreciated and acknowledged, . . . a scheme which will tend so powerfully to assist in throwing light on natural laws and in bringing within the reach of scientific men facts and figures from a quarter of the globe, which, rich in phenomena, has heretofore yielded so few data for systematic generalization.⁸⁶

In 1873, Hart moved to try and formally establish meteorological stations, and the lights were his sites. He had a staff of ‘fairly intelligent Europeans’, who ‘will only be too glad to have something given them to do, to occupy the lonely hours of their isolated lives’. Campbell was to consult the British astronomer-royal, Sir George Airey, then president of the Royal Society, about the instruments needed and then ship them. But he was also instructed to consult other scientists, in any field at all, ‘to find out if there is any special line in which such stations can be made useful’. Hart aimed to hook his lights into international scientific networks, as much as maritime ones.

To a very great extent he succeeded – the meteorological data systematically recorded by the Customs provides a bank of historic climate information of importance still today. The Jesuit-run Zikawei (Xujiahui) Observatory (established in 1873) became the key meteorological centre in China – substituting for a Central Observatory in Peking, which had been the ‘Inspector General of Everything’s’ plan – before the establishment in 1929 of the Institute of Meteorology at Academia Sinica under its director Zhu Kezhen.⁸⁷ Zikawei’s staff made significant contributions to the scientific understanding of typhoons, and as practical meteorologists, they inaugurated at Shanghai in 1883–4 a reporting and storm warning system that was in fact later to shape the International Meteorological Organization’s nascent storm warning system in the early twentieth century. The Marine Department, which worked very closely with Zikawei (and less smoothly with the Royal Hong Kong Observatory (established in 1883)), became the key supplier of the data all of these institutions needed.⁸⁸

Data without dissemination is of little value. The Customs collated and disseminated internationally vast amounts of data throughout its history.

⁸⁶ IG Circular No. 28, 12 Nov. 1869, in *Inspector general’s circulars: first series: 1861–1875*, p. 245.

⁸⁷ P. Kevin MacKeown, *Early China coast meteorology: the role of Hong Kong* (Hong Kong, 2010); Lewis Pyenson, *Civilizing mission: exact sciences and French overseas expansion, 1830–1940* (Baltimore, MD, 1993); Wu Zengxiang, *Zhongguo jindai qixiang taizhan* (Meteorological observatories in modern China) (Beijing, 2007).

⁸⁸ Robert Bickers and Catherine Ladds, “‘Throwing light on natural laws’: meteorology on the China coast”, paper presented at the conference on ‘Treaty ports in modern China’, University of Bristol, July 2011.

Hart and his senior staff devised rigorous systems for collecting and collating data at individual stations, which were also protected by strict regulations about restrictions on who could and who could not see the material. Returns of data were made to the Statistical Department of the Customs at Shanghai, which organized the publication of annual reports and returns of trade, as well as a ten-yearly and other retrospectives.⁸⁹ These publications circulated internationally. The data they contain still drives much academic research into the history of the Chinese economy and Chinese society. Meteorological data flowed from the Customs at two speeds, as monthly reports from the lighthouses, and two or several times daily from stations (mainly ports) connected by telegraph. The monthly returns were checked and published in Zikawei's monthly reports, but also informed the scientific research there into regional weather systems. By telegraph, it flowed mainly to Zikawei and also to Hong Kong, and was processed at each, with other streams, into daily weather reports. The telegraph and the lighthouse in fact properly made their debut in China at the same spot and almost contemporaneously, at Gutzlaff Island in the mouth of the Yangzi, where the Great Northern Telegraph Company's submarine cable was brought ashore in 1869, and where a permanent office was established.⁹⁰

The lights system contributed to the standardization of time in China. The imperative of the meteorological network after 1884, and the development of telegraphy, and the telephone, built up pressure for adoption of a standard time and a single time zone. This developed some time after the 1884 Washington Conference which recommended Greenwich as the prime meridian, but the delay in adoption was not unusual, and there were developments from the start.⁹¹ Zikawei ran a time service from 1884 onwards.⁹² From 1 January 1903, the Customs more widely adopted 'China Coast Time', set at Greenwich mean time plus eight hours. Clocks at Shanghai fell back 6 minutes. The colonies at Qingdao (15 January 1903) and Hong Kong (1 November 1904) fell into line. While local time was still kept in many places, shipping followed China coast time, the imperial railways of north China adopted it in March 1903, and other agencies followed. Timetables impelled conformity to a legible and consistent system. Official minutes and seconds started to tick away in unison. Local practices might indeed seem little affected, certainly initially, by the adoption of standard time, as cities and towns kept old and new times in unison for different activities, but in this area as in others, the system made the China coast, and the world of the Customs, legible in international terms, and brought it into line with new norms.⁹³

⁸⁹ Statistical work: Andrea Eberhard-Bréard, 'Robert Hart and China's statistical revolution', *Modern Asian Studies*, 40 (2006), pp. 605–29, and Lyons, *China Maritime Customs and China's trade statistics*. ⁹⁰ Baark, *Lightning wires*, p. 81.

⁹¹ On the wider international process, see Peter Galison, *Einstein's clocks, Poincaré's maps: empires of time* (New York, NY, 2003).

⁹² *NCH*, 22 Aug. 1884, p. 203.

⁹³ *NCH*, 14 Feb. 1908, 'Late news extra', p. 1.

James L. Hevia has outlined how British empire generated and circulated a body of information, an 'imperial archive' in his conception, which it then deployed to master China.⁹⁴ As stimulating metaphor this has much to commend it, though schematic tidiness can be countered by knowledge of the under-budgeted administrative and human inefficiencies of the real state. Hart clearly aimed to generate data, but his aim was to contribute to a universal 'scientific world', not to a British imperial project. We might certainly consider how such conceptions overlap, but we should not assume that a man like Hart thought them synonyms. From 1867 to 1905, the Customs was responsible for developing Chinese participation in international exhibitions and made much of its own achievements therein. In the twentieth century, it also worked to represent China in international conferences and organizations. The Customs participated in the international lighthouse conferences that began to be held in the interwar period, starting with the 1929 London conference. Tweedie-Stodart reported after the 1937 Berlin Conference that 'China is not in a position to carry out scientific investigations herself [developing new lights technology]', but participation allowed the Customs to liaise with new suppliers and learn from peer services. Ambitious desires for technological development had to be tempered by a realistic appraisal of the general, poor accessibility of the widely spread-out Chinese service. And little faith was also put in the ability of Chinese staff to maintain adequately the very sophisticated lights systems that were discussed at the conferences.⁹⁵ Little faith had been evinced from the start in the ability of Chinese staff to maintain any equipment, or to abide by systems, especially at night. Only in 1947 were Chinese formally recruited for the first time into the lights service proper.

The work of the Marine Department more widely needs noting. From 1875 onwards, an annual *Report on lights and beacons* was published, which became in 1909 the annual *Report of the Marine Department*.⁹⁶ The 1932 report gives a mercilessly detailed account of its activities, the number of charts sold, the number of vessels entering and clearing each port, dead bodies recovered, details and numbers of wrecks, and wrecks cleared, steamers involved in collisions, vessels pirated, lives known to be lost. The Marine Department was busy. It also issued collections of its *Notices to mariners* annually from 1883, and from 1872 an annual *List of lighthouses, light-vessels, buoys, beacons, etc.*⁹⁷ The *List* was issued in Chinese from 1877 onwards, although after 1904 it only appeared every two years. The Customs mapped and charted in English, and securing

⁹⁴ James L. Hevia, *English lessons: the pedagogy of imperialism in nineteenth-century China* (Durham, NC, 2003).

⁹⁵ 'Report on the work of the conference, by Mr L. Tweedie-Stodart, technical adviser to the delegation from China', 6 Aug. 1937, SHAC, 679(1), 21911, 'Berlin Lighthouse Conference, 1937'; see also SHAC 679(1)21905, 'London Lighthouse Conference, 1929'.

⁹⁶ Published as Series III, Miscellaneous Series, No. 38.

⁹⁷ Published as Series II, Special Series, No. 5, and Series III, Miscellaneous Series, No. 6, respectively.

Chinese names to match its anglophone world was a difficult job for a translator. A report in 1917 noted that junk traffic ignored any Customs guide, and the Chinese navy simply used the English version.⁹⁸ Tellingly, the Customs *List of lighthouses* incorporated all foreign-administered lights (barring Taiwan's): this was presented as a single system, crossing borders and sovereignties, lighting a coast, and not a country's shores.

IV

The China coast lights provide a case-study of the development of the infrastructure underpinning nineteenth-century globalization. There could be 'no extension, intensification and quickening velocity of flows of people, products and ideas' at the pace associated with globalization in the modern era without installations as seemingly mundane as harbours, jetties, and warehouses, or without buoys, beacons, and lighthouses, and all the activities and initiatives predicated on them. The wider contexts always need remembering, not least the recurrent exercise of military violence by foreign powers, upon which the entire China coast system remained contingent after 1842, and the diplomatic and consular policing of the treaties which underpinned its development. But the initiative reminds us also of the complexities of infrastructural developments, and thereby of processes of globalization, that they could be genuinely cosmopolitan, could serve the needs and strategic objectives of both colonial powers and of states resisting colonial power, and that while they served local and national purposes they also formed part of an increasingly global infrastructure.

Much work on Sino-foreign relations and the enforced integration of China into the world economy on British terms has failed to pay attention to the physical infrastructures which were vital to functional integration, and the China literature is not alone in that. This article has outlined how the Chinese Maritime Customs Service created a physical network of lighthouses and navigational aids, and also used them to generate data that joined other information that it was involved in disseminating globally across a dense web of overlapping networks. Information was as functional an objective as the lights that shone along the coast from Guangdong to Manchuria. As China was not a colony, there was no obvious mechanism for enforcing the evolving global norm that was lights provision. Unlike in the Ottoman or Japanese examples, foreign powers did not use coercive measures (treaties, demarches) to secure compliance. Instead, China's foreign civil servants themselves launched the initiative, seizing the opportunity to insert China into mainstream international engineering, scientific and information networks, 'normalizing' China as a

⁹⁸ Correspondence in SHAC, 679(1), 21516, 'Customs publication: III. Miscellaneous Series No. 7: "List of Chinese Lighthouses, etc.: Chinese version"'.



Fig. 5. Panel affixed to statue of Sir Robert Hart

Source: *Documents illustrative of the origins, development and activities of the Chinese Maritime Customs Service*, iv (Shanghai, Statistical Department of the Inspectorate-General, 1939), pp. 203–4.

visible international actor. Technological opportunity and logic also carried its own logic, impetus, and momentum.

The lights system was in fact a service to ‘humanity’ in the eyes of those who celebrated it or who worked for it. Leading Customs staff were keen to present the work of the Marine Department in this light at the time as well, in print, exhibitions, or on the sides of Robert Hart’s statue on the Shanghai Bund (erected in 1914) (Figure 5). Plainly, at times ‘humanity’ was a synonym for ‘civilization’, and civilization and civilizing were coded terms, at least up to a point. It was easy to switch terms, from ‘humanity’ to ‘British influence and

enterprise'.⁹⁹ We might compromise on 'colonialism', but that would also potentially occlude a nuanced understanding of the overlapping multiple purposes of a China coast lighthouse unless seen in a plurality of contexts and motivations (not least, as we have seen, in terms of local and national Chinese state imperatives). It is worth taking such terms at face value, however, to some extent. The developmental impulse, while often tarnished by other impulses, perhaps beyond recall, was no less real and genuine for that. Michael Brian Schiffer has, moreover, suggested that lighthouses, as a visible commitment to maritime safety, were often viewed as a civilizing benchmark, influencing 'their nation's standing in the international community'.¹⁰⁰ Given the dominance of discourses that focused on Chinese 'indifference' to suffering, and cruelty, the humane achievement of coast lighting was potentially also a useful corrective for its defenders. But 'humanity' can also be read, of course, as international communications, and the logical infrastructural consequences of enforced integration into the international economy. Even time in China fell into line.

Sir Frederick Maze, inspector-general from 1929 to 1943 also argued frankly that the Marine Department's work was a key facet of Customs activity generally, on which rested the 'creditworthiness' of the Chinese state in the eyes of foreign bankers, and diplomats. We cannot disentangle these threads. But we should also recognize that overall the foreign inspectorate of the Chinese Maritime Customs itself represented a pragmatic solution to a Qing problem – how to secure foreign trade without tears, and produce from it reliable revenue streams – and that it also helped facilitate a sense of a national economy, not least by collating statistical data which presented the 'trade of China' as if there obviously was such a thing, and it allowed the central state to drill more deeply down into provincial revenues. It helped map national borders and project the Qing and its successor states into its maritime and other borderlands. The lights service facilitated internal and national trade as well, lighting the major rivers and the coastal shipping routes. This was not a simple one-way transfer of technology that produced a simple one-way benefit. It was appropriated by the Qing and the Chinese republican states, and by a host of other local and national actors in China, and beyond.

British and other imperial/strategic concerns and visions can certainly be discerned in the lighting programmes and attendant activities of the Marine Department. Their relationship to global developments, such as the coming of the steamship and the opening of the Suez Canal, seems very clear. Hart liaised with diplomats and admirals; the Marine Department shared data with the Royal Navy. But while there was a general move to light the coasts in the fifty years from the 1860s onwards – on Ottoman shores, in Southeast Asia, Japan,

⁹⁹ See the discussion in Jürgen Osterhammel, *Approaches to global history and the question of the 'Civilizing Mission'* (Global History and Maritime Asia working and discussion paper series, Osaka, 2006).

¹⁰⁰ Schiffer, 'The electric lighthouse in the nineteenth-century', p. 380.

and China – there is more than enough evidence to temper too schematic an analysis of such development. There was little by way of effective co-ordination, and no grand imperial project. Intra-colonial politics, notably the politics of resource (or profit), consistently and uniquely shaped the development of each individual lighting programme. But there was a technological logic, and there were increasingly high expectations of what was expected. And such expectations were shared in China by the staff of an agency which had the power and resource to try to match them. For Robert Hart, this was both a logical development of his responsibilities, as he saw them, and of the expectations of his office. But it was also a project he personally drove and believed in. The Customs Service not only regulated and tempered the often contentious point of Sino-foreign interaction. It brought evolving global norms into Chinese practice. At its simplest, ‘sufficient’ integration of China into the developing global world economy (to use Gallagher and Robinson’s classic formulation)¹⁰¹ required ‘sufficient’ physical structural integration. It required looping China into shipping routes and telegraph networks, bunding and conservancy projects, securing port cities (establishing municipal institutions, building roads), and developing the circulation of information. It also required engineers and technicians, architects and lawyers. And it required the building of a lights service and the active ongoing work of the Marine Department. ‘Humanity’, ‘civilization’, colonialism, and infrastructural globalization went hand in hand in the project to light the Chinese coast, and to shed empirical light on China’s physical, physiological, social, and economic realities.

¹⁰¹ John Gallagher and Ronald Robinson, ‘The imperialism of free trade’, *Economic History Review*, n.s., 6 (1953), p. 5.