

British Ships for the King of Spain: An experiment in technology transfer

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Introduction

The practice of looking at foreign methods and replicating them at home can be a practical option in considering the methods available for technological modernisation. It is, however, a technique, known as technology transfer, which is fraught with difficulties as S. Herbert Frankel states

‘the problem might appear to be merely one of introducing new methods of production and the instruments, tools or machines appropriate thereto. But what is really involved is a vast change in social beliefs and practices’ (Cipolla, 1965: pp. 129–30)¹⁹.

This was undoubtedly the case with the development of naval construction in mid-eighteenth century Spain when Ferdinand VI (1746–59) gave royal permission for the recruitment of some 90 British shipbuilding artisans into Spanish service.

Armed Neutrality

At the beginning of the 1750s Spain was recovering from the War of Jenkins’ Ear (1739–48, known in Spanish as the Guerra del Asiento), a conflict with Britain in which none of the causes that had led to it had been resolved²⁰. At the same time, war between France and Britain seemed imminent and Spain was likely to get caught in the crossfire. Ferdinand VI, however, was adamant that he wanted his reign to be peaceful and his chief minister, Zenón de Somodevilla, Marqués de la Ensenada (1702–81), sought to make this possible by developing a policy of ‘armed neutrality’ (Rodríguez Villa, 1878: pp. 43–65)²¹.

¹⁹ See Fernández González, Ferreiro, Nowacki (eds), 2006; Ferreiro, 2007; Merino Navarro, 1981; and Pritchard, 1987, for various arguments over the value of technology transfer.

²⁰ See Lynch, 1989, for a history of eighteenth-century Spain, as well as Merino Navarro, 1981, and Fernández Duro, 1895–1903, for the history of the Spanish navy. See Black, 1991; Pares, 1936; and Walker, 1979, for Spain’s foreign policy; Harding, 2010, for the War of Jenkins’ Ear (1739–48) and Dull, 2005, for the Seven Years’ War (1756–63).

²¹ Ensenada outlined his policies in a series of ‘Representations’ to Ferdinand VI which were published in full in Rodríguez Villa, 1878. See Gómez Urdáñez, 1996 and Delgado

Spain, he argued, lacked the military and naval capability to challenge either Britain or France by itself, but it could expand its forces so that a potential alliance with either one of them would present a real threat to the other. Both would then respect Spanish interests. Ensenada, who had risen through the administrative ranks of the navy, reasoned that it was the navy in particular which was in need of reform and expansion (Rodríguez Villa, 1878: pp. 109–11, 113–42).

Aware of the tense European situation and the need for urgent action, Ensenada, therefore, pushed through an unprecedented era of naval construction in the 1750s. In the thirteen years of Ferdinand's reign, 48 ships of the line were built. By contrast, 62 had been built in the 46 years of Philip V's reign, 57 were to be built in the 29 years of Charles III's reign and 16 in the 12 years of Charles IV's reign (Harbron, 1988: pp. 164–73).

Jorge Juan y Santacilia's Voyage to London

These ships were built to new designs, the result of an espionage mission to England by a Spanish naval officer, Jorge Juan y Santacilia (1713–73). This officer spent over a year from 1749 to 1750 studying the Royal Navy – especially its shipbuilding – and recruiting shipwrights and artisans for Spain²².

Juan, on his return home, became a leading figure in the reform of the navy and, with the assistance of those he recruited, developed and implemented a new establishment of naval construction and design which was given the name *la inglesa*, a term that translates into 'English-style'. This was officially established at the Council of Constructors held in Madrid in 1752 chaired by Juan and attended by his recruits Richard Rooth (the master shipwright at Ferrol arsenal), Matthew Mullins (that at La Carraca in Cadiz), Edward Bryant (in Cartagena) and Almon Hill (Master Draughtsman and shipbuilding instructor at the Academia de Guardias Marinas in Cadiz Department). The plans they drew up (which today can be consulted at the Naval Museum in Madrid) became the designs for Spanish warships built during the 1750s and were only officially replaced in 1765, by 'French-style' shipbuilding under the direction of a French master shipwright, François Gautier.

Barredo, Gómez Urdáñez (eds) 2002, for an analysis of Ferdinand VI's ministers, their policies and reforms.

²²See Lafuente and Peset, 1981; Soler Pascual, 2002; and Valverde, 2012, for Juan's biography and time in London, as well as Scheybeler, 2014, pp. 42–109, for an analysis of Juan's mission and *la inglesa* shipbuilding.

A la Inglesa Construction

A la inglesa design was loosely based on the British 1745 Establishment though from the beginning there existed differences between the two systems. Overall a la inglesa ships were larger, so that the Spanish 68-gun ship of the line was closer to the size of a British 90-gun ship and they had a reduced depth in proportion to their length and breadth²³.

The construction of the hulls, however, represented a marked break with the previous system of construction. At the risk of over simplifying, where the traditional Spanish system used the largest timber parts possible with the fewest possible joints and bolted these together with iron, the British employed a greater number of smaller parts, scarphing these together into an interlocking frame and securing them with treenails. The latter was introduced to Spain with a la inglesa construction²⁴.

When this happened, however, there was one very substantial oversight – timber seasoning was not altered to accommodate the new system of construction. At the Royal Dockyards in Britain compass timber, plank and treenails were seasoned and stored, roughly hewn, in a covered, dry environment (Roberts, 1992: p. 102)²⁵. Ships were also built over a longer period of time and allowed to season in frame (Lambert, 1991: pp. 120–21). By contrast, in Spain, timber was cut to size in the forests where it had been felled, transported to the sea by river and seasoned in ponds or on beaches buried in sand or mud where it would regularly be covered by sea water (AGS Marina 315, Autrán, ‘Notas sobre el estado de los arboles ...’, 20 May 1747). This practice was not altered throughout the period of a la inglesa construction even though the British master shipwrights at each of the

²³See Kew Adm 95/12 for detailed proportions of 1745 Establishment ships to compare to Kew Adm 49/90 proportions of a la inglesa ships Aquilón, Soberano and San Antonio. These ships were among those taken by the British at Havana in 1762 and their proportions taken in Britain in the British style, thus it is possible to obtain an accurate comparison with 1745 Establishment ships. Details of the 1745 Establishment and Spanish ships taken into British service can also be found in Gardiner, 1992; Lavery, 1998; Lyon, 1993; and Winfield, 2007.

²⁴ See Rivera, 2012, for a la inglesa ships; Fernández González, Apestegui Cardenal, Migueléz García (eds) 1992, for the previous form of construction and Manera Regueyra (ed) 1981, for the evolution of Spanish naval construction in the eighteenth century.

²⁵ See Albion, 1926, p. 13 and Lambert, 1991, pp. 110, 118–23 for the preparation and preservation of timber for shipbuilding.

arsenals did ask for it. In May 1750, for example, Rooth wrote that it was not suitable to store the planking in water because:

“it ate its substance and would later cause it to split. The method of seasoning it was to store it in a warehouse where it could not be reached by either rain water nor the sun”

(AGS Marina 318, Alvarez to Ensenada, 12 May 1750).

Ensenada did confer with the Naval Intendants asking them what they thought but they replied that the traditional Spanish methods of timber seasoning were the best. Ensenada, therefore, dismissed Rooth's suggestion (Scheybeler, 2014: pp. 78–80).

A common defect subsequently reported by naval officers who captained these ships was that the treenails and caulking fell out and that the ships needed more iron to hold them together, some specifying that they meant in the freeboard, the portion of the hull that is above the water (AGS Marina 330, 1758 ship reports) – a likely outcome of the timbers contracting as they dried which would be more noticeable above the waterline.

At the same time as these ships were entering Spanish service, a political event which was to have a significant effect on the development of a *la inglesa* construction occurred in Madrid. On 21 July 1754, Ensenada was ousted from power in a political coup and, thereafter, the shipbuilding project and those employed in it received very little support from the central government. Without it, conditions at the three arsenals of Ferrol, Cadiz and Cartagena began to exert a greater force on a *la inglesa* shipbuilding.

Ferrol

Ferrol, due to its location on the north-west coast of Spain, was intended by Ensenada to take over from Cadiz as Spain's principal naval base. The designs for it, therefore, made it larger, with four dry docks to Cartagena's two (none as yet being projected in Cadiz), and it was where Richard Rooth, the most senior of the shipwrights recruited by Juan, was employed (AGS MPD 3/23, 17/17). In 1753, however, it was still just a small regional town, poorly connected with the interior of Spain, relying heavily on food imports and with a skilled workforce brought in from more traditional shipbuilding areas, namely the Basque Provinces. Cramped conditions, frequent shortages of food and elevated prices resulted in a disgruntled

workforce prone to recurrent outbreaks of disobedience and violence even before a group of much better paid foreigners were placed in authority²⁶.

Into this delicate situation was brought Richard Rooth who considered this opportunity to work in Spain as potentially very lucrative. Not only did he earn a large salary as master shipwright but he also set himself up as a merchant, getting favourable contracts transporting naval stores and importing Newcastle coal. It seems that from the outset he flaunted his newly acquired wealth and status. The British consul at Corunna, Joseph Jordan, disliked him intensely, complaining Rooth behaved as 'lord paramount' of a 'clan of English & Irish renegados' and that his 'grand living, keeping an open table &c.' was offending those at the arsenal (Kew SP94/227). Soon Jordan was reporting a rift between Rooth and Antonio de Perea, Naval Intendant at Ferrol, noting that 'the Intendant is no friend to the English in general and a great opposer of Rooth in particular' and later that Perea was 'Rooth's irreconcilable enemy' (Kew SP94/228). By 1754, it seemed the two could no longer work together and either Rooth or Perea would have to be removed from their post (Kew SP94/228). On 7 July 1754, Rooth appeared to have won out and Perea was replaced by Juan Francisco de Medina but after Ensenada was ousted from government on 21 July the new naval minister, Julián Manuel de Arriaga y Ribera (1700–76), reinstated Perea (Kew SP94/228)²⁷.

Without support from either the central government or the local naval administration, Rooth struggled to run the arsenal's shipbuilding with any authority. He experienced numerous clashes but an incident while organising the launch of the *Soberano* on 21 July 1755 serves to illustrate his predicament. On this occasion, Perea forwarded Arriaga in Madrid a petition from Antonio de Urbietta, foreman of the *Soberano*, claiming Rooth had ill-used him. According to Urbietta, when Urbietta had used a first-rate timber for the launch of the ship at Rooth's request, the latter had flown into a rage, hitting Urbietta with a cane, calling him a 'filthy cur' ('perro canalla') and telling him never to set foot in the arsenal again. Perea forwarded this complaint without first consulting Rooth complaining to Arriaga that it was difficult to keep the workforce under control when Rooth had such a violent temper (AGS Marina 235, Perea to Arriaga, 22 July 1755).

²⁶ See Scheybeler, 2014, pp. 112–36, for an analysis of conditions in Ferrol and difficulties in recruiting skilled labour.

²⁷ See Baudot Monroy, 2012, for an analysis of Arriaga as naval minister.

At this point, Rooth, in his turn, also complained to Arriaga because Perea had not brought the matter to his attention even though he had visited Perea's house every evening since the altercation. In Rooth's account, Urbieta had used one of the best timbers available when he, Rooth, had assigned a different, less valuable one. When instructed to replace it, Urbieta had just stared at him 'smirking and by way of disrespecting me turning to those present making gestures and ridiculing him' for which reason Rooth had hit him and told him to get on with work. He later discovered that Urbieta, at Perea's suggestion, had left the arsenal, was refusing to return to work and had written a formal complaint against Rooth (AGS Marina 235, Rooth to Arriaga, 29 July 1755)²⁸. Arriaga settled the matter by informing Rooth that Perea could be trusted to defend Rooth in such disputes with the workforce and Perea that until Rooth was no longer necessary he should appease both parties (AGS Marina 235, Arriaga to Perea, 6 August 1755).

Rooth remained master shipwright at Ferrol until his death in 1761 without his relations with either Perea or the workforce improving. In 1757, Perea and Francisco de Orozco, Commander General at Ferrol, succeeded in persuading Arriaga to let them build the last ship being built at the arsenal to a la inglesa proportions but fitted in the traditional manner – against the opinions of Jorge Juan and the British shipwrights. The resulting ship, the 58-gun *Campeón*, was found heavy and unwieldy. Arriaga asked Rooth to explain why the *Campeón*'s sailing qualities differed so much from those of the *Tridente*'s but Rooth refused responsibility claiming William Turner, the assistant shipwright at Ferrol who was on better terms with Perea, had drawn her plan and this had been approved by the court. To the best of his knowledge that was how she had been built (Scheybeler, 2014: pp. 98–100).

La Carraca

Cadiz was a long-established naval base and the headquarters of the Director General of the Navy who throughout the 1750s was Juan José Navarro, Marqués de la Victoria (1687–1772). The shipyard was located within Cadiz Bay on the peninsula of La Carraca²⁹. As a result of Cadiz's importance and history, it was where most of those who had led the previous method of ship construction were based. Of these, the most significant was Ciprián Austrán Oliver (1718–73), a

²⁸ 'sonreíendose y a modo de despreciarme volviendo con mofa y gestos la cara a la gente'.

²⁹ See Quintero González, 2000, and Quintero González, 2004, for La Carraca.

shipwright who had expected to head the shipbuilding project when preparations began in 1748 but who, in the end, was only to occupy the post of master attendant at La Carraca³⁰. He represented the old establishment of naval construction and from the outset was opposed to a la inglesa³¹.

After July 1754, Autrán regained much of the authority he had lost when the a la inglesa project had the full support of the court. With his opinion once again considered valuable and with the support of Juan Gerbaut, Arriaga's replacement as Naval Intendant at Cadiz, Autrán used every opportunity to criticise a la inglesa with the hope of reinstating the previous establishment of naval shipbuilding.

Again, given Cadiz's significance, it was at Cadiz where most of the councils to discuss a la inglesa were called. One of the most noteworthy of these took place on 9 October 1754 and was attended by the Marqués de la Victoria, Juan, Mullins, Gerbaut, Autrán and eight naval officers who were then in Cadiz and had experience of captaining a la inglesa ships. At the meeting, the Marqués de la Victoria asked all those present to submit a written statement outlining their proposed modifications to this form of shipbuilding. Autrán submitted a lengthy critique that categorically rejected a la inglesa construction and advocated a return to the previous system. The Marqués de la Victoria forwarded all the statements to Arriaga but noted that Autrán's had the backing of Gerbaut and most of the naval officers. In Madrid, Arriaga had copies made of Autrán's statement with the addition of an extra paragraph compiled from the statements of the other officers and forwarded these to each of the British master shipwrights giving them eight days to respond. Rooth, Mullins and Bryant each submitted reports rejecting Autrán's proposed modifications point by point. Of these, Rooth's was forwarded to the Marqués de la Victoria who was instructed to call another council. This time with just himself, Juan and Gerbaut and they were to make definitive judgements. They were unable to come to an agreement but after Arriaga again insisted that

³⁰ In Spanish dockyards, the master shipwright was in charge of construction and the master attendant, who was the more junior, was in charge of ship repairs and maintenance. In AGS Marina 315, Autrán's correspondence in relation to the preparation of timber for the forthcoming construction makes it quite evident that he expected to be the master shipwright as was only natural considering that, at that time, he was the most senior shipwright in Spanish service.

³¹ This is demonstrated by his correspondence with Ensenada on the subject of Jorge Juan's discoveries in London, see Autrán to Ensenada, 8 June 1749 (AGS Marina 316) for an example.

they do so they agreed to make six changes and Almon Hill, the British shipwright at the Academia de Guardias Marinas was called upon to draught the new plans. The changes were small and generally those that Rooth in his report thought appropriate. The only substantial alteration and the one that went against the thinking of Jorge Juan and all the British shipwrights was that iron nails, not treenails, should be used in the freeboard. Even though Juan and all the British master shipwrights pointed to the use of green timbers as being the source of many of the problems, this subject was not addressed (Scheybeler, 2014: pp. 83–98).

This council set the pattern for most of those that were subsequently called. In the end, the debate always seemed to revert to a discussion of whether the previous system of construction was better than a *la inglesa* rather than adapting and improving a *la inglesa*. In these discussions, it was evident that Mullins' opinions, even though he was considered a good shipwright, held less sway at court than Autrán's.

Cartagena

Edward Bryant had an easier time in Cartagena than either Rooth in Ferrol or Mullins in La Carraca. He handled his situation prudently and, in turn, he was left unhindered in his work and the Intendant's reports generally speak highly of him. In 1760, for example, Barrero said of him that 'this person's skill is of the best known and recognised by all' (AGS Marina 236, Barrero to Arriaga, 13 February 1760)³². His ships were, on the whole, the most well-received in Spanish service. The *Tridente*, for example, was considered so good that her plans were officially made the standard design for 58-gun ships in the Spanish navy in 1756 (AGS Marina 326, Arriaga to Juan, 30 December 1756). Hence, as previously mentioned, when Arriaga was asking Rooth to explain the sailing qualities of the *Campeón*, he asked why they were not equal to the *Tridente*'s.

Bryant, however, did not play a significant part in the debate over a *la inglesa* shipbuilding because Cartagena arsenal was not much involved in it. Cartagena had only become a naval base in 1733 when Philip V had made it the Mediterranean Naval Department's capital and transferred his galleys from Barcelona to Cartagena³³. It had functioned primarily as a galley base until 1748

³² 'la inteligencia de este sugeto es de las mejores que se conocen, y notoria a todos'.

³³ See Pérez-Crespo, 1992, for a history of this arsenal.

when this service was cancelled and only then was the arsenal built to cater to ships of the line. It also became the home of a xebec squadron that took over from the galleys as the main force employed against North African privateers.

Conclusions

S. Herbert Frankel's assessment that the introduction of new systems, such as a *la inglesa* construction, required a vast change in 'social beliefs and practices' to be successful was substantially accurate. The need to vary timber-seasoning techniques to suit a *la inglesa* shipbuilding, for example, was necessary but it contravened intrinsic beliefs held in Spain about timber seasoning and was, therefore, impossible at the time.

There were, however, several other factors that hampered the project and these were mainly political and social. Too many ships were built too quickly without adequate testing and research because Ensenada considered Spain dangerously vulnerable without warships to defend its interests. Furthermore, the project was so closely associated with one political faction that when this faction lost its power the incoming politicians were unwilling to support it. The experiment, in fact, highlights how vital consistent, long-term political support was for a revolutionary rather than evolutionary construction scheme. At Ferrol, the behaviour of Rooth and those he brought with him from Britain alienated the local naval administration and workforce making progress nigh on impossible. Whereas in Cadiz those with a vested interest in returning to the previous system of construction – from 1754 unchecked by the central government – also hampered the necessary reform of a *la inglesa* construction. Conversely, Bryant in Cartagena was not brought into the discussion.

Since this paper has focused largely on the immediate difficulties involved in introducing a foreign method of construction, it may appear that this venture yielded few results. The outcome of Jorge Juan's espionage mission to London and the adoption of a *la inglesa* shipbuilding, however, was not all negative especially in the long-term. The challenge to traditional Spanish shipbuilding methods brought about greater thinking on the subject and, moreover, elements of a *la inglesa* construction were kept or later re-instated. The most substantial advantage was in infrastructure. Dry docks, masting engines, stoving ovens, state-run sail and rope factories were built largely based on their British equivalents. In all, this form of technology transfer can be very productive but it cannot be, in

Frankel's words, 'merely one of introducing new methods of production and the instruments, tools or machines appropriate thereto'.

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