Royal Belgian Institute of Marine Engineers

THE HISTORY OF BRITISH MARINE ENGINEERS LICENSING

When, two centuries ago, engines were first installed in ships, the promoters probably had little appreciation of the impact the new technology would have on ships manning. At a stroke a new and significant craft appeared aboard ships which would rival and out-class such long-standing ships -board skills as seamanship, sail-making, gunnery, cooperage, blacksmithing, shipwrighting and even, when a theoretical basis for ship's engineering had been developed, navigation.

Half a century from their introduction, ship's engineers would be licensed in the same way that ship' mates and masters had been sufected to licensing a decade earlier. By the end of the nineteenth century, marine engineers would be emerging as another of the sub-groups of increasing engineering specialization identified in the formation of professional institutions: Civil Engineering (1818), Mechanical Engineering (1845), Naval Architecture (1860), Marine Engineers(1889). By 1900 engine room departments of engineers, firemen and trimmers on ordinary merchant ships matched in numbers the deck departments of master, mates and seaman, and on powerful liners greatly exceeded them. Yet merchant ship engineers have been little studied, while they appear to be almost invisible if the string of parliamentary publication concerned with shipping safety is relied upon, and the vast array of literature concerned with shipping also seems to largely to ignore them.

The early history of commercial steam shipping lies in the river services and then, in the 1820s, coastal services , with passengers and high value, small volume cargoes. With operational experience cam technical development in both engines and boilers, but, despite some Trans-Atlantic voyages in wooden paddle steamers, long distance oceanic operation only became an economic reality with the replacement of wooden hulls by iron, and paddle output by screw, together with boilers capable of higher steam pressure, compound engines and the development or the network of coaling stations.

The oceanic steamship age really dates from the 1860s, the larger ships these advances allowed, and the associated improved reliability. Although engineers appear to have featured little in public discussion about merchant ship manning, and though autobiographies and literary depictions are rare, like other merchant seafarers they are recorded in the official documentation or ship manning, and as with masters and mates, data about them survives in the records of the licensing system from 1862. At the heart or this paper is an analysis or data to be found in 'engineers' application to be examined for certificates of (BoT),held now at the National Maritime Museum. (I) This seeks to throw light an such basic question as the age at which engineers obtained the Second and First Class Certificates of Competence, their preparation for those awards in terms of prior share experience and sea service.

(I) *The Marine Department came into being as a result of the Merchant Marine Act at 1850. It was renamed the Mercantile Marine Department in 1922, and after several further changes during the twentieth century , its functions are now undertaken by the Maritime Coastguard Agency.*

With the first initiatives dating from the beginning of the eighteenth century, 100 years of development had taken place before the successes full application of steam power in ships in the 1820's.

This was time enough on land for the development of some specialism in the manufacture of steam engine plant in workshops which themselves would evolve into factories. In addition to engine design, a wide range of metalworking skills was needed combining those of the foundry where the individual parts of engines were cast, the workshop with the hand and machine tools where the parts were refined, and the assembly shop where the engine was built and tested. Clearly skilled labour was required.

Such skills were acquired through experience, and the evolving engineering industry adopted the time-honoured approach of taking on youths for an apprenticeship which in theory provided for experience of all different skills involved trough understudying, that is working with a skilled ,or journeyman mechanic.

Periods of between four and seven years might be served, at the end of which journeyman status was granted to men by then in their early twenties, and they could begin to earn their livings. It is not difficult to speculate that when new steam plant was being installed for a customer, manufacturers' own skilled craftsmen would undertake the installation and oversee the early operation, if necessary training the customer's own employees. Once operational , the manufacturer could be called in when difficulties were encountered. One could say those workshops were the first schools for ships engineers.

The Board of Trade knowed this and had already in the I840s made it possible for full qualified journeymen and fitters to obtain after 4 years service as an donkyman or fitter to obtain a Service Certificate from the BoT. For many years these men have been the backbones of ships engine rooms. Also some ship and engine builders leased full skilled craftsmen who had been trained and educated in their own shops and factories.

While practical experience in mechanical engineering through the apprenticeship and journeyman stages in workshops ashore was all important in the background of future ships engineers, educational experience of theoretical principles underlying engineering design, was not entirely neglected.

Indeed as professional consciousness developed demand grew for improved engineering education as an under-pinning to responsible positions in engineering employment. Interest in theory had developed early in the nineteenth century through the spread of the mechanics institutes movement which had originated in Scotland. By 1825 institutes offering lectures and evening classes in scientific and technological principles had spread throughout the country and were particularly strong in industrial areas. By the 1860's

Department or Science and Art (1853) was promoting classes such as mechanics and running an examination system offering certification. By the I890s this approach was coalescing in the emergent technical colleges and increasing numbers of engineering apprentices were attending evening classes on a regular basis.
Undoubtedly the introduction of Certificates of Competence for merchant ship engineers under the Merchant Shipping Acts Amendment Act, 1862 boosted the provision of vocational educational education ashore for ship's engineers, though largely through private schools specializing in preparing candidates for the examinations and through the production of textbook guides to the examinations. Towards the end of the century university level institutions were beginning to offer engineering subjects and some of those went to sea as ship's engineers. But those with a better secondary education and ability were able to rise more rapidly to the position of chief engineer.

The 1862 Act referred to the compulsory system or examinations for mates and masters, there had been a long period or debate and a short lived scheme (1845-50). The debate was informed by the practise in the East India Company and in the Royal Navy or examine for lieutenants' appointments. But the genesis of a system for the mercantile marine as a whole lay with the investigations and recommendations or the Select Committee on Shipwrecks.
The compulsory system from 1851, set the lowest possible standard and provided for the examination of second mates, first mates and masters of foreign-going ships. The requirement was extended to mates and masters of home- trade passenger ships. The shipping press appears to content itself with reporting the provisions in the act and the subsequent regulations issued by the Marine Department. The Mitchell's Steam Shipping Journal, however, offered a comment appearing to support the argument for chief engineers to have equal status with masters.

The Mitchell's Steam Shipping Journal wrote:
" *In steamships the engineer is one or the most important, perhaps the most important member of the ship .The safety of lives of all on board, and of the property committed to the masters' charge depends more or less on the competence, skill and steadiness of the engineer".*
" *It is obvious, therefore, that the men who have such important functions to discharge, should be subject to the test or sufficiency already established for masters and mates.*"

The argument may be muddled but it points to tension between engineers who qualified through their training ashore as apprentices and journeymen and those who advantage of the provision in the regulations designed to allow men with ample seagoing expertise and demonstrated ability with ships engines to progress to chief engineer. Similar arrangements allowing ABs to attempt the second mates' examination and thus offering the change to progress to master, were referred to as " coming up through hawse pipe". In the same context engineers who had been stockers were called "shovel engineers". The primacy of practical experience over theoretical knowledge would be constantly argued in deliberation about ships' engineers in the century from 1863.

Both the assertion just quoted are "after the event comments" but what triggered the inclusion of examination in the 1862 Act? The answer will have to await further research. However one can point to two developments which may have had a bearing. In 1837 the Royal navy gave some recognition to the engineers it had engaged for its steam ships classing them as third, second or first class. At that time the navy was still recruiting its engineers from the civilian industry ashore and initially did not fit them into naval manning. Classification in 1837 gave engineers warrant officers status, but below carpenters in the hierarchy, and a careers structure within the navy, though for social reasons officer status would not be on the agenda. for many years.

The reason for this discrimination was the British class system, Royal navy officers come from the upper class and most engineers belonged to the lower middle class of the working class (This anachronism was altered by Admiral John Fisher when he became First Lord or the Admirality, Admiral Fisher had been studied engineering and modernized the Royal Navy between 1870 and 1904 he invented several types warships including the famous dreadnoughts.)
The 1863 regulations, which set a pattern for engineers certificates of competency which would last until 1980, contain some significant details differing from the wording adopted in the 1862 Act. The 1863 Regulation, in a most convoluted text, refer to steam ships or nominal horsepower and second and first class engineers' certificates. Nominal horsepower (NHP) was a calculation using for condensing engines the formula $D^2 \times N / 30 = NHP$, where D is the diameter of the cylinder and the number or cylinders.
A more complex formula was used for compound engines. In addition to the Second Class- and the First Class Engineer's Examination, provision was made for an Extra First-Class Engineer's Examination, a voluntary qualification, intended for such persons who wish to prove their superior qualification. (an Extra First Certificate could only obtained by holder of the British Nationality). This emulated the Extra Master examination in the Masters and Mates regulations. Engineers who could prove service of sufficient length as second or first engineer in ships of the appropriate power could apply to be issued with a Certificate of Service without examination.

However such certificates, though legal, did not carry the same status as a certificate of competency and some holders of service certificates later chose to attempt the examinations. The conditions for admission allowed for an apprenticeship in an engineering factory or in a engineering repair shop, and four years at sea in the engine room as an apprentice engineer or as a fitter. At the same time there was agitation for the introduction of a Third Class Certificate, partly to cater for the large number of uncertificated permanent third engineers.

Despite the use of this grade in some other countries. The BoT resisted its introduction in Britain. The minimum age for candidates was set at 21 years. The Suez Canal opened at 1869, this brought the steam ship into its own as the mode of sea transport for the future. Ships became larger, the production of high grade steel and tempered cast iron more powerful engines could be constructed. New types of steam engines so as the Triple and the Quadruple Expansion Engine were installed in ships and high pressure water pipe boilers with super heaters. High steam pressure and over heated steam came in use. Trough the invention and the application of oil fired steam boilers with forced draught could the mechanical and the thermical efficiency of the engine improved.

Steam power was used to drive small auxiliary steam engines. The early use was the bilges pump. But as steam ships grew in size and functions such as steering gears anchor winches exceeded normal capability and winches for cargo handling were introduced the whole installations become more and more complicated and dangerous.
By the end of the nineteenth century all tramp ships were equipped in this manner. But the evolution of cargo and passenger liners promoted the installation of a wide range of additional facilities which were driven from the engine room. Such services included cabins services such as hot and cold running water, and heating. Refrigerated food storage improved the quality meals served to passengers, the installation of generators allowed electric lighting to be installed. By the end of the century pumping systems had extended bulk petroleum cargoes in tankers, and refrigeration to cargoes of frozen meat. Two sup-specialised in particular, emerged, ships electricians and ships refrigerating engineers.

In the late 1800’s the Parson steam turbine and the Diesel motor were installed in ships as main propulsion engines. This made it necessary for ships engineers to adapt new technologies and working method’s. The higher propulsion power and the speed of passenger liners was one off the reasons for the "Races of the Blue Ribbon" which were held in the North Atlantic.

The first winner of the “Blue Ribbon” was 'SS MAURETANIA, of the Cunard Line. She won "The Blue Ribbon" in 1907. (The ship had a gross tonnage of 31,938 GT and an engine power of 70,000 SHP the ship had two HP Parsons turbines and two LP Parsons turbines which drove 4 propellers, she could reach a speed of 27.4 miles.

Between 1907 and the outbreak of the "First World War" several types of engines on board of ships as main propulsions or as auxiliary engines, so as the steam motor and the combined turbine installation and the Diesel engine.

In the 1920’s Diesel engines were altered from blast injection into high pressure fuel injection and supercharging by means of blowers were-installed to boost the propulsion power of the engines. Those facts and the fact that Diesel engines hand a higher thermal efficiency was the main reason that Diesel engines took over a great deal of the propulsion of ships. Propulsion by steam turbines would only used in large tankers, liners and warships.

CONCLUSION

The licensing of British merchant ships' engineers 1862 is undoubtedly a measure of their growing significance in merchant ship manning. Coming in the same decade in which power driven ships achieved world - wide operational capability and in which the Suez Canal opened (1869), it may be seen as another element conceding to bring the steam ship into its own as the mode of sea transport for the future.

Licensing was also significant in vocational terms. Without perhaps realizing it the Government had created a national vocational qualification which found acceptance in the engineering world ashore.
Although unproven it seems probable that many men obtaining certificates of competence spent a minimum time at sea before seeking employment ashore superior to their work going to sea.

The wastage between Class 2 and Class 1 may in part reflect this. Licensing was also a step in the direction of the professonalisation of the ship's engineer, giving their leading representatives, such as BoT surveyors, engineers and marine superintendents of shipping companies, a say in the formulation of professional standards for the occupation. There can be little doubt the BoT surveyors were influential in the introduction of certification. Today universities and polytechnics institutions offer to holders or an Extra First Class Certificate or Competency, to study for a BSc and a MSC in Marine Engineering or for a degree into the marine field related subject, and to the status of Chartered Engineer.

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