Marine Engineering Training in Singapore During the Early Days (Part 1)

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Unlike the training process in other specializations of engineering, an ideal training in Marine Engineering should be structured to provide students with adequate practical training so that they are able to handle any problems when they are out at sea. This is important since marine engineers are expected to be in the position to repair engines and machineries on board ship with little or no assistance from manufactures or support infrastructure located on land.

Due to this requirement, a good foundation in technical practical skills is essential as marine engineers need to innovate and work with basic materials and tools in the absence of special machinery on board ships. Before a special engine part can be created, these engineers would need to be able to hand-make the special required shapes like a perfect square from a round bar. In addition, when faced with limited resources, marine engineers would have to be able to create or convert existing resources to become parts that are needed to resolve problems faced onboard, where spare parts are not available.

Apprenticeship scheme

The apprenticeship scheme is the classical training for marine engineers. During their training, all young apprentices are required to work at shipyards or engineering companies and will be attached to mentors, who are skilled craftsmen, which would help lay the foundation of engineering skills for these prospective marine engineers.

During most of their training, young apprentices will be exposed to engineering fitting. Engineering fitting is defined as the skills needed to perform the following tasks; opening up, checking, maintaining and cleaning of machinery, making adjustments to the necessary clearances, re-assembling, fitting machinery together and testing them for use.

Besides acquiring skills, young apprentices are also encouraged to further their theoretical knowledge. Those who have outstanding academic results in Mathematics and Science are encouraged to take up either engineering courses at diploma or higher professional levels, while those who have “O” level passes in Mathematics and Science will be asked to attend technical colleges to obtain the necessary certificate or diploma required for trained technicians. Young apprentices who do not have “O” level passes in Mathematics and Science will be trained in craft courses. Hence, young and competent apprentices are developed such that they are able to serve at the various range of levels needed for operating ships and working in shipyards.

British model of the apprenticeship scheme

There are various apprenticeship schemes; these included the German, Norwegian, Dutch, French and the British schemes. The British's model of the apprenticeship scheme was the most popular. This was because shipbuilding and ship repair featured prominently in England's economy during 18th and 19th century and the invention of the steam engines and other machine engineering devices caused England to lead in this field. In addition, the British Empire was the foremost global power then. By 1922, it was estimated that the British Empire had a population of about 458 million people and covered more than 13,000,000 square miles.

According to the British's model of apprenticeship scheme, all shipyard apprentices would have to attend night schools. Apprentices who were not too academically inclined would choose to attend craft courses to be trained as skilled craftsmen, while those who were keen to enhance their practical skills gained through the apprenticeship training would opt to take up either the Ordinary National Certificate (ONC) course or the Ordinary National diploma (OND) course. Candidates of the ONC had to undergo a three-year evening-only part-time course which allowed them to work in the day, whereas candidates of the OND could choose to undergo a two-year full-time course in between their practical working training.

Even though apprentices do not need to have ONC or OND qualification to be junior engineers on board ships, many still enrolled for courses to earn these qualifications as they are part of the pre-requisites that enabled junior engineers to progress in their careers to become senior watch keeping engineers on board ships. Junior engineers had to earn at least a Part A of the Second Class MOT Certificate of Competency (COC) to be qualified as senior engineers. The full Second Class Certificate is usually known as the Second Engineer's COC.

In the early days, Singapore's Department of Marine conducted examinations for the British MOT Second Class and First Class Certificates, with Singapore Polytechnic running course to prepare the returning sea-going engineers for these exams. Singapore Polytechnic still does these but now the Maritime and Port Authority (MPA) awards these COC. The Part A of the Second Class Certificate is now called COC5. As I am not updated on the terminology of the COC now, I will leave younger members to describe the present COC's and concentrate on describing the MOT's COC in those early days.

As OND was considered to be slightly higher than the ONC in the academic/ theoretical context, apprentices with OND qualification were fully exempted from Part A of the Second Class COC. On the other hand, apprentices with ONC qualification had to sit for one paper (Engineering Drawing) before they could qualify for Part A of the Second Class COC and were thus only exempted from those theoretical subjects that constituted Part A of the Second Class COC.

For ONC and OND apprentices who excelled in theoretical learning, they could choose to further their theoretical knowledge by pursuing the Higher National Certificate (HNC) and Higher National Diploma (HND) respectively. Apprentices with ONC qualification had to do two more years of night studies to be awarded the HNC, whereas apprentices with OND qualification had to a one-year full-time course to obtain the HND. All apprentices with HNC and HND qualifications would be given complete exemption from the Second Class Part A of the MOT COC. However, only apprentices with HND qualification would be given exemption from certain academic subjects of Part A of the First Class COC.

Even though apprentices with good HND and HNC qualification were able to apply for admission to do their B.Sc. in engineering degree courses in universities located in England, many rather pursued sea careers and rose through the ranks to become Chief Engineers. A handful of them did eventually return to shore from sea careers after one or two years to complete their degrees in engineering.

The complete Part A and Part B of Second Class MOT COC qualified one to serve as a Second Engineer on board ship. Those with only Part A of the Second Class were usually considered to be competent to serve as Third Engineer or Fourth Engineer holding watch keeping responsibility.

Typically, the ship's Engine Room is managed around the clock with two engineers on duty at all times. The Second Engineer is regarded as the overall in charge of the Engine Room and is assisted by a Junior Engineer. They are required to do a four hour watch interposed by 8 hours of rest. During those 8 hours that the Second Engineer is resting, a Third Engineer who is assisted by another Junior Engineer would be in charge of the Engine Room for the first four hours. A Fourth Engineer who is also assisted by another Junior Engineer would be in charge of the Engine Room for the next four hours, before the Second Engineer returns for duty. To do proper engineering duties on board, Junior Engineers need not have the Part A of the Second Class Certificate but must be shipyard trained or previously served as Cadet Engineers on board.

As the Chief Engineer normally does day work only, he would enter the Engine Room during daylight hours to supervise. Still, he would be available 24/7 to manage and control any situation. If the Chief Engineer had to go to the Engine Room too often, then the Second Engineer is deemed not to be doing his role. The Second Engineer is usually even qualified with MOT First Class Certificates but would sail for some time as Second Engineer before he or she is promoted to the position of Chief Engineer.

Singapore's model of the apprenticeship scheme

When Singapore started its technical education in vocational institutes and Singapore Polytechnic in the 1950s, it was heavily influenced by the British educational system. Shipyards and engineering companies' apprentices who were not academically inclined would choose to attend craft courses conducted at Vocational Institutes to be trained as skilled craftsmen, while those who had "O" levels and were more keen to further their theoretical knowledge would opt to take up courses that gave out higher qualifications which were equivalent to those offered in England.

The Singapore Polytechnic then offered technician diploma courses in various disciplines of Engineering. Notably, the Mechanical Engineering course at technician level was used by apprentices for their academic qualification. All students who successfully completed their three-year full-time technician diploma course would be recognized as having a qualification equivalent to the HND. On the other hand, apprentices under the part-time or day-release technician diploma course in Mechanical Engineering had to undergo three years of part-time theoretical studies before they were granted exemption from all theoretical subjects, except engineering drawing, for the Part A of the Second Class COC. These apprentices that continued to spend two additional years to finish their 5 years part-time technician diploma in Mechanical Engineering (which was recognized as a qualification equivalent to the HNC) were given complete exemption from the Part A of the Second Class COC Engineer (Part A of the Second Engineer COC). The third year of the part-time technician diploma in Mechanical Engineering here is therefore considered as on par to the ONC in British Technical Colleges.

Despite this, many apprentices under the part-time technician diploma course in Mechanical Engineering would rather leave their shipyards or engineering companies' apprenticeship after completing three years of theoretical studies. This is because they wanted to go to sea two years earlier as Junior Engineers and were willing to put off their examination on theoretical subjects till later. They will however have to take the Engineering Drawing paper to get their Part A of the Second Class COC.

Apprentices that stayed on to complete their technician diploma in Mechanical Engineering, could either sail to fulfill the compulsory sea time of 18 months and then enroll for preparatory courses for Part B of the Second Class Certificate (Second Engineer Certificate) exams & sit for the Exams to get their Full Second Class Certificate of Competency, or they continue working ashore in shipyards as technicians and rise up the engineering management ladder ashore.

Shipping companies usually preferred to hire apprentices with part-time or day-release technician diploma course in Mechanical Engineering rather than those with a full-time technician diploma course in Mechanical Engineering. This is because the latter did not have the practical training in shipyards or engineering companies and as such, was more suitable to work as land-based mechanical engineers.

However, students who signed up for the special technician diploma course for Marine Engineering, offered by Singapore Polytechnic, were given special treatment as they were perceived to be more relevantly trained than those with the technician diploma course in Mechanical Engineering. This is because they had to complete a two year full-time course of academic work and also 18 months sea time as part of their diploma course. Upon returning from sea, they would have to do a final year of night studies while working in shipyards before they could graduate with their diploma. Those days, these specially trained Marine Engineering diploma holders were much in demand to sail as Junior Engineers.

Another specialize Marine Engineering training program was conducted by the old British Naval Base Dockyard School. Secondary school students joined this special school even before they completed their "O" level. They attended normal school in the naval base, learnt more relevant technical subjects and worked also in the naval base workshops. They also received qualifications that were considered as equivalent to the ONC and received exemption from Part A of the Second Class MOT COC. May I leave the detailed description of this course to those who completed this special avenue of Marine Engineering training in Singapore? This is also sometimes called the Sembawang Apprenticeship Scheme, as the Naval base became Sembawang Shipyard in the 70s.

Types of engineers in Singapore

As a result of the above various aspects of Singapore's model of Marine Engineering training, three main types of Marine Engineers were produced to support Singapore's maritime industry from the 1970s to 1990s.

Classical apprentices:

These apprentices had to complete a five year apprenticeship scheme which encompassed of academic work at night in the polytechnic and trainings at shipyards. After which, they had to go out to sea to clock up sea time before they are entitled to sit for Part B of the Second Class COC. After qualifying, they would have to go out to sea again to clock up further sea time before they could present themselves for the First Class COC. Those who wished to obtain Chief Engineer Certificate on Motor Ships would have to do their sea time on Motor Ships. Similarly, those who did their sea time on steam ships would sit for

the First Class Certificate exams on Steam Ship engineering. Those who want both the joint qualification as First Class Chief Engineer Certificate (Steam and Motor Ships), would have to sit for both exam and do sea time on board both steam and motor ships.

Those who were more theoretical inclined would pursue further education in colleges located in England to earn the Extra Chief Marine Engineer Certificate. This qualification would allow recipients to be regarded as Chief Engineers who had theoretical qualifications that were equivalent to that of a B.Sc. Engineering Degree.

Marine engineers with technician diploma in marine engineering :

Students who attended the technician diploma course in Marine Engineering at Singapore Polytechnic formed the second type of marine engineers in Singapore. They underwent training that were relatively similar to the apprenticeship scheme and hence, were also trained to be both skilled in hands-on practical work and academically trained.

After completing their polytechnic diploma, graduates had to go through the same route as classical apprentices did to obtain their Second Class and First Class Certificates, Combined Chief Engineer Certificate (Steam and Motor Ships) and Extra Chief Marine Engineer Certificate as described earlier.

Marine engineers with degree in marine engineering :

In the early days, none of the universities in Singapore offered degree course in Marine Engineering. Thus, it was a common trend among prospective marine engineers who were theoretical inclined to pursue overseas degree courses from countries such as England, Japan or Germany through scholarships from the Public Service Commission, shipyards or self funding.

After completing their degree course in Marine Engineering or Naval Architecture, these graduates would return to Singapore to form the third type of marine engineers. They would work in various shipyards and shipping companies. Some would go out to sea to clock up sea time that was necessary for the exams for the Chief Engineer First Class COC. Others might stay ashore and rise in the shipyard as Engineering Manager or Commercial, Design or General Managers. Some joined Classification societies, where their theoretical knowledge was most needed in plans approval, assessment projects or in design.

In the 1960s, the Singapore Polytechnic also offered professional diplomas in Mechanical, Electrical and Civil Engineering. These are for all intent and purpose equal to B.Sc. degrees elsewhere, but as the polytechnic did not have the charter to issue degrees, these were termed as “professional diplomas”. Holders of these diplomas would join shipyards and engineering companies, particularly the mechanical and electrical graduates and practiced as engineers and evolved into Marine Engineers. The Professional Engineers Board also accepted and registered them as Professional Engineers after they had attended the same professional training that overseas degree holders had to do. In those days, the sea-going Marine Engineers who were Chartered Members of the Institute of Marine Engineers and the Royal Institution of Naval Architecture were also registered as Professional Engineers by the Professional Engineers Board.

Changes faced by Singapore's maritime industry and how it affects Singapore's model of the apprenticeship scheme

In late 1970s, there was a tremendous expansion of the local shipyard sector as a result of a rapid increase in ship construction, foreign investment and manufacturing activities. Many apprentices who had their Second Class Certificates and sailed as Second Engineer for a while would return ashore to work in the shipyards as Ship Repair Manager or to serve their shipping companies as Superintendent Engineers.

The traditional apprenticeship scheme was not producing enough skilled technicians and engineers to support Singapore's maritime industry. Hence, major shipyards started to set up formal training schools in an attempt to produce more than the average quantum of apprentices.

However, in 1990s, the recession in shipping coupled with the development and expansion of other sectors of Singapore's economy resulted in a contraction in the maritime's shipyard sector. Over time, this affected the number of young people signing up for training schools or apprenticeship scheme. Eventually, these apprenticeship schemes ceased to exist. The shipyards then concentrated on producing skilled workers to meet NTC 3 level.

In addition, at that time, prospective marine engineers were also attracted to new diploma course in Offshore and Marine Technology offered by Ngee Ann Polytechnic. As such, from the 1990s onwards, the two polytechnics replaced the role of the apprenticeship scheme and continued to produce future Technicians and Marine Engineers.

This concludes part one of this re-collection. In subsequent parts, I will try to elaborate on the apprenticeship scheme that I went through at Keppel, as well as touch on the move by Singapore Maritime Foundation to initiate a B.Sc. degree course in Marine Engineering, Naval Architectural and Offshore Technology in Singapore.

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