MARINE ENGINEERING AS FUTURE CAREER IN MALAYSIA

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ABSTRACT

The employability of seafarers is directly linked to their competency level. Perhaps, this is the main reason why crew members from certain countries enjoy preference in the employment market. Therefore, the sea career prospects of Malaysian seafarers should be viewed from their competency which strongly related to the kind of training offered by Marine Education Training (MET) institutions. In this paper, the developments of maritime industry in last 10-15 years reviewed the limitations of the STCW 95 training standards in achieving the knowledge demands of high technological equipment on board new merchant ships is reviewed. The authors identified essential training for Malaysian seafarers. Malaysian Maritime Academy (ALAM) has taken important initiatives of enriching MET curriculum work done, beyond the minimum stipulation of the STCW 95, and benchmarking with leading world class MET institutions is reported. The DNV Sea-Skill audit and certification is an example of the commitment by ALAM which offer a program for competence beyond compliance. The paper also reviewed discusses the importance of University Malaysia Terengganu (UMT) degree program maritime Technology as support to need for more theoretical knowledge required to compliment STCW.

Keywords: Education, Engineering, Maritime, Training, ALAM, UMT

1. INTRODUCTION

Due to ever rising fuel prices, stringent environmental restrictions, deteriorating global security and sharp increase in the salary of seafarers the shipping business has become very competitive. This compels ship owners to adopt new and more advanced technologies which can bring down the overall ship operating cost and guarantee them a viable return on their investment. This new shipping business environment is gradually bringing about changes in the ship design practices, shipboard operational procedures optimization in routing and voyage planning to ensure optimal most economical operation of the vessels.

In new ships, now it is quite common to find increasing use of ICT and other advanced technologies such as Distributed Control Systems (DCS), on line machinery fault diagnosis system using neural network/Fuzzy logic based mathematical models of the propulsion plant and vibration analysis techniques for condition monitoring etc to achieve best performance in terms of reduced manpower and lower cost of maintenance. The new ships are, therefore, technologically more advanced in comparison to their earlier generations and offer significant benefits in terms of less fuel consumption, low maintenance, cargo carrying capacity, safer environment tolerant and reduced manpower. These benefits have been obtained at the cost of using high technology components and systems for the hull, machinery and propulsion controls which places high competency demands from shipboard personnel.

Because of all these developments, the technical and commercial viability of traditional propulsion plants are already under close scrutiny and new more fuel efficient alternatives are slowly replacing the old installations. Some of the most promising alternative propulsions under considerations by many ship owners are the all electric integrated system, fuel cell systems and GT based hybrid cogeneration conventional mechanical propulsion systems. These new alternative propulsion systems integrated with advanced technology tools offer better fuel consumption, less maintenance, longer machinery life, environmental safety resulting in increased ship availability and better overall financial returns to the ship owners.

The introduction of these advanced technologies in the new and future ships has obvious implications for the education and training of seafarers. The old traditional methods of MET conceptualized by the IMO which is implemented through the instruments of STCW 95 is no longer able to meet the challenges of these new shipboard technologies. This is already becoming evident from the many catastrophic accidents reported from time to time where the lack of crew competence in the operation of high technology equipment has been pointed out to be the main contributing factor in the incident.

To address this issue effectively, the MET institutions will require taking urgent steps to produce competent seafarers who can confidently and safely handle the advanced technological equipment on board new ships. This call for the MET institutions take a serious review of their current STCW 95 compliant training curriculum and realign with the future technology needs of the maritime industry. Some countries that were more proactive anticipated these events long time ago and have taken timely measures to improvise and upgrade their training curriculum in line with the future needs of the maritime industry. But, in Malaysia we have not been so alert to this issue which will have a definite impact on the future employment prospects of our seafarers.

Recognizing that, we at ALAM, taking advantage of our networking with a few leading world classes MET institutions, have taken note of these technological developments and are carrying out the necessary changes in our curriculum. There is also a need for the other institutions of higher learning in the country to share this responsibility by introducing appropriate technical courses in their programs which fall well outside the academic scope of ALAM.

2. SHIP PROPULSION SYSTEM AND FUTURE OF MARINE ENGINEERING

Traditionally, for the reasons of fuel economy and reliability, merchant ships have been fitted with steam turbines and slow speed direct coupled diesel propulsion systems. However, with the rising cost of fuel and increasing uses of ICT in merchant ships the search for low maintenance, reliable and fuel efficient propulsion systems has gained priority. The following paragraphs discuss some of the most promising propulsion systems which are emerging attractive alternatives that will be given direction for a future career in marine engineering.

2.1 DIESEL PROPULSION

The single, slow speed two-stroke diesel engine, burning heavy fuel oil and connected directly to a fixed pitch propeller, is the marine industry's established benchmark for optimum fuel efficiency. But, while these engines give satisfactory performance in smaller ships, for the power requirements of large tankers these advantages are greatly lost mainly due to the increased size of the hull which requires bigger power packs sometimes with twin shaft configurations. Sometimes to improve the fuel efficiency of these propulsion systems for larger ships, exhaust gas fed cogeneration system has been proposed which considerably improves the fuel savings. The search for an alternative propulsion system for LNG tankers has been even more urgent to prevent losses from forced burning of the valuable boil off. Configuration of a typical proposed propulsion system for LNG tankers which is incorporated with sophisticated fault diagnostics tools are shown in Fig-1 below (Sulaiman et al).

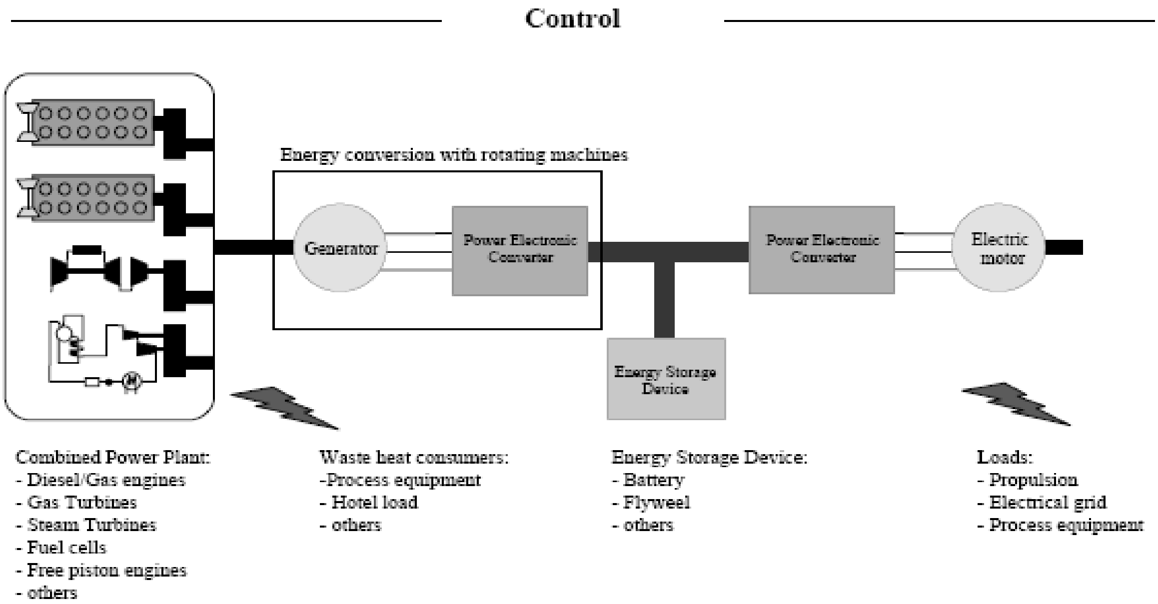

Figure 1: Two- stroke diesel with reliquefaction

2.2 GAS TURBINE PROPULSION

Because of the light weight and low mechanical vibrations gas turbines have been a preferred propulsion system for the naval warships for a long time despite their high fuel consumption. However, with enhanced technology of the gas turbine designs they are also now becoming more fuel efficient and attractive for powering many special types of merchant ships. From their experience of gas turbine propulsion systems in naval and cruise ships, Lloyd's Register have issued an approval in principle of GE Energy's LM2500-based, gas turbine propulsion system for use in liquefied natural gas (LNG) ships (Harper Tan, 2002). In another paper, Lloyd's Register Asia (2005) report a recently completed study of the first full safety case of a gas turbine propulsion system for LNG carriers of 250,000 cubic meters and above for Rolls-Royce's MT30 system.

This study was carried out in conjunction with Daewoo Shipbuilding & Marine Engineering Co, Ltd (DSME) and Rolls-Royce, this work was designed to fulfill the requirement of the fuel source involved in the Qatargas and RasGas projects that ship-owners, yards and class ensure that proposed ship design concepts are as sound as practicable. The turbines have duel fuel capability and drive 6.6-11 kV generators which will drive propulsion motors and also power all the auxiliary electrical loads. The system is proposed to operate as a combined cycle cogeneration plant to raise the efficiency level comparable to 2 stroke slow speed diesel engines.

2.3 ELECTRICAL PROPULSION SYSTEM

In some applications, the electrical propulsion system has been identified as the preferred solution because of its certain very specific features which offered inherent benefits in terms of overall operating cost and flexibility of design. Because of that electrical propulsion schemes have been adopted for numerous applications ranging from warships to research vessels, icebreakers, cruise liners, shuttle tankers, offshore support vessels, survey ships etc (Poten and Partners, unknown). In particular, the following factors make electric propulsion a superior alternative to conventional systems for new merchant ships.

- Gas Turbine propulsion with cogeneration.
- Reduced total installed power.
- Low fuel consumption and emissions.
- Enhanced manoeuvrability and crash stop.
- Flexible, redundant configurations.
- Increased cargo capacity.
- Reliability and availability.

The type of propulsion system for merchant ships will primarily depend upon their size and cargo carrying capacity. In integrated electrical propulsion system a common power plant can be used for both propulsion and cargo handling which offers opportunity for load optimization resulting in substantial reduction in total installed power. Schematic layout of a typical integrated electrical propulsion system used in a medium size LNG ship of 153 km^3 capacity supplied by ABB is shown in Fig-2(Sulaiman et al).

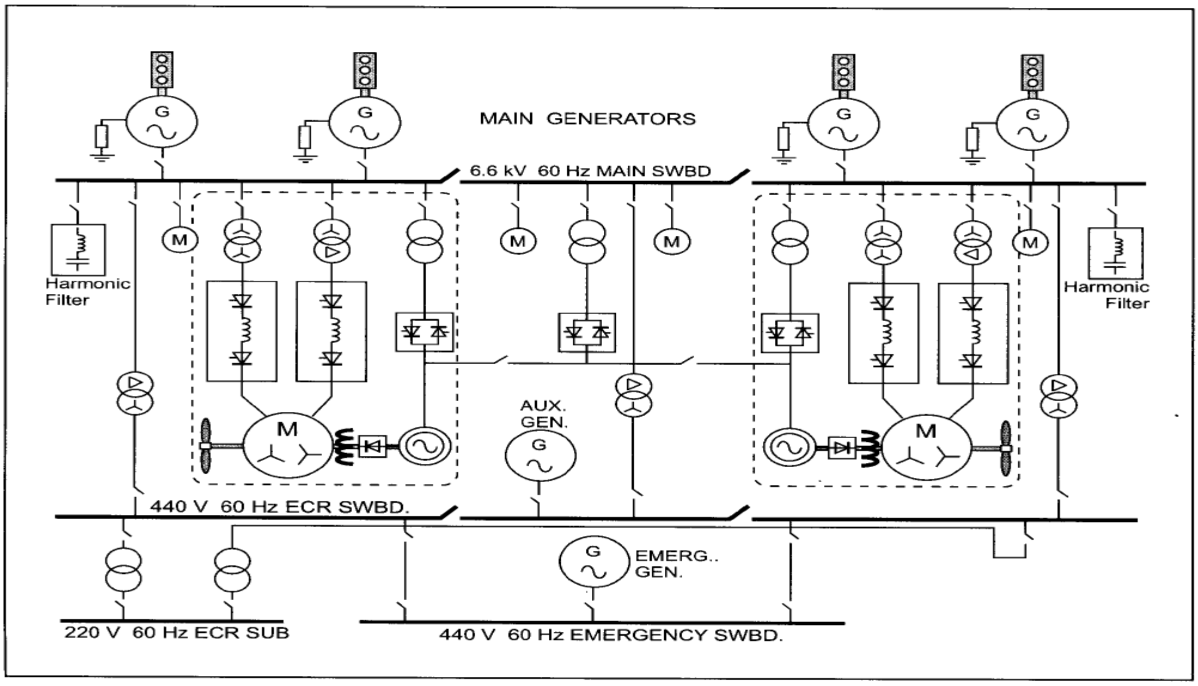

Figure 2: Schematic layout of a typical integrated electrical propulsion system

In this propulsion system, four medium speed duel fuel diesel engine drive respective AC generators to produce 6.6 kV, 60 Hzs electrical power which energise propulsion motors and also the auxiliary services after stepping down to 440 V. The 2 x 14 MW medium speed propulsion motors are connected to a common gear-box for driving a single fixed pitch propeller. Each motor is controlled by an ACS 6000SD frequency converter, which is the latest generation of MV (medium voltage) drives from ABB utilizing IGCTs (Integrated Gate Commutated Thyristors) as switching devices and the ABB patented DTC (Direct Torque Control) principle for synchronous motor drive.

The DTC control is developed for optimizing the dynamic torque response and minimizing the torque ripple on the motor shafts, hence leading to minimize machinery induced vibration and noise levels (Rune et al, 2004). The above review reveals that, the following advanced technologies are progressively entering into the shipboard engineering systems though implementation of advanced design procedures and operating practices.

- Gas Turbine propulsion with cogeneration
- Fuel Cells propulsion with advanced power electronics
- High Voltage Systems
- Permanent Magnet Motors/ Generators
- Power Electronics and AC Variable Speed Drives
- Microprocessors based instrumentation and controls
- Distributed Control Systems
- Vibration analysis and condition monitoring
- Neural Networks and Fuzzy Logics
- Model Based Machinery Fault Diagnosis

The current MET programs which mostly comply with the STCW 95 guidelines are based on the shipboard technology of the 1980-1990s and hence fail to adequately address the training needs of these new technologies. Therefore, the revised MET programs for the seafarers should be tailored to include these technologies.

3. CURRENT MET CURRICULUM OF ALAM

ALAM offers comprehensive MET programs comprising of Pre-Sea, Post Sea and short modules of ship safety and HSE courses.

3.1 PRE-SEA TRAINING PROGRAMS

ALAM offers a 3 years diploma program of 99 credits which focuses mainly on the operational and applied aspects of the marine engineering. The curriculum is based on the STCW 95 guidelines and is conducted in six semesters as shown in Appendix 1. The course contents of the post-sea training programs are also tailored to the guidelines of the STCW 95 (see Appendix 1 for reference).

3.2 MET COMPETENCY GAPS

Review of the current MET programs of ALAM mainly on the development of competency skills and the coverage of new shipboard technology is totally lacking. The most glaring technology discrepancies are found in the following areas.

3.3 INITIATIVES TAKEN BY ALAM

To address this technology gap in the MET curriculum, ALAM has been taken a number of initiatives and is implementing the following action plans.

3.4 REVIEW OF THE EXISTING MET CURRICULUM

A thorough review of the existing curriculum of the marine engineering program has been taken up on priority with the objective of replacing the outdated topics under STCW 95 with the most relevant ones which can support the training needs of the new shipboard equipment.

3.5 CERTIFICATION OF CURRICULUM BY DNV SEA – SKILLS

ALAM has hired the services of world renowned MET consultants the DNV Sea-skills of Norway to benchmark the curriculum with world class MET institutions. The first phase of this benchmarking has been already completed and the DNV is continually auditing the curriculum to raise the course contents to the required world class levels

3.6 MECHANICAL ENGINEERING DIPLOMA BRIDGING PROGRAM

A proposal to induct mechanical engineering diploma or degree holders through a bridging program has been submitted to the Marine Department for approval. This scheme is intended to cut short the duration of the overall MET program to almost half and also introduce some additional technical skills which could not be included in the marine engineering diploma program of ALAM due the constraints of credit hours.

3.7 NETWORKING AND BENCHMARKING WITH LEADING METS

To promote academic exchange and share their experience ALAM has signed MOU with various distinguished world class MET institutions such as World Maritime University, Merchant Marine Academy of USA, Australian Maritime College and South Tensyde College, UK, besides of course with few local universities which also include Univeristy Malaysia Terengganu (UMT) and University Technology Malaysia (UTM). This networking provides opportunity for benchmarking and in the long run it is intended to bring global recognition to ALAM as MET institution of good standing. Also regular faculty exchange with some of these institutions has been practiced to derive mutual benefits.

3.8 SHIP SIMULATION CENTER

Simulation based training has been popular and effective in the shipping industry and all established MET institutions are offering this mode of training. Recognizing this requirement, ALAM has set up a ship simulation centre which offers the following courses:

- Ship Handling Simulation Course
- Engine Room Simulation Course
- Cargo Handling Simulation Course

The simulation center is also well equipped for conducting research and consultancy work by the maritime professionals and academia.

3.9 ENHANCED UTILIZATION OF TRAINING SHIP

Availability of ship training facility has great learning value and any MET institution of some standing always aspires to provide this training if they can afford to. In this regard, ALAM has been very fortunate to be gifted with a fully operational chemical tanker by the MISC which is utilized to the fullest extent for conducting the pre-sea as well as post sea training. To reinforce the practical ship training further, the Malaysian International Shipping Cooperation (MISC) has also converted two LNG tankers into cadets training ship with additional accommodation for 30 cadets in each.

4. CONDUCTING SHORT TECHNOLOGY SPECIFIC COURSES FOR THE INDUSTRY

Due to gradual entry of new technology in the shipping industry frequent requests come from the ship owners to conduct special short courses to meet their urgent operational needs. The following short courses of durations varying from 3-7 days have been developed and offered to the industry on demand.

- Distributed Control Systems Course
- Marine Electrical and Electronics Course
- High Voltage Course
- Energy Conservation Management Course
- Hydraulic and Pneumatic Controls Course
- Gas Turbine Technology Course
- Cryogenics and liquefaction of Natural gases
- Shaft and Machinery Alignment Course

Although these courses have been offered on a regular basis but their effectiveness is limited mainly because the participants lack the required foundations to grasp the technology. To ensure proper understanding of these courses the participants need to be exposed to the fundamentals of these technologies at pre-sea stage of their training.

5. ROLE OF OTHER NATIONAL MET INSTITUTIONS

Since ALAM is permitted to conduct only diploma level programs, there is restriction to the technical contents that may be included in its MET curriculum. Therefore, other national institutions who also offer MET programs and particularly those offering degrees and higher level courses need to come forward and join ALAM in addressing this issue. In particular, UTM and UMT who offer undergraduate, postgraduate and Ph.D programs in the MET related fields are best placed to address the advanced technology end of the issue by promoting research and development in those areas. This may be better achieved by suitably restructuring their post graduate programs which facilitate registration of the working professional from the maritime industry for those courses. This will ensure that Malaysian seafarers are adequately trained to meet the challenges of future shipboard technology and thereby remain globally employable.

In fact technical topics such as neural networks, fuzzy logic, distributed controls, vibration analysis and high voltage technology etc are already active areas of postgraduate research, particularly in UTM, and hence the issue of the bridging technology gap merely requires effective integration of these research activities in the industry. In this regard recently created MISC professorship chair at UTM is very timely and should become the nucleus of maritime technology research at the national level.

6. PROSPECT OF MARINE ENGINEERING

For century human has used the earth's mighty oceans and waterways to do various kinds of unparalleled marine task, the diverse field of marine engineering offers many career opportunities, IT is one of the most growing and sustaining job markets. The nature of marine engineering requires working along the coast and at sea. The field has always served a crucial function. The maritime industry is responsible for the transport of goods and people via the water. Marine engineers are responsible for the design and construction of ships, the construction of ports and waterfront cargo facilities, and the operation of ships and support vessels. Marine engineers are responsible for selecting ships' machinery, which may include diesel engines, steam turbines, and gas turbines.

Marine engineers are also responsible for the design of mechanical, electrical, fluid and control systems of the vessel. Students interested in ship design, building and maintenance will see more opportunities in the future as new challenges arise. In an era where the primary trend affecting all aspects of the industry is the gradual movement of larger container ships, this trend presents technical challenges to the ship designers and builders. It also creates environmental challenges to those engineers and managers seeking to ensure safe and environmentally sound navigation within our waterways.

Today the earth's oceans and waterways are used to harness power, and mine minerals from seabed. Offshore drilling is getting more and more challenging as companies are seeking oil in deeper waters. In the future, marine engineers will be dealing with more complicated structures that will create more complex problems to solve. Marine engineers are needed in the design of recent need for deep water offshore oil operations therefore opening opportunity for students who want to spend time on the open seas, including the design and maintenance of rigs, such as exploratory and jack-ups.

The major advantage of becoming a marine engineer is that students entering careers in marine engineering have nearly 100% placement rates because the demand for them is always so great. In recent years, there have been calls for the use of information technology for ship tracking devices and information systems to monitor what is coming into the port. Also the latest developments in moving natural gas from ports in the pipeline. Students with marine engineering backgrounds will be needed to develop and run these plants.

Marine engineering career guarantees a higher starting salary**,** most maritime industry employers would prefer to see some understanding of the marine environment. However, entry-level employees will likely require training once they start their job. Marine engineering is a highly specialized and highly complex industry that spans oceans and national borders, and it deals with the risks associated with the ocean and the weather. For that reason, most entry-level engineers, analysts and managers will be given advance courses training either on the job or via graduate school, followed by a very exciting and challenging career.

Students interested in research work on marine engineering could also find opportunity hydro-elastic design of surface-piercing and prediction of the slamming pressure of sea waves from under-deck impact, different aspects of the largest moving structures in the world, stability calculations, hull forms, dynamics structural analysis and engine room arrangements, to name a few. The career opportunities available to future marine engineers are exciting; students may work on projects that have a global impact from mobile oil rigs in deep waters to keeping the shore side safe through port security. Also, the added benefit of a good starting salary and secure job market should make any engineering student think about a career in marine engineering. However this career opportunities demand compliments for a formidable institution of higher learning that offer marine engineering.

In Malaysia, the institution that offers marine engineering courses, have some programs that only award diplomas. It is only at ALAM students can have added value to this qualification that is being complimented with STCW courses that allow students to graduate with license to sail on world's oceans and added discipline and leadership values from the regimentation. Recent time has also indicated scarcity of manpower and officers to man the ship, which is another open door for young people to have secured jobs as most stakeholder in the industry, prefer to nurture, train and sponsor their future officer from cadetship. In order to meet this future challenge, ALAM has taken for broader steps to start awarding degree in the near future and in talk with UMT for collaboration on joint degree program.

7. CONCLUSIONS

To ensure that Malaysian seafarers remain competitive in the global employment market, they need to be trained in the advanced technology of current ships. The authors identify the technology base of current and future shipboard equipment/machinery and highlight the training gaps of the Malaysian seafarers. This requires many corrective actions at the national level to enhance their training much beyond the current scope of STCW 95 guidelines and make them competent to meet the technology challenge of new ships and thereby enhance their employability globally.

ALAM is implementing a number of initiatives to meet this technology challenge which includes revision of the MET curriculum, course certification by the DNV and also general enhancements of the training infrastructure. The authors also highlight the role other national institutions like UMT of higher learning need to play in addressing this issue and suggest restructuring their postgraduate programs which can facilitate the participation of practicing engineers from the industry in applied research. This will greatly accelerate the industry academia interactions and promote shipboard technology transfer.

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