A Career as a MARINE ENGINEER

also known as a **SHIP's ENGINEER**

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if there is a more recent update.

Do you want to be either a MARINE ENGINE DRIVER or a MARINE ENGINEER, who sails on commercial cargo ships, oil tankers, tugboats, dredging vessels or offshore oil & gas vessels, ferries and tourist vessels and operates and repairs all the ships machinery and related systems? Or perhaps a ship's ELECTRO TECHNICAL OFFICER?

NOTE: this career is NOT about the Navy or armed forces.

No matter which level you enter it at, the marine engineering profession provides an interesting technically-challenging career, with technical responsibility, personal accountability and scope for advancement to the next higher qualification improving your employment prospects within a single company or across the wider industry. When you qualify, and pass your Australian Maritime Safety Authority exams for issue of a Marine Engine Driver, Marine Engineer or Electro Technical Officer Certificate of Competency, you will need to look for work across the various sectors of the Australian merchant shipping industry where the employment conditions (and prospects for work) vary considerably:-

- Holders of a Marine Engine Driver Certificate of Competency (Grade 3, Grade 2 or Grade 1) most frequently find employment on ferries, vehicular-ferries, and tug/workboats working within or near a port, as well as small tourist-vessels an some small coastal cargo vessels servicing remote or island communities. Many have also found employment on 'crew-boats' and Pure-Supply-Boats supporting the offshore oil and gas industry. Working conditions are typically similar to those ashore, with weekends off (or other days in lieu) and are mostly daylight operations so it is usual to get home each night. Wages range typically from about $65,000 to $90,000 p.a
  Many of our members working in these jobs also hold deck officer qualifications such as a Certificate of Competency as Coxswain, or Master <35metres or higher.

- Holders of a Marine Engineer Class 3 Certificate of Competency are qualified to be Chief Engineer for larger more powerful vessels so they can perform all work that can be done by a Marine Engine Driver, but in addition can find employment on larger vehicular-ferries, larger tourist-vessels, larger coastal cargo vessels servicing remote or island communities and some fishing 'mother-ships'. Many have also found employment on smaller offshore oil and gas supply-boats. These larger vessels often do not return to port each night, and may be at sea for many days at a time. Working conditions therefore vary. If they have banded together as members of AIMPE then it is likely they

will have asked their employer for a proper seagoing leave-accrual system that gives proper compensation for the fact they do not get home each night. Wages range typically from about $85,000 to $110,000 p.a.

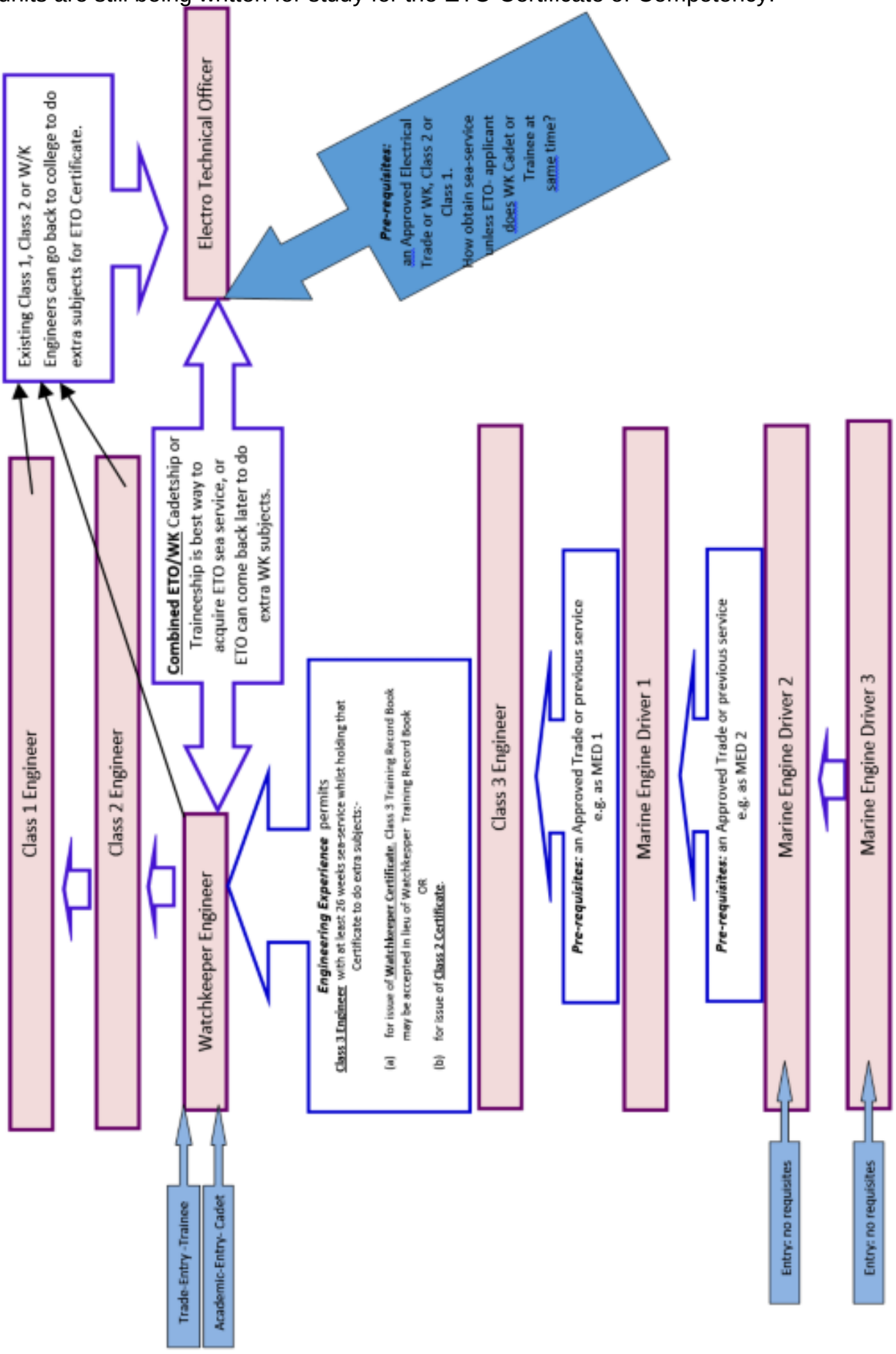
- A Certificate of Competency as Marine Engineer Watchkeeper is an STCW-qualification, and therefore recognised to perform such work anywhere in the world. Holders are qualified to be an assistant engineer (NOT the Chief Engineer) for the largest most powerful merchant vessels including oil-tankers, bulk-ships, dredges and gas-carriers and offshore oil and gas vessels. In addition they can perform all work that can be done by a Marine Engine Driver.
  These vessels normally do not return to port each night, and may be at sea for many weeks at a time. Working conditions therefore vary. If they have banded together as members of AIMPE then it is likely they will have asked their employer for a proper seagoing leave-accrual system that for example gives 6 weeks of paid leave after 6 weeks work at sea. Wages range typically from about $100,000 to $130,000 p.a.

- A Certificate of Competency as Marine Engineer Class 2 or Marine Engineer Class 1 is an STCW-qualification, and therefore recognised to perform such work anywhere in the world. Holders are qualified to be the First Engineer or the Chief Engineer for the largest most powerful merchant vessels including oil-tankers, bulk-ships, dredges and gas-carriers and offshore oil and gas vessels. In addition they can perform all work that can be done by a Marine Engineer Class 3 or a Marine Engine Driver.
  These vessels normally do not return to port each night, and may be at sea for many weeks at a time. Working conditions therefore vary. If they have banded together as members of AIMPE then it is likely they will have asked their employer for a proper seagoing leave-accrual system that for example gives 6 weeks of paid leave after 6 weeks work at sea. Wages range typically from about $150,000 to $190,000 p.a.

- Whilst to a varying extent, increasing with the grade of the qualification, Marine Engine Drivers and Marine Engineers are approved to perform electrical work on ships, parts of the industry are gradually re-introducing ‘Marine Electricians’ where the shipowner considers it warranted or if the vessel is registered in another country that foreign country may have issued a Manning Certificate for the vessel requiring that an Electro Technical Officer be included in the vessel’s complement. A Certificate of Competency as ELECTRO TECHNICAL OFFICER is an STCW-qualification, and therefore recognised to perform such work anywhere in the world.
  IMPORTANT: the Australian Government/AMSA has NOT made this qualification a mandatory requirement on Australian-registered ships at this time, so for example the Chief Electrician and First Electrician on each of the Spirit of Tasmania vessels are not required by AMSA to hold the ETO Certificate of Competency and whilst there are about another 8 Australian-registered ships to which STCW applies, none of them have an electrical-specialist position as part of the statutory manning of the vessel. On the other hand most vessels working in Australia’s offshore oil & gas sector, or from time to time in dredging of ports, are foreign ships. Many foreign nations have mandated that a ship registered under their flag must carry an ETO so if Australians get the opportunity to work on that vessel we must hold STCW qualifications including for the ETO position. One for one seagoing leave usually applies and wages range typically from about $130,000 to $170,000 p.a.

Part A - Entry & Educational Requirements

The task of a Marine Engineer in the merchant shipping industry is a specialised one, the pre-requisites for which can be illustrated graphically as set out below. NOTE: the path for ETO that AIMPE is proposing to industry is set out below, BUT IS NOT YET IN PLACE: our proposal has won wide support and we are working with AMSA and Australian Industry Standards Ltd to make it a reality, but do not expect to have it available for students until 2020 as the Maritime Training Package training-units are still being written for study for the ETO Certificate of Competency.



Worldwide, the maritime industry is a specialised industry with unique hazards. To combat this, nations have come together via the International Maritime Organisation ('IMO') to agree to a number of 'Conventions' establishing safety standards for vessels in international trades and for those who crew them. These include:

- United Nations Convention on the Law of the Sea ("UNCLOS"); and
- Convention on Safety of Life at Sea ("SOLAS"); and
- Convention on Standards of Training Certification and Watchkeeping ("STCW")

The Australian Parliament has given effect to the STCW Convention by enacting the ***Navigation Act 2012*** to apply these international safety requirements to various Australian seafarers including Electro Technical Officers and Watchkeeper/Class2/Class1 Marine Engineers.

As the STCW Convention does not directly apply to a nation's vessels/seafarers within 'near-coastal-limits' (i.e. our 200 nautical mile Exclusive Economic Zone or 'EEZ') the Australian Parliament enacted a separate piece of legislation to regulate domestic shipping [not including (i) regulated-Australian-vessels covered by the Navigation Act or (ii) foreign vessels or (iii) defence vessels]. Accordingly the ***Marine Safety (Domestic commercial Vessels) National Law Act 2012*** governs the requirements for the three grades of Marine Engine Driver and for Marine Engineer Class 3.

Entry & Educational Requirements are therefore set by these two different sets of legislation and the Australian Maritime Safety Authority ('AMSA') provides detailed regulations called ***Marine Orders*** dealing with such things as crew qualifications and medical standards.

In short there are several pathways for a new entrant to enter the marine engineering profession:-

- Working your way up from Marine Engine Driver, progressing to larger vessels as you go; OR

- Entry as a Cadet Engineer or Trainee Engineer direct to WATCHKEEPER LEVEL.

These pathways are described in more detail below.

NOTE re MEDICAL STANDARDS

Eyesight & Medical standards under the ***Marine Safety (Domestic commercial Vessels) National Law Act 2012*** are described at https://www.amsa.gov.au/domestic/domestic-quals/obtaining-qual/

Eyesight & Medical standards under the ***Navigation Act 2012*** are described in ***Marine Order 9 Health & Medical Fitness*** at https://www.amsa.gov.au/vessels/standards-regulations/marine-orders/documents/MO9-modcomp-130726Z.pdf
However Marine Order 9 is under review and will be re-numbered ***Marine Order 76 Health & Medical Fitness*** at the conclusion of that review.

A1. Working your way up from Marine Engine Driver

A1.1 Entry as Marine Engine Driver Grade 3 ('MED3')

The lowest entry level is to obtain work experience on a commercial vessel, with inboard diesel engine(s) of at least 75 kW ***propulsion power***[1], as either a (i) general purpose hand or (ii) coxswain or (iii) in some other role acting as an assistant to a Marine Engine Driver or Marine Engineer.

The work experience must be at least 60 day's but can be reduced to 20 days if you also completed an approved task book whilst gaining that work experience.
In addition you must complete a short college-course from an AMSA-approved registered training provider ('RTO') at Certificate 2 level relevant to obtaining a Marine Engine Driver Grade 3 qualification, and pass a final assessment.
A table setting out RTOs who provide the Marine Engine Driver Grade 3 course is available at http://www.amsa.gov.au/domestic/domestic-quals/training-organisations/

A1.2 Entry as Marine Engine Driver Grade 2 ('MED2')

The next entry level is to obtain work experience on a commercial vessel, with inboard diesel engine(s) of at least 150 kW ***propulsion*** **power**[i], as either a (i) general purpose hand or (ii) Marine Engine Driver 3 or (iii) in some other role acting as an assistant to a Marine Engine Driver or Marine Engineer.

The work experience must be at least:

- 360 day's work experience as a general purpose hand.
- OR 240 days if you held an approved Coxswain qualification whilst gaining that work experience.
- OR 240 days if you held Marine Engine Driver Grade 3 whilst gaining that work experience.
- OR 180 days if you also completed an approved task book whilst gaining that work experience
- OR 180 days if you held an approved Trade (called a ***workshop skills equivalent qualification***).
- OR 120 days if you held Marine Engine Driver Grade 3 whilst gaining that work experience AND if you also completed an approved task book whilst gaining that work experience.
- OR 90 days if you held an approved Trade (called a ***workshop skills equivalent qualification***) whilst gaining that work experience AND if you also completed an approved task book whilst gaining that work experience.

In addition you must complete a short college-course from an AMSA-approved registered training provider ('RTO') at Certificate 3 level relevant to obtaining a Marine Engine Driver Grade 2 qualification, and pass a final assessment.
A table setting out RTOs who provide the Marine Engine Driver Grade 2 course is available at http://www.amsa.gov.au/domestic/domestic-quals/training-organisations/

A1.3 Entry as Marine Engine Driver Grade 1 ('MED1')

Once having obtained MED3 or MED2 advancement to MED1 is possible. Or if you hold an approved Trade (or equivalent) you can directly enter at MED1 level. See item A1.6 detailing how holding an EWK also entitles the holder to work in a role as MED1 or lower CoC.

The requirement is to obtain work experience on a commercial vessel, with inboard diesel engine(s) of at least 375 kW ***propulsion power***[1], (calculated on only ONE main engine as for MED2), as either a (i) general purpose hand or (ii) Marine Engine Driver 3 or (iii) Marine Engine Driver 2 or (iv) in some other role acting as an assistant to a Marine Engine Driver or Marine Engineer.

The work experience must be at least:

- 480 day's if you held an approved Coxswain qualification whilst gaining that work experience.
- OR 360 days if you held Marine Engine Driver Grade 3 whilst gaining that work experience.
- OR 240 days if you held Marine Engine Driver Grade 2 whilst gaining that work experience.
- OR 240 days if you held an approved Coxswain qualification and if you also completed an approved task book whilst gaining that work experience.
- OR 180 days if you held an approved Trade (called a ***workshop skills equivalent qualification***) whilst gaining that work experience.
- OR 180 days if you held Marine Engine Driver Grade 3 and if you also completed an approved task book whilst gaining that work experience.
- OR 120 days if you held Marine Engine Driver Grade 2 and if you also completed an approved task book whilst gaining that work experience.
- OR 90 days if you held an approved Trade (called a ***workshop skills equivalent qualification***) and if you also completed an approved task book whilst gaining that work experience.

In addition you must complete a short college-course from an AMSA-approved registered training provider ('RTO') at Certificate 4 level relevant to obtaining a Marine Engine Driver Grade 1 qualification, and pass a final assessment.
A table setting out RTOs who provide the Marine Engine Driver Grade 1 course is available at http://www.amsa.gov.au/domestic/domestic-quals/training-organisations/

A1.4 Progress to Marine Engineer Class 3 ('EC3')

A Certificate of Competency as Marine Engineer Class 3 ('EC3') is a National Law qualification, and holders are qualified to be:

- Chief Engineer of vessels up to 2999kW propulsion power[1], (calculated on only ONE main engine as for MED2), in Australia's EEZ; and
- an assistant engineer (but NOT the Chief Engineer) on vessels of unlimited propulsion-power anywhere in the world
- and they can perform all work that can be done by a Marine Engine Driver or engine rating.

Once having obtained MED1 advancement to EC3 is possible.

Alternatively, holding an Engineer WatchKeeper (EWK) does NOT entitle the holder to be Chief Engineer, so EWK holders with 3 months sea service holding EWK may apply to AMSA to do an ORAL Exam and may be issued with EC3 if they pass.

The requirement is to obtain work experience on a commercial vessel, with inboard diesel engine(s) of at least 400 kW ***propulsion power***[i], (calculated on only ONE main engine as for MED2), as either a (i) Marine Engine Driver 1 or (ii) if you held an approved Trade (called a ***workshop skills equivalent qualification***) whilst gaining that work experience in some other role acting as an assistant to a Marine Engineer.

The work experience must be at least:

- 360 days if you held Marine Engine Driver Grade 1 whilst gaining that work experience.
- OR 240 days if you held an approved Trade (called a ***workshop skills equivalent qualification***) whilst gaining that work experience.
- OR 180 days if you held Marine Engine Driver Grade 1 whilst gaining that work experience and if you also completed an approved task book whilst gaining that work experience.
- OR 120 days if you held an approved Trade (called a ***workshop skills equivalent qualification***) and if you also completed an approved task book whilst gaining that work experience.
- OR 90 days if you held an ENGINEER WATCHKEEPER[ii] qualification whilst gaining that work experience.

In addition you must complete a college-course from an AMSA-approved registered training provider ('RTO') at Diploma level relevant to obtaining a Marine Engineer Class 3 qualification, and pass an AMSA final assessment.
A table setting out RTOs who provide the Marine Engineer Class 3 course is available at http://www.amsa.gov.au/domestic/domestic-quals/training-organisations/

A1.5 Advancement to Watchkeeper, Marine Engineer Class 2 & 1

Once having obtained Marine Engineer Class 3 advancement to Marine Engineer Watchkeeper ('EWK') or Marine Engineer Class 2 ('EC2') is possible. See item A3.
After that, advancement to Engineer Marine Engineer Class 1 ('EC1') is possible. See item A4.

A1.6 EWK can serve in other roles

MED1: The ***Marine Safety (Navigation Act seafarer qualifications) Exemption 2016*** [also known as 'Exemption 30'] permits the holder of EWK to serve in any MED1 or lower role. EWK can also apply for EC3: see item in yellow highlighting above.

EC3: An EWK who did the CADET COURSE including all EC2 Subjects and have 12 months sea service holding that EWK may apply to AMSA [no ORALS is required] for an ENDORSEMENT to perform the same duties as an EC3.

EC3: Any EWK holder with 3 months sea service holding EWK may apply to AMSA to do an ORAL Exam and may be issued with EC3 if they pass.

A2. Entry as a Cadet Engineer or Trainee Engineer direct to WATCHKEEPER

Large ships do not just have a single engineer officer, they have several.
Most vessels above about 10,000 tonnes have 4 engineers whilst some, like the *Spirit of Tasmania* vessels (there are 2 of them: see photo next page) have 10 engineers/electricians working onboard for several weeks at a time whilst the other complement of 10 engineers/electricians are at home on paid leave.

A 'Watchkeeper' is one of the engineer officers who for a fixed period (known as a 'watch') is responsible to the Chief Engineer Officer for operation of the propulsion machinery and all auxiliary plant in the machinery spaces[iii]. At the end of that period the Watchkeeper (or 'Duty Engineer') hands over the to the next engineer officer. When not performing watchkeeping duties the engineers perform maintenance on the duplicated machinery not currently in service.

A Certificate of Competency as Marine Engineer Watchkeeper ('EWK') is an STCW-qualification, and therefore recognised anywhere in the world.
Holders are qualified to be an assistant engineer (but NOT the Chief Engineer) on vessels of unlimited propulsion-power and they can perform all work that can be done by a Marine Engine Driver or engine rating.

An approved training program for Marine Engineer Watchkeeper includes:

- an approved Diploma level college course; and
- 36 weeks workshop skills training. NOTE: Trainee Engineers holding an approved Trade (called a ***workshop skills equivalent qualification***) are EXEMPT this requirement; and
- at least 36 weeks qualifying sea service; and
- completion of an onboard training record book during that sea service.

A table setting out AMSA-approved registered training providers ('RTO') who provide the Marine Engineer Watchkeeper college course and workshop skills training [costing about $12,000 in 2017] is available at
https://www.amsa.gov.au/forms-and-publications/fact-sheets/amsa1590.pdf

After completing the college-course a candidate must pass an AMSA final assessment for issue of their Certificate of Competency.

Once that has been achieved AMSA will not issue the Certificate of Competency until the following AMSA-required 'short-courses' [costing about $9,000 in 2017] are also obtained:-

i. advanced fire fighting training from an AMSA-approved RTO
ii. medical first aid training from an AMSA-approved RTO
iii. basic safety training from an AMSA-approved RTO
    a. personal survival techniques; and
    b. fire prevention and fire fighting
    c. elementary first aid
    d. personal safety and social responsibilities
    e. security awareness training
iv. certificate of proficiency in survival craft and rescue boats other than fast rescue boats; and
v. certificate of medical fitness from an AMSA approved Doctor.

Qualifying Sea Service

Marine Order 72 (Engineer Officers) provides that in addition to an approved college course suitable for Engineer Watchkeeper, a candidate must obtain *Qualifying Sea Service* on a vessel with an aggregate ***propulsion power***[iv] (i.e. total of ALL main engines) of no less than 750kW which can be gained in the capacity of:-

- at least 36 weeks as Cadet Engineer; or
- at least 36 weeks as Trainee Engineer; or
- at least 26 weeks whilst holding a qualification as Engineer Class 3

Problem is how does a candidate obtain that sea service as a Cadet or Trainee?

Candidates holding an Engineer Class 3 will have already obtained the minimum sea service requirement, and so are entitled to study for Watchkeeper Certificate of Competency, however that sea-service is often not on a vessel providing ideal experience. Whilst there are many smaller domestic vessels (under the 'National Law') which meet the 750 kW requirement most of those smaller vessels do not have many of the kinds of machinery/systems covered in the Engineering Knowledge part of the college course such as:-

- fuel-oil and lube-oil centrifugal separators/purifiers; and
- water-tube boiler (either waste-heat recovery unit or free-standing); and
- main engine operating on other than light diesel fuel (e.g. heavy fuel requiring fuel pre-heating to reduce viscosity); and
- complex freshwater cooling-water system with heat exchangers; and
- multiple diesel-alternators requiring to be synchronised when more than one alternator is to supply power into the same distribution circuit; and
- power generation in excess of 400 V AC
- freshwater generator

So whilst it is possible to be a candidate without such experience, it is *desirable* to obtain experience on a vessel with as many of the above installations as possible, but these are only normally found in vessels above about 2,000 tonnes in size.

Unfortunately there are not so many vessels above 2,000 tonnes left under Australian operation because:

- For several decades our Federal Government has increasingly permitted tax-free foreign seafarers on tax-free foreign-registered vessels to compete in Australia's

domestic shipping task, without passing legislation to require them to re-register under the Australian Flag.

- These foreign ships and foreign workers are therefore NOT subject to Australian law.
- So they do NOT fall under Australian TAX laws either.
- Via this biased arrangement Australian seafarers on Australian-registered ships, who pay corporate and PAYE Tax, have been systematically displaced by tax-free foreign seafarers on tax-free foreign-registered vessels. The foreign ships will not take on Australian Trainee Engineers or Cadet Engineers so there are many less positions to acquire qualifying sea service than there once was.

Nevertheless, the Australian Institute of Marine and Power Engineers ('AIMPE') has agreements with most of those remaining Australian ship-operators with vessels above 2,000 tonnes regarding carrying a Cadet-Engineer or Trainee-Engineer above the manning requirement of the vessel.
There is considerable competition by candidates to obtain such a position.
Every 2 weeks AIMPE provides employers with a list of our Members who are seeking a Cadetship or Traineeship.

A2.1 Entry as Cadet Engineer ('Cadet')

In addition to the requirements set out in A2.0 above :-

- AIMPE recommends that a candidate seeking an Engineer Cadetship should have year 12 passes in at least English, Mathematics and a Science subject.
- For a candidate who is a Cadet Engineer, the approved Cadet Engineer program takes 3 years, includes 36 weeks workshop skills training and normally offers all the academic theory up to Class 1 level.

A2.2 Entry as Trainee Engineer ('Trainee')

In addition to the requirements set out in A2.0 above, candidates who hold an approved Trade (called a ***workshop skills equivalent qualification***) can do the Engineer Watchkeeper training as a Trainee Engineer in about half the time of a Cadetship, by virtue of that Trade training.

Marine Orders 72 (Engineer Officers) defines ***workshop skills equivalent qualification*** as follows:

"…workshop skills equivalent qualification means any of the following:

(a) Certificate III in Engineering/mechanical trade;
(b) Certificate III in Electrical fitting;
(c) Certificate III in Automotive diesel engine technology;
(d) Certificate III in Automotive/mechanical — diesel fitter;
(e) Certificate III in Automotive/mechanical — heavy vehicle road transport;
(f) Certificate III in Automotive/mechanical — heavy vehicle mobile equipment, plant/earthmoving/agriculture;
(g) Certificate III in Automotive engine reconditioning;
(h) Certificate IV in ESI generation maintenance — electrical electronics;
(i) Certificate IV in ESI generation maintenance — mechanical;

(j) an Australian trade certificate in fitter and turner/machinist;
(k) an Australian trade certificate in diesel fitter;
(l) an Australian trade certificate in electrical fitter;
(m) an Australian Recognised Trade Certificate in the same classification as an Australian trade certificate mentioned in this definition;
(n) any other approved qualification that includes workshop skills.
Note for paragraph (m) Australian Recognised Trade Certificates are issued in recognition of trade certificates or other qualifications of a country other than Australia.

A2.3 Progression from Engineer Class 3

A candidate for Engineer Watchkeeper who has 26 weeks qualifying sea service whilst holding a certificate of competency as Marine Engineer Class 3 is entitled to train to the requirements set out in A2.0 above. Depending on their particular merit

they may also get some recognition of workshop skills equivalent qualifications and/or experience.

A2.4 Combined EC3, ETO and EWK Training is coming

AIMPE is also working with AMSA and Australian Industry Standards Ltd to create a new Diploma of Marine Engineering which will have a 'core' set of training units which are COMMON to EC3, EWK and ETO.
Having completed these core units a student could then:-

- Go to AMSA to present sea service credentials and sit the AMSA ORALS for issue of the EC3 CoC; or
- Do another 20 training units to meet all of the requirements for certification as an EWK; or
- Do another 19 training units to meet all of the requirements for certification as an ETO.

An outcome on this is expected in 2020.

A3. Progression to Marine Engineer Class 2 ('EC2')

A Certificate of Competency as Marine Engineer Class 2 ('EC2') is an STCW-qualification, and therefore recognised anywhere in the world.
Holders are qualified to be:

- Chief Engineer of vessels of up to 2999kW ***Propulsion Power***[iv] anywhere in the world; and
- an assistant engineer (but NOT the Chief Engineer) on vessels of unlimited ***propulsion power***[iv] anywhere in the world
- and they can perform all work that can be done by an Engineer Class 3, Engineer Watchkeeper and a Marine Engine Driver or engine rating.

Once having obtained EC3 or EWK, or equivalent, advancement to EC2 is possible.

An approved college course for Marine Engineer Class 2 includes:
- an approved Advanced Diploma level college course; and
- at least 12 months qualifying sea service whilst holding Engineer Watchkeeper; or at least 24 months qualifying sea service whilst holding Engineer Class 3.

A table setting out AMSA-approved registered training providers ('RTO') who provide the Marine Engineer Class 2 college course and workshop skills training is available [costing about $12,000 in 2017] at
https://www.amsa.gov.au/forms-and-publications/fact-sheets/amsa1590.pdf

After completing the college-course a candidate must pass an AMSA final assessment for issue of their Certificate of Competency.

Once that has been achieved AMSA will not issue the Certificate of Competency until the following AMSA-required 'short-courses' [costing about $9,000 in 2017] are also obtained:-

i. advanced fire fighting training from an AMSA-approved RTO
ii. medical first aid training from an AMSA-approved RTO
iii. certificate of proficiency in survival craft and rescue boats other than fast rescue boats; and
iv. certificate of medical fitness from an AMSA approved Doctor.
v. a candidate only holding Engineer Class 3 must complete basic safety training from an AMSA-approved RTO in:
    a. personal survival techniques; and
    b. fire prevention and fire fighting
    c. elementary first aid
    d. personal safety and social responsibilities
    e. security awareness training
vi. a candidate holding Engineer Watchkeeper must complete security awareness training

A4. Progression to Marine Engineer Class 1 ('EC1')

A Certificate of Competency as Marine Engineer Class 1 ('EC1') is an STCW-qualification, and therefore recognised anywhere in the world.
Holders are qualified to be:
- Chief Engineer of all vessels of unlimited propulsion-power anywhere in the world
- and they can perform all work that can be done by an Engineer Class 2, Engineer Class 3, Engineer Watchkeeper and a Marine Engine Driver or engine rating.

Once having obtained EC2, or equivalent, advancement to EC1 is possible.

An approved college course for Marine Engineer Class 1 includes:
- an approved Advanced Diploma level college course; and

- at least 42 months qualifying sea service whilst holding Engineer Watchkeeper or Engineer Class 2, at least 18 months of which was whilst holding Engineer Class 2 and at least 24 months of which was whilst holding Engineer Class 3; or
- at least 36 months qualifying sea service whilst holding Engineer Watchkeeper or Engineer Class 2, at least 12 months of which was whilst holding Engineer Class 2; or
- at least 24 months qualifying sea service whilst holding Engineer Watchkeeper or Engineer Class 2, at least 12 months of which was whilst holding Engineer Class 2 and serving as First Engineer.

A table setting out AMSA-approved registered training providers ('RTO') who provide the Marine Engineer Class 2 college course and workshop skills training is available [costing about $12,000 in 2017] at
https://www.amsa.gov.au/forms-and-publications/fact-sheets/amsa1590.pdf

After completing the college-course a candidate must pass an AMSA final assessment for issue of their Certificate of Competency.

Once that has been achieved AMSA will not issue the Certificate of Competency until the following AMSA-required 'short-courses' [costing about $9,000 in 2017] are also obtained:-

i. advanced fire fighting training from an AMSA-approved RTO
ii. medical first aid training from an AMSA-approved RTO
iii. security awareness training
iv. training from an AMSA-approved RTO
v. certificate of proficiency in survival craft and rescue boats other than fast rescue boats; and
vi. certificate of medical fitness from an AMSA approved Doctor.

A5. Electro Technical Officer ('ETO')

The 2010 'Manila Amendments' to the STCW Convention introduced the capacity for ship's electrical/electronics engineers to be recognised by issue of an STCW Certificate of Competency, and Australia has given effect to this in *Marine Order 72 (Engineer Officers)*.
Accordingly the holder of an ETO Certificate of Competency is qualified to perform electrical and electronic work on all ships within Australia or around the world.

As a first step AMSA has set standards to be met for existing 'Marine Electricians', as well as Marine Engineers holding an Electrical Trade, to be issued with a Certificate of Competency as Electro Technical Officer and the Australian Maritime College (nested within University of Tasmania) has been providing ETO training modelled on the STCW/IMO 'model course' for ETOs.

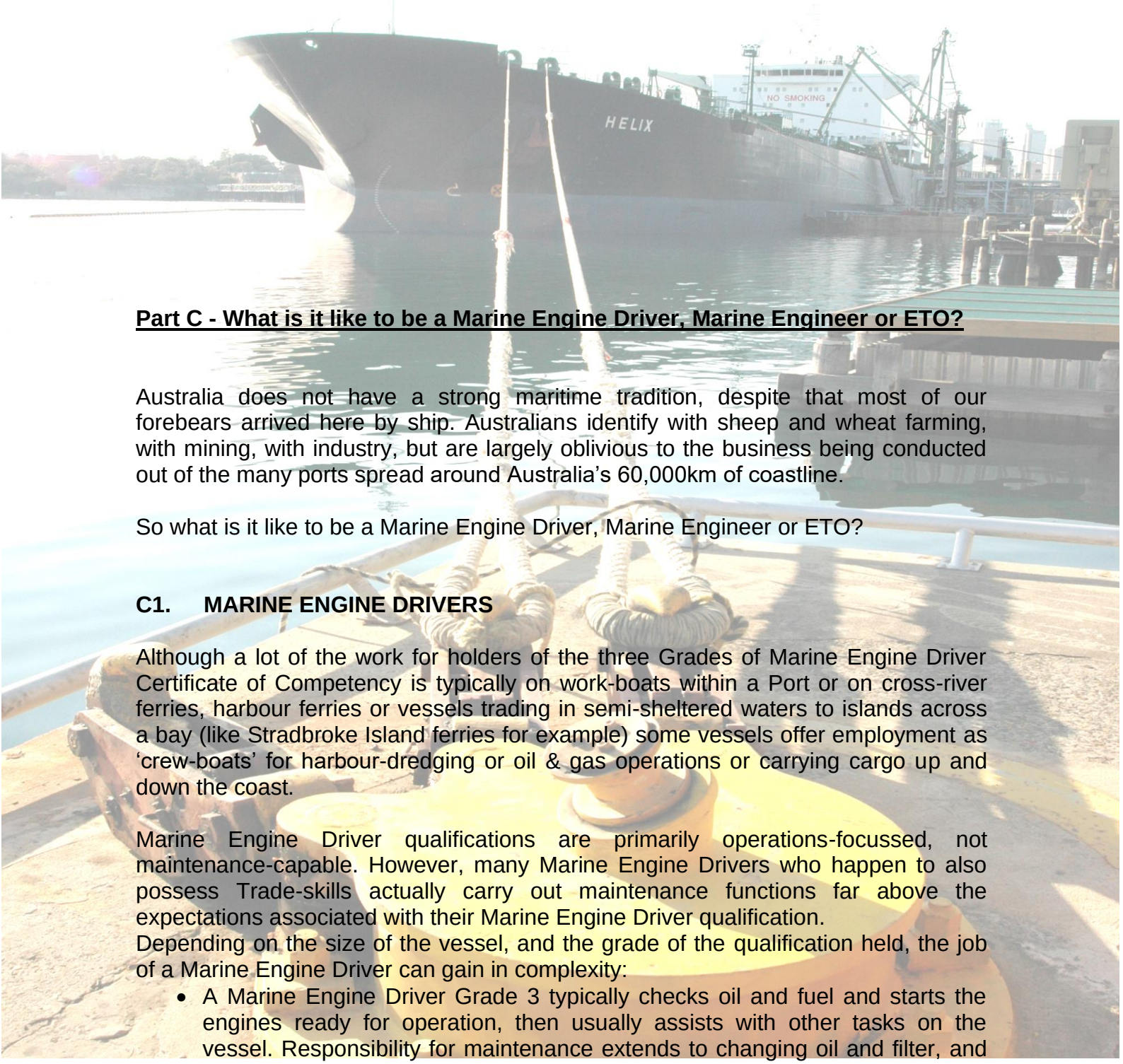
TAFE colleges however are required to teach in accordance with the Maritime Training Package, and this has not yet been amended to incorporate ETO training under the VET system. AIMPE through the Maritime Industry Reference Committee, in conjunction with Australian Industry Standards Ltd, is in the process of contributing to these changes to set out the training requirements to be met by AMSA-approved RTOs in training ETOs in future. The new arrangements are likely to be available from about 2020.

Part B - What is AIMPE?

The Australian Institute of Marine and Power Engineers ["AIMPE"] is the professional organisation and trade union for Marine Engineers in Australia, a role it has fulfilled since engineers banded together to protect themselves and their profession in 1881.

As well as representing the professional interests of AIMPE members with regulatory authorities and government, AIMPE is also the trade union representing your industrial relations interests, negotiating employment conditions in industrial agreements with your employer.

You will find more information on our website:
www.aimpe.asn.au



Part C - What is it like to be a Marine Engine Driver, Marine Engineer or ETO?

Australia does not have a strong maritime tradition, despite that most of our forebears arrived here by ship. Australians identify with sheep and wheat farming, with mining, with industry, but are largely oblivious to the business being conducted out of the many ports spread around Australia's 60,000km of coastline.

So what is it like to be a Marine Engine Driver, Marine Engineer or ETO?

C1. MARINE ENGINE DRIVERS

Although a lot of the work for holders of the three Grades of Marine Engine Driver Certificate of Competency is typically on work-boats within a Port or on cross-river ferries, harbour ferries or vessels trading in semi-sheltered waters to islands across a bay (like Stradbroke Island ferries for example) some vessels offer employment as 'crew-boats' for harbour-dredging or oil & gas operations or carrying cargo up and down the coast.

Marine Engine Driver qualifications are primarily operations-focussed, not maintenance-capable. However, many Marine Engine Drivers who happen to also possess Trade-skills actually carry out maintenance functions far above the expectations associated with their Marine Engine Driver qualification.
Depending on the size of the vessel, and the grade of the qualification held, the job of a Marine Engine Driver can gain in complexity:

- A Marine Engine Driver Grade 3 typically checks oil and fuel and starts the engines ready for operation, then usually assists with other tasks on the vessel. Responsibility for maintenance extends to changing oil and filter, and

unclogging the sieves/strainers that prevent marine life from being sucked in with engine-cooling seawater. However this is a great way to commence a career in marine engineering.

- A Marine Engine Driver Grade 2 can also find work on larger vessels such as vehicular ferries and some work-boats (small tugboats that tow barges). In addition to the checks performed by a Marine Engine Driver Grade 3 they would be expected to monitor the running of machinery and check the safety of batteries used for engine starting and emergency lights. They normally lend a hand with tying-up the vessel or other tasks as well. The 'National Law' permits the holder to be Chief Engineer on a vessel of less than 500 kW propulsion power operating within Australia's EEZ.

- A Marine Engine Driver Grade 1 can serve as Chief Engineer on a commercial vessel of less than 750 kW propulsion power operating within Australia's EEZ. This often sees them employed on small cargo vessels (such as Landing Barges or similar) supplying island communities in each of the States but particularly in Northern Australia. Some smaller vessels in a dredging operation may also offer employment, along with smaller vessels in offshore oil and gas construction operations.

- Marine Engine Drivers employed in bays/harbours/rivers normally get home each night and so they work similar hours/shifts to a worker ashore.

- But those Marine Engine Drivers employed in vessels trading up the coast or in offshore oil and gas operations do not get home each night and so they normally ask AIMPE to help them negotiate a leave-accrual system to recompense them for the loss of time at home.

C2. MARINE ENGINEERS

A Marine Engineer not only operates marine propulsion and related machinery, but is trained to *maintain* and *repair* that machinery, whether mechanical, electrical or hydraulic.

Most employment of Marine Engineers is on vessels that preclude getting home each night and they are required to live onboard the vessel, and so they normally ask AIMPE to help them negotiate a leave-accrual system to recompense them for the loss of time at home.

A Marine Engineer Class 3 can serve as Chief Engineer or assistant engineer on a commercial vessel of less than 3,000 kW propulsion power operating within Australia's EEZ. This often sees them employed on larger cargo vessels (usually less than 2,000 tonnes) workboats involved in a dredging operation or smaller oil-rig supply-vessels in offshore oil and gas operations or with Customs/Border patrols.

A Marine Engineer Watchkeeper can serve as an assistant engineer on a commercial vessel of unlimited propulsion power operating anywhere in the world. This often sees them employed on large cargo vessels (more than 2,000 tonnes and usually more than 20,000 tonnes), large vehicular ferries like the 'Spirit of Tasmania',

large harbour-dredging and large oil-rig supply-vessels, seismic-survey vessels, floating production/storage/offtake ('FPSO') facilities and other offshore oil and gas vessels.

A Marine Engineer Class 2 can serve as Chief Engineer or assistant engineer on a commercial vessel of less than 3,000 kW propulsion power operating anywhere in the world. Additionally they can serve as First Engineer or assistant engineer on a commercial vessel of unlimited propulsion power operating anywhere in the world. They are employed in the same places/vessels as Watchkeepers, or Engineer Class 3, but in a higher Rank and with higher pay. They are often also employed as Chief Engineer on harbour-towage tugboats.

A Marine Engineer Class 1 can serve as Chief Engineer or assistant engineer on a commercial vessel of unlimited propulsion power operating anywhere in the world. They are employed in the same places/vessels as Watchkeepers or Engineer Class 3, but in a higher Rank and with higher pay. They are often also employed as Chief Engineer on harbour-towage tugboats.

C2.1 SEAGOING LIVING ENVIRONMENT

A large ocean-going cargo ship will have a complement of Chief Engineer and 3 other engineer officers, Captain and 3 other deck officers, a Cook and possibly an additional Caterer, and a number of Integrated Ratings [i.e. a rating who works in either the engineroom or on deck as required] and a Chief Integrated Rating. As a Marine Engineer Officer you are entitled to your own cabin, with bed, wardrobe and desk and usually also with a couch and sometimes an armchair. Most have an en-suite (shower + toilet). A large ocean-going cargo ship will have a Duty-Mess for eating meals when in working clothes and a 'restaurant' for when the meal is in your off-duty time. There is an Officer's Recreation Lounge [which may or may not have a Bar depending on the type of trade the vessel is in] with audio-visual entertainment equipment and a similar Ratings Recreation Lounge elsewhere in the ship. There will be a small Library and there may be a TV Room and a gymnasium.

C2.2 Hours of Work & LEAVE

Most sectors of the industry work a 10 to 12 hour day, 7 days per week.... you may think that is a lot but you are away at sea and wont get home for many weeks so it is good to be kept busy.

More importantly as you have worked about 80 hours per week whilst at sea you have earned the equal-time leave: for each day you have worked you have accrued a day of leave which keeps you on full salary when your 'duty-swing' is complete and you go home for a similar number of weeks of leave.

Some ships are never far from home, have telephone and email contact most of the time, and the 'duty-swing' is as short as 5 to 6 weeks. Other ships trade all around the Australian coast and overseas and the 'duty-swing' is 10 to 12 weeks. Some of the oil-producing ships [called FPSOs] work 3 weeks on duty, 3 weeks off duty, 3 weeks on duty, 6 weeks on duty..... naturally these jobs are sought-after.

C2.3 SEAGOING WORK ENVIRONMENT

Every activity described herein is performed on an unstable deck/ platform that pitches, rolls, and yaws or heaves, sways and surges according to the condition of the sea and the actions taken by the helmsman; neither of which you can see or predict. Many seafarers on their first-trip get very seasick.

Most adapt within a few days and have little trouble thereafter. Some hardy souls get seasick for the first day or so of every voyage no matter how many years they work at sea.

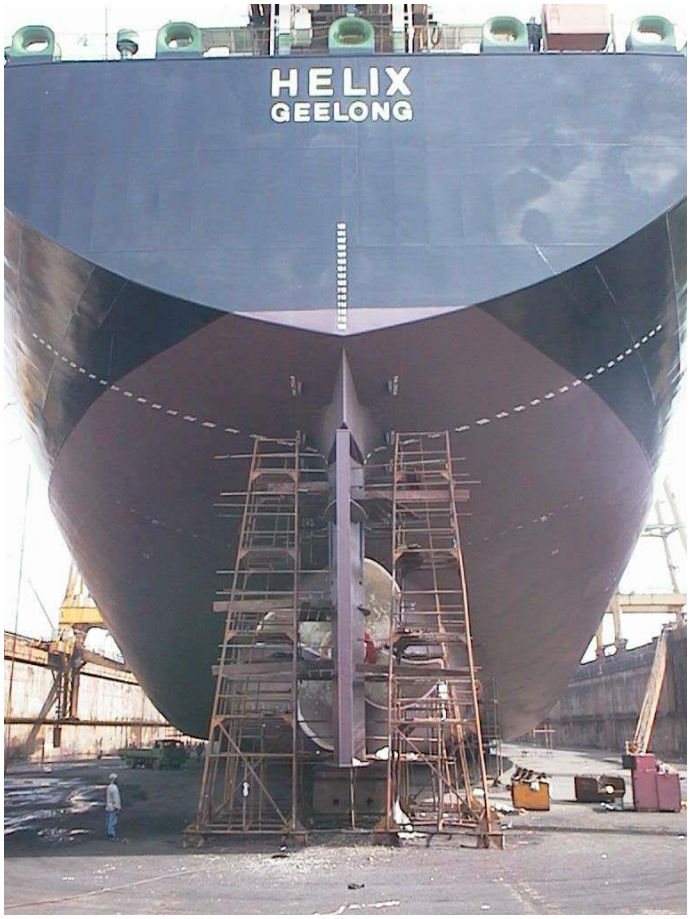
(there are many other types of commercial vessels of different sizes and engine-capacity but the following description is typical of the largest ocean-going cargo vessels).

In addition the deck/platforms, within the (approximately) 10-storey high space that is the engine-room are vibrating/oscillating as a result of the percussive effect of each

explosion in each massive cylinder of the ship's slow-speed main engine in which the cylinder is half a metre to 1 metre wide and has a stroke approaching six foot long and operates at only ninety (90) revolutions per minute.

Added to this is an ambient air temperature in the hotter parts of the engineroom of 35 to 45 degrees Celsius and the turbo-charger whine which at 1 metre commonly measures over 110 dBA.

Machinery and plant is found at all levels within the engineroom and access is via engineroom 'ladders'; these ladders have steel treads about 100mm wide and are usually inclined at about 30 degrees away from the vertical. Tools in hand, and in a sea-way, the Engineer must access all levels of the engineroom to perform adjustments and repairs and monitor gas and fluid levels/temperatures/pressures and respond to alarms from the 2000-point machinery-alarm system which the duty Engineer monitors from the Engine Control Room [see photo].



Even when you reach the peak of your career as Chief Engineer, and your role becomes increasingly technical/ administrative/ supervisory your responsibilities still require you to respond day or night to take charge of the engineroom should the situation get beyond the capacity/experience of the Engineer in charge of the watch.

C2.4 Duties

Marine Engineers are responsible for the operation, and for the maintenance, of all propulsion systems whether steam, gas-turbine or marine-diesel and for all the cooling systems, heat-exchangers, lubricating systems, fuel-systems, water-treatment systems, as well as electrical power [415Volt multi-alternator systems and some use 6kV systems] generation and distribution on the ship, for all the diesel engines or steam-turbines that drive such alternators, for all hydraulic power systems, pneumatic systems, control systems, alarm systems and emergency systems. We cannot begin to describe all the duties of the marine engineer: to try would be to reproduce STCW95, Marine Orders 28 [Operating Procedures and Standards] and the International Safety Management Code. In short, however, the simple truth is that the marine engineer must in any situation rely on him/herself to do what it takes to ensure the safety of personnel, machinery and ship; there is no one else to turn to at sea.

Large merchant cargo ships [say 10,000 tonnes and larger] commonly are manned by four Marine Engineers; a Chief Engineer, First Engineer, Second Engineer and Third Engineer.
The lower 3 engineers take turns in being the 'Duty-Engineer' responsible for a 24 hour period for all alarms and isolations. The engineer may be asleep or in the shower but must respond immediately to such alarms and if the alarm is not cancelled within the first few minutes it will default to the Chief Engineer's cabin and wake him/her up too.
These three engineers are also allocated specific machinery/systems for which they take primary responsibility for all maintenance; this is not simply a case of waiting for

something to breakdown, instead there are 2 important methods of determining maintenance-needs: (1) observation and diagnosis and (2) "Planned Maintenance" a system in which according to operational running-hours the machine is taken out of

service and dismantled by the engineer so that its condition can be measured, parts machined/refurbished or spare parts fitted as required, then re-built. The pump/engine/compressor/centrifuge/heat-exchanger etc can be taken out of service after the 'standby' machine in the system is started and operated in the stead of the machine to be overhauled. It should be noted that this is heavy physical work which the Engineer does him/herself; you dismantle the machinery, you lump the heads of the diesel-alternator out to where you can get a sling on to it for access to any crane or overhead rail to raise it up several levels to the workshop, you re-condition it and return it to the engine and rebuild it, torque the bolts to the manufacturer's specifications. When this same task is done on a main engine bolt of about 100 mm diameter, you may have to use 'flogging-spanners' and a sledgehammer to apply the correct torque or on more modern ships use hydraulic bolt-tensioning equipment to do so. Within the crankcase of the main engine you climb on top of the oil-coated crankshaft and lift heavy hydraulic equipment into place to torque the nut holding each piston rod to the engine cross-head so that you can remove the piston to change the (half a metre to 1 metre wide) cast-iron piston-rings then stand inside the cylinder using an angle-grinder to smooth score-marks on the cylinder-liner. Many tasks, including changing a broken piston-ring, may at times have to be performed as an emergency break-down repair at sea with the vessel entirely at the mercy of the waves as you work to repair the propulsion machinery.

Your duties are performed all over the ship and will include the following examples:-

- From the Forecastle:

Inspect/operate/maintain emergency diesel-driven fire pump, deck-air compressor, hydraulic power systems for anchor-windlass and deck-winches and climb down vertical ladders to bow-thruster room (immediately under the bow) to inspect/repair the bow-thruster machinery as required.

- To the main deck

Work on deck to take fuel tank 'soundings' using a steel tape down the pipe for each of the many tanks Port and Starboard for light diesel fuel and heavy fuel oil. Also work on deck to repair hydraulic systems for winches, cargo hatches & hydraulic systems or electrical systems for deck-cranes [depending on type of vessel]

Work beneath the deck when Ballast and other tanks are opened up for inspection or to gain access to deep-well pumps which are submerged inside the tanks. Climb vertical ladders to the bottom of the cargo holds to overhaul hold-bilge pipes and valves and (on dry-cargo self-discharger ships) inspect/adjust/maintain/repair in-hold cargo-conveyor-systems and cargo-bucket/scraper systems as well as all associated machinery.

- To the ship's Accommodation

Supply/maintain electricity, hot and cold water, sewerage treatment, heating and air-conditioning to the ship's living areas, all ship's refrigeration plant and cold-rooms, plumbing, bathrooms, toilets, ventilation system, washing machines, drying machines, galley equipment [similar to a large commercial kitchen] and services to all cabins and public rooms.

- To the engine-spaces:

These extend from the main deck downwards about 5 or 6 storeys [to the bottom of the ship] and from the main deck rise 4 or 5 storeys [surrounded by accommodation levels].

At the bottom of the ship you will be checking the condition of the stern-tube-seals on the propeller-shaft [see photo right] at the rear of the bottom-most depths of the engine-room (see photo, right), then lifting hatches in steel bottom-plates [1 to 2 square-metre pieces of steel chequer-plate flooring] to access fuel/ballast/bilge pipes and pumps to inspect pump-seals and use hand-operated-valves.
Nearby will be the sewage treatment plant and usually on this level that the fresh-water-generator [for producing drinking water from seawater] is located. This is also the level of the main-engine crank-case doors which are opened in port to allow you to perform maintenance such as inspecting all fasteners within the crankcase, climbing over the crankshaft to take readings of crankshaft – deflections, changing bearings, removing piston-nuts to permit piston-removal and overhaul etc.

Up the next engine-room ladder you will find the engine-side manual-control station which you would use to operate the main engine under local-control should all forms of remote-control fail. Pumps, heat exchangers, lubrication systems and cooling water systems are all around you.

Up the next engine-room ladder you will find the engine-tops where each cylinder has a separate head fastened on with 8 to 12 large bolts (bolt-diameter up to

about 100mm) which you will need to remove to gain access to that cylinder to remove the piston, change rings, etc.

The Engine Control Room will likely be adjacent and have a window looking out onto this level of the engineroom; this is your first stop when answering an Alarm as the Duty Engineer and you will silence the Alarm, identify the hazard, determine and take corrective action and when safe operation has been restored, cancel the Alarm.
Some manual 'Logging' of these events will be required, no matter how well the control systems make an electronic log of events.

Up the next engine-room ladder you will usually find 3 diesel-alternators, each diesel about 3 metres long and typically outputting about 800 to 1200kW , a workshop and storerooms for spare-parts and engineers equipment and tools.
On these and ever-higher levels within the engineroom spaces you will also be responsible for an oil-fired Boiler, exhaust-gas waste-heat boiler/economiser, fuel heating, fuel oil and lubricating oil centrifuge/purifier units (see photo above) systems,
cooling water [Freshwater] systems, cooling water [Seawater] systems, boiler-water systems and the like. This description is illustrative, not exhaustive.

C2.5 SEAGOING TECHNOLOGY.

If you want to become a Marine Engineer because you see yourself tapping the keys of a computer operating high tech equipment in air-conditioned comfort and spotless white overalls then be aware that there is only one place in the Engine Room that is air-conditioned, and that is the Control Room, a place that you will spend only a

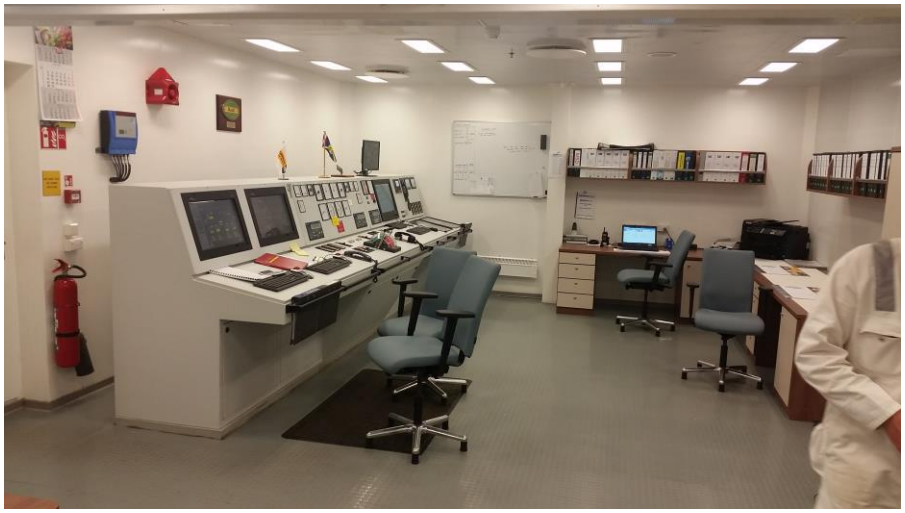
small proportion of your time. The remainder of your time is spent in physically inspecting machinery, operating it, fault-finding/diagnosis and maintenance tasks.

There are some ship operators prepared to invest in new technology: for example

the brand new “Searoad Mersey II” (pictured) whose MAK engines operate on LNG rather than diesel fuel.

However, the job of a Marine Engineer is to adapt to and excel in operating and maintaining whatever the era of technology is available to them, no matter the vintage of the equipment.

Most of the technology is in the design/construction of the machinery for which you are responsible plus in your knowledge that will [in time] permit you to take readings and make adjustments to the operation of machinery to optimise its operation.



The rest of the technology is in your head; it is the engineering knowledge that will allow you to look at the systems around you and understand them so well that you will know when a noise/ smell/ temperature/ pressure indicates a fault and you will have the skills to deduce where in the system corrective adjustment or maintenance is required.

Other Requirements

A seafarer must be able to pass the Medical-examination for issue of a certificate of Fitness from an AMSA-approved Doctor who will test your general health[v], vision (including colour), and hearing.

A seafarer will have unrestricted access to port and ship 'security-zones' and therefore must also be able to pass the AFP/ASIO assessment for issue of a Maritime Security Identification Card.

You want to know more?

If you want to know more about becoming a Marine Engine Driver, Marine Engineer or ETO see our website www.aimpe.asn.au , contact one of our Branch offices, or contact me at hchristiansen@aimpe.asn.au

Henning Christiansen,
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[i] In this case on a domestic vessel operating within Australia's EEZ, that is less than 35m long and has multiple main engines the ***propulsion power*** is NOT the addition of ALL engines capable of propelling the vessel, it is only the power of ONE Engine. This is because the 'National Law' refers to the National Standard for Commercial Vessels, Part 'D' of which defines '***propulsion power'*** as:

> "…The largest value of maximum continuous rated power of the vessel's main propulsion machinery, for the propulsion of the vessel by 1 screw, on the vessel's certificate of survey or certificate of operation…"

[ii] ENGINEER WATCHKEEPER does not permit the holder to be Chief Engineer, even on a small vessel, so they sometimes go sideways and seek an EC3 certificate permitting role as chief engineer on some vessels.

[iii] STCW sets watchkeeping obligations and standards, and Australia gives effect to this through a regulation called Marine Order 28 (Operations Standards & Procedures)

[iv] In this case propulsion power is the addition of ALL engines capable of propelling the vessel. This is because the STCW Convention, the Navigation Act and Marine Order 72 (Engineer Officers) define '***propulsion power'*** as:

"… the total maximum continuous rated output power, in kilowatts, of all a vessel's main propulsion machinery which appears on the vessel's certificate of registry or other official document…"

[v] To a standard set under Marine Orders Part 9 [Health-Medical Fitness]. Aids to vision are permitted but colour blindness can be a problem. If in doubt go undertake the AMSA-Medical before you commence this career.

Australian Institute of Marine & Power Engineers