

Career spotlight: working as an electro-technical officer on mega yachts

As summer approaches, here at Wiring Matters our minds turn to visions of bright blue skies and fresh sea air. And maybe some time aboard a mega yacht – well, one can dream! However, if you don't mind working on board as opposed to sunbathing, David Carlisle takes us through the electronics systems on the mega yachts, and what you need to know to become an electro-technical officer.



The Motor Yacht Ice

As the trend for ever bigger mega yachts continues, the electrical and electronic systems that power them is equivalent, and sometimes even superior, to what is being installed on modern cruise ships. As all these yachts are entirely bespoke; the cost of the biggest mega yachts is estimated to be many times higher than a cruise vessel of an equivalent size and can take years to design and build.

The most important electrical and electronic systems on board a mega yacht are described below.

The diesel-electric propulsion system

One of the biggest changes in the last 25 years for large passenger vessels is the use of a diesel-electric propulsion system. This system consists of a number of generator sets that typically have a medium speed diesel engine as the prime mover and an alternator that generates either 6.6 kV or 11 kV at 50 Hz or 60 Hz. This can then be used by the propulsion drives (which allow variable speed control of large a.c. motors for main propulsion) and can be stepped down to a lower voltage and used to supply the rest of the yacht's services. The main advantages of this platform are that generator sets can be started and stopped to adapt to changing load requirements thereby making the system efficient; the reduction of noise and vibration; and the ability to position the generator sets for optimum weight distribution in the engine room. An additional benefit is the ease of integrating large electrically driven side and azimuth thrusters to allow even the largest mega yachts to manoeuvre into tight anchorages or berths.

Due to the flexibility of the diesel-electric platform, most large mega yachts that are currently in production are adopting it for their propulsion system. As with passenger vessels, the propulsion load is by far the biggest consumer and the total available power from all the generator sets is in the region of 25 MW for the largest mega yachts, with about 80 % of this used by the propulsion system when at full speed.

Systems for self-sufficiency

The propulsion and all the other technical systems on board are controlled and monitored from an engine control room (ECR). As the yacht can spend weeks at sea it must be largely self-sufficient, with the ability to produce its own fresh water and have space in freezers and cool rooms to store enough food and drink for all the owner's requirements.

The HVAC system must be able to cope with outside air temperatures ranging from below freezing to above 40 °C and be able to accurately maintain individual room temperatures throughout the guest accommodation.

The waste treatment system can process all of the grey and black water produced on board until it is of high enough quality to be discharged overboard.

There's even a garbage treatment system to enable rubbish to be processed, sorted and stored until it can be taken ashore.

Navigation and bridge control systems

The navigation and bridge control systems allow the yacht to be navigated by a single person safely and accurately in all conditions. For transiting between ports, the bridge systems are built around the electronic chart display and information system (ECDIS), which provide electronic charts that can be used to plot a course for the autopilot to follow. The ECDIS can also show overlays from the radars, allowing the course and speed of nearby vessels to be monitored.

The automatic identification system (AIS) can display relevant information about any vessel within UHF range. This enables the navigation officer to maintain an overview of the traffic situation and compare the predicted course of all vessels in the area with the course set in the autopilot and to ensure that a safe distance is kept between all traffic.

Slow-speed manoeuvring: the dynamic positioning system

For slow-speed manoeuvring to bring the yacht alongside or to maintain position at an anchorage, a dynamic positioning system, or DP system, is commonly used. This system uses a computer generated model of the propulsion characteristics of the yacht and allows all the side and azimuth thrusters and main propulsion to be controlled in a consolidated way.

In the case of maintaining the yacht's position, the DP system compares the readings of several sensors that measure the yacht's heading and positions, and several environmental factors such as wind speed and direction, and then adjusts the outputs of the individual components of the propulsion system to keep the yacht at the same heading and position.

The DP system can also be used to manually manoeuvre the yacht at slow speeds; this is typically achieved using a 3-axis joystick that is controlled by the navigation officer on the bridge. The inputs at the joystick are translated into propulsion outputs to enable the yacht to

move in the desired direction so that very fine control of the yacht's movements can be achieved. This means that the yacht can be manoeuvred into berths only a little longer than the overall length of the yacht itself.

The safety system

In addition to navigation, the bridge is also responsible for the overall safety of the yacht, which is monitored with a dedicated safety system. This system is responsible for fire detection and damage and flooding control, with several more advanced systems also providing a decision-support system to allow the safety officer to have quick access to the recommended steps to deal with any emergency situation on board.

The electro-technical officer

The interior of the yacht is finished to the highest standard and would normally be equipped with a cinema, swimming pool and occasionally a mini-submarine. The lighting and audio/visual systems are state-of-the-art and there is usually at least one elevator that links all the guest decks.

The person on board responsible for maintaining all these systems, as well as all the other electrical sub-systems that allow everything to function properly, is called an electro-technical officer (ETO). Most large yachts carry a single ETO but the largest mega yachts are now carrying a senior and a junior ETO, as the amount of equipment to maintain would be too much for a single person.

How to become an ETO

There is an internationally recognised ETO qualification available in a number of UK maritime colleges but until recently there has been no requirement for yachts to have someone on board with that qualification, so the role of the ETO has been carried out by people with an HND or above in electrical engineering or an equivalent qualification.

Last year the Maritime and Coastguard agency announced that only people holding a recognised ETO qualification will be allowed to sign onto the yacht as an ETO, but there is a path for people who are currently serving in that role to obtain the ETO certificate based on their previous qualifications and experience. Currently, there are no requirements for yachts to carry an ETO, however, it appears that yachts with diesel-electric propulsion are soon going to be required to carry at least one person on board with ETO certification.

This is a big step forward into the recognition of the complex and dangerous job that ETOs perform while working on the onboard systems and ensures that the position of ETO is now protected in the same way as an engine officer or deck officer. This reflects the growing importance of the role of the ETO for modern yachts and should allow for greater professional recognition of the ETO in the shipping industry.

To become an ETO you must first complete a cadetship with a sponsoring company that will consist of several academic phases at a UK maritime college and sea phases on a yacht controlled by the sponsoring company. While serving as a cadet, the sponsoring company will cover the costs of all your training and you will be given an allowance to live on for your college phases. Typically, a cadetship is three years long and some companies require a minimum amount of service (typically two years) after you complete your qualification.



Due to the number and the range in the size of yachts, the conditions for an ETO range from a full time position to time-for-time rotation. The salaries are in line with engine officers and are typically higher than the salaries of ETOs in the commercial sector.