Marine Engineers' Hands-on Skills Ensure Compliance with Environmental Regulations Even as Computer Controls Advance

Hiroyuki Ide,
Chairman, Japan Marine Engineers' Association

The Japan Marine Engineers' Association is made up of marine engineers of major Japanese ocean shipping companies. The association conducts various research and study activities and engages in public relations activities to improve the technical skills and capabilities of marine engineers and improve its members' benefits and career prospects.

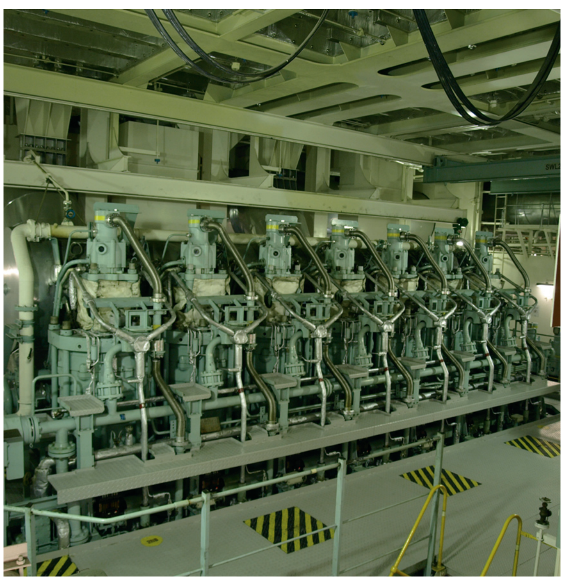
The editor interviewed Japan Marine Engineers' Association Chairman Hiroyuki Ide, asking an array of questions — how have environmental regulations changed the marine engineer's job? How will their work change in the future with the advent of diversified propulsion systems and automated vessel operation? And what must we do to attract young people to careers as marine engineers?

1. Current situation facing marine engineers

— How did marine engineers comply with the environmental regulations that took effect recently?

Traditionally, the biggest issue for marine engineers was to make sure their ships were operating efficiently and economically. That is still important, but now they must also face issues such as complying with stricter standards for exhaust emissions of SOx and NOx. SOx emissions can be reduced through the use of low sulfer fuels. On the other hand, combustion of fuel and engine operation always generates NOx emissions, and eliminating it will require the installation of new equipment. Denitrification systems rely on recirculation and cleaning of exhaust gas. As higher performance equipment is introduced, maintenance and cleanup become more critical than ever – and all of this depends on skilled human hands.

Human effort is also key to conventional cleanup of exhaust emissions. For example, channels in the exhaust gas boiler become dirty and clogged, and must be cleaned with water. Then the water, which is contaminated with sulfur and strong acid, must be treated with caustic soda. And deposits of soot must be scraped out manually.



—Marine engineers must learn to operate new equipment?

It is not so hard to learn how to operate new equipment, but there are still challenges. For example, denitrification systems rely on urea, a hazardous material, so they have to learn how to handle it.

— There is a shortage of marine engineers who can operate the engines of advanced LNG carriers. How will that affect shipping companies' business development plans?

There are two categories of vessel engines—diesel and steam turbine. Steam turbine engines are less commonly used because of their lower thermal efficiency. On LNG carriers, the turbine is powered with steam generated by combustion of boil-off gas (BOG) from the cargo. Currently, it's fair to say that all steam turbine vessels are LNG carriers.

In recent years, marine engineers' boarding and operation experience has focused on oil tankers and LNG carriers, so captains and chief engineers who have no experience are not allowed to serve aboard those vessels. At least three years of onboard experience are required. This has a polarizing effect between marine engineers who serve only aboard diesel ships, and others who have worked only on steam turbine vessels. As a result, some marine engineers are not familiar with diesel engines. However, recent developments allow LNG to be burned even in diesel engines. In addition, chief engineers and other marine engineers who can operate diesel engines are training and practicing on turbine vessels, while those who work on turbine vessels are learning about diesel ships. Shipping companies are training personnel to board both. Thus, the issue of a labor shortage on LNG carriers has been resolved.

— In recent years, shipping companies have adopted slow steaming due to deterioration of the market. How does this factor affect engines and marine engineers?

Conventionally the speed was decelerated to 60% of output, but in recent years, the output can be cut even further, to 40% or even lower and engines can run continually. While engines operate at a low load during low-output operation, they do not get enough air to reach optimum combustion efficiency. That means more sludge accumulating inside the engine, which requires more frequent maintenance intervals and additional cylinder oil to ensure better piston movement. We are seeing improvement in the efficiency of turbochargers, which force additional air into the engine, and auxiliary blowers, as well as advanced electronic controls to add oil to the cylinders at the proper time. These advances allow efficient low-speed operation. This also requires engineers to acquire more sophisticated computer skills.

2. Changes in environment surrounding marine engineers—globalization and technological renovation

— Considering that more and more mariners are non-Japanese, does that not cause some difficulty in communications for you, too, Mr. Chairman?

Speaking from my own experience, when non-Japanese first started becoming part of Japanese crews, we were used to giving one command and having the Japanese crew do everything necessary to accomplish it. But Filipino and other non-Japanese crewmembers do only what the command says, so sometimes work did not progress smoothly because of such differences in customs and cultures.

Pulling pistons

removal of a cylinder cover

pulling a piston from the cylinder by an overhead travelling Crane

Even though such crewmembers are instructed to put tools back in their proper place the first time, many of them leave the tools lying where they were used the next time, so we must emphasize thorough orderliness at all times. When we show them that if a tool is left on deck, waves can wash it overboard so it is lost at worst or cause it to quickly rust at least, so those crewmembers begin to understand.

Also, talk of politics or religion onboard ship is forbidden. We learned that even among Filipino mariners, because they may come from different islands, trouble can happen, so our rules against such conversations help keep the peace and prevent quarrels from breaking out.

There came a point in time when Japanese ocean shipping companies began to train and educate seafarers from other countries, the Philippines in particular. Highly competent people were offered scholarships to merchant mariner schools, and other methods of improving the level of potential crewmembers, and such well-trained seafarers have become vital support for Japanese merchant fleet.

One of the most important elements of living with non-Japanese is food. At first, we had crew on board that was used to Philippine food, but as the number of ships increased, that became impossible, so we had our Filipino crewmembers to get used to Japanese food. Personally, I like to cook, and when I captained a ship, I often instructed the chefs. Now miso soup, a very typical Japanese food, has become part of our regular menus.

At any rate, I must say that we have found it absolutely necessary to speak clearly and say exactly what we mean, especially if we are to successfully communicate with non-Japanese.

— Engine technology continues to evolve. What technical evolutions have you experienced, Mr. Chairman?

My first shipboard assignment was in 1969. In those days there were still some vessels with reciprocating engines, but diesel ships were becoming mainstream. After that, there were eye-opening advances in diesel engine technology. One of them was the ability to use lower quality fuel. The development of technology that enabled the use of fuel oil that continued to degrade over time was a tremendous boon to the ocean-shipping industry.

— Has the marine engineer's job changed very much?

Back then, the interval between engine maintenance was quiet short. For example, the moment we arrived in port, we just naturally pulled the pistons (a maintenance process for overhaul inspection of the parts inside the cylinders of diesel engines). We had to divide up the duties of inspecting the welds of all the structures above deck. In our time, we did a lot of shipboard preventative maintenance by ourselves.

— Do marine engineers pull pistons less often now?

Back then, we pulled the pistons every 1000 hours, but now engine performance has greatly improved, and that kind of maintenance is done every 10,000-15,000 hours of engine operation. At that time, pistons were 50-60cm in diameter, but now they are around a meter, and parts can weigh between 100kg and a full ton. Further, there is little space inside the crankcase, so it's very difficult to perform repair work on board. For these reasons, we do not assign engineers who are not familiar with that work. Therefore, we most often put the ship into a dock to do those jobs.

— What advances in marine technology are you interested in?

Fuels have become much more diversified. We use not only heavy fuel oil, but also natural gas, and in the future, hydrogen may also become a fuel we can use. From now on, marine engineers need to know vessel operation and structure, and we've got to make sure that happens.

— How do you view electronic control of a ship's engines?

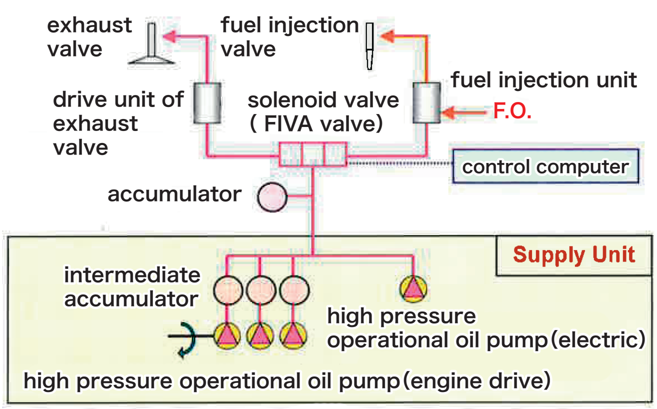
In the answers to a questionnaire to member companies by our association asking about cases of engine trouble, we found that about 15% of their ships' engines are electronically controlled. Nowadays, new ships are all fitted with electronically controlled engines.

Personally, among all engine controls, I'm paying particular attention to electronic governors. Onshore, computers can now win at chess and shogi against human players, so we can expect considerable advances in the realm of electronic controls aboard ships

structure of electronically controlled engine(1)

type in which camshaft of conventional engine is replaced by hydraulic system ※

(Example) MAN Diesel engine, Mitsubishi UEC-Eco engine

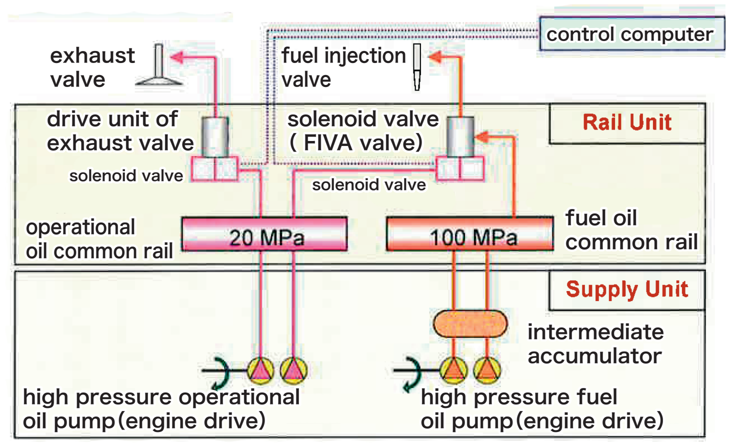


Source:material for the technology seminar by Class NK in 2009 Spring
※Lately, new type has been developed in which only camshaft of fuel injection unit is replaced by hydraulic system.

structure of electronically controlled engine(2)

common rail type

(Example) Wartsila RT-flex engine



Source:ditto

— With electronic control, don't you worry about computer breakdown?

If a computer breaks down, we have spare parts that can replace the ones that failed. Computers are machines that send and receive signals, so we tend to have more trouble with faulty connections or input from faulty sensors. Computers control output, but the opening and closing of valves is hydraulic. When there's trouble, it tends to be with fuel valves or the hydraulic system. Ships sail on salt water and are thus prone to rust and corrosion, and they vibrate, so electric systems sometimes loosen and cause faulty connections. When there is trouble in the electric systems, the problem is always in pinpointing the cause. Once the problem is identified, it does not take long to remedy it.

A ship's main engines are remotely controlled from the bridge. In the past, if the remote broke down, there were manual mechanical systems for keeping the engines going. Now there are none. Now it's just like a hybrid car. The system is programmed by one-push button, and then the engine sucks air and starts up.

Now ships are expected to slow steam, so there's a good chance that electronic control systems that are programmed for low fuel consumption at slow speeds will penetrate the market. Improved switches and hydraulics may be part of the equation necessary for such penetration.

— If you can operate the ship with just a computer, don't you tend to forget the principle of the vessel itself?

The engine system that moves the ship is basically the same. The mechanical, hand-operated parts have been turned over to electronics to eliminate human error. There is no need to worry about the ongoing use of IT on ships.

3. The future of marine engineers

— How far do you think automation and electronics control will go?

Computers that do chess and shogi already make use of artificial intelligence, but what about operating a vessel? A vessel is much more than the engines that drive it. There are peripheral components, electric power generators, and the principle of propulsion, hydraulics, and electronics are all different, even though used together.

The engine room stands no watch at night. By the same token, inspection of the machinery and other necessary work are done in the daytime.

Both computers and robots perform the commands of human operators. To trust those operations to artificial intelligence (AI) would mean that when something abnormal occurs, the system must make judgments and decisions like a human being.

We plan to use the big data collected from shipboard to automatically operate vessels from the point they exit a harbor until they are offshore from their destination port, but we must keep a sharp eye on the technology of marine equipment makers, data collection and analysis systems, in order to determine just when that plan can become a reality.

— There is some concern about future lack of marine engineers, what appeals do you think could be made to the general public in order to secure the manpower needed?

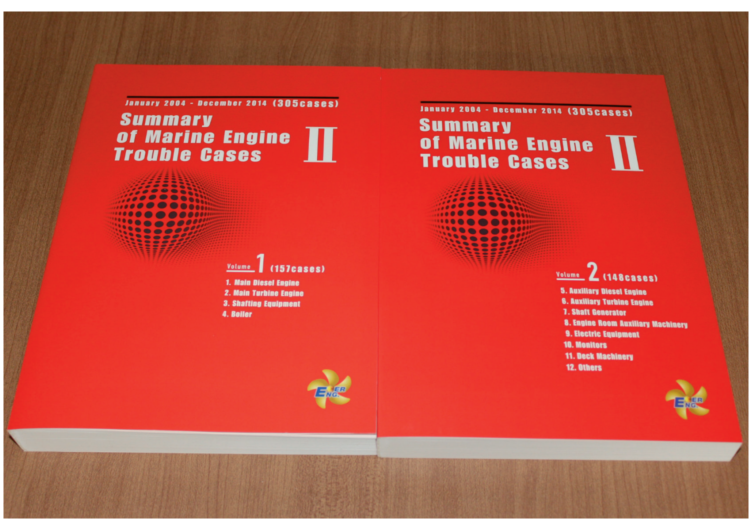
It will be important for us to be able to convey the magnificence of the ocean and of ships, but it seems that marine engineers do not excel at self promotion, and as a result, we've not done adequate PR on those positions.

— In getting enough marine engineers, do you think it is necessary to make an appeal to children with an interest in mechanics?

Graduates of colleges other than maritime universities are eligible, as are graduates in the humanities who may be interested in machinery. That said, it is up to us to arouse their curiosity and spark their interest. That is, we must note that a marine engineer is not someone who makes machinery, but one who operates it. The marine engineer also does machinery maintenance, and feeds back information on problems to the manufacturer so adjustments and improvements can be made in future engines.

— Won't those huge containerships and the mammoth engines that propel them attract many people?

To us, they are everyday items, but to non-seafarers,



they might have some appeal. These big ships have engines just as strong as Astro Boy (a Japanese comic book character that's a robot with a heart like a human's), rated at some 100,000 HP. Still, if we are appealing with large oceangoing ships, perhaps big cruise ships would be more effective. Their engines are very big, and also very quiet.

— What new initiatives does the Marine Engineers Association have?

Every year, the association asks all ocean shipping companies to complete questionnaires on engine problems, compiles the data, and analyzes them for trends. Last year, the International Mariners Management Association of Japan (IMMAJ) asked us to gather accident and trouble information into a volume of examples. As a result, we were able to deliver a textbook and DVD on the subject. Also, as an ongoing project, we help train young marine engineers in the latest new technology so all will be working from the same knowledge base.

— A personal question, if we may, Mr. Chairman. Why did you choose to become a marine engineer?

I loved messing with machinery even as a boy, especially I like to take things apart. As a child, I would even take clocks apart. The main reasons I chose kobe university of Mercantile Marine was its relatively low tuition and the fact that it had a machinery department.

— So marine engineer was your special calling, then?

Undoubtedly. It wasn't that I had to study even though I didn't want to. Yes, there were some difficult periods, but basically my life as an engineer was a happy one.

— What kinds of memories or incidents from your life as a marine engineer come to mind?

I've had a few close calls in my time. Onboard ship, the most frightening things are taking on water and fires. One time, the valve that controlled the cooling seawater let into the lubricating oil cooler got corroded without anyone noticing. The valve broke and a lot of seawater got into the ship. That was a cold-sweat moment. Afterward, I realized that we had not paid enough attention to the plumbing and machinery in the engine room. Several times we've had power generator fuel lines develop leaks that sprayed on the hot

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exhaust pipe and burst into flames. That's scary, too.

Fun things? Parties we had to celebrate completion of important overhauls or a crewmember's birthday. Filipino crewmembers would sing and dance, and we would often join them.

When I went ashore in New York, I saw the movie Towering Inferno, and when I got back to Japan, I told people about it. The movie had not yet been shown in Japan, so people were a little jealous of me. That's one of the good things about working aboard an oceangoing ship.

— Do you have a message for the younger generation?

Use your own eyes, feel with your own hands, listen with your own ears, make the decision to use all your five senses on the job. Alarms go off when someplace in or on the engine is at an abnormal temperature, but if you find a place that's hot before the alarm goes off, often it can be remedied before any alarm. Sometimes thermometers go wrong. No matter how convenient machinery gets, safety management is mainly up to humans.