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BIG CHANGES AHEAD FOR CRUISE SHIPS (Published in Cruise Industry News)

If the continuously increasing ship sizes and ever increasing number of special features are excluded, there have not been too many major changes in ship design and technology for several decades. However, due to recently introduced new rules and regulations, together with the question of future fuel, significant changes are taking place today.

NEW RULES IMPROVE SAFETY BUT MEAN MORE COMPLICATED SHIPS

Within few years several new rules affecting passenger ship safety will come into force, new probabilistic damage stability calculations being the most famous of these. Some of the new rules are less significant, but still important: one would think emergency lighting would already be installed in cabins, but only now they will be required.

The so called “Safe Return to Port” requirement is one of the most significant new regulations affecting larger passenger ships. This regulation clearly improves the safety of passenger ships, but it can also mean more complicated arrangements. Simplified description of this rule is that the vessel needs to be able to return safely and under own power to the nearest port, when any one of her rooms or compartments is lost due to fire or flooding. Thus propulsion, steering, navigation, fire fighting and other crucial systems need to be operational even if, for example, one watertight compartment is lost. Many, but not nearly all, of today’s ships have main engines in two separate compartments, but the new regulation will go beyond that.

On diesel-electric ships the “Safe Return to Port” requires that propulsion motors are in two separate watertight compartments. With a pod vessel this is easy to achieve, but if the vessel has traditional shaftlines, the propulsion motors need to be enclosed into own watertight rooms, or be longitudinally in different compartments. For diesel-mechanical propulsion this regulations easily leads to navy ship type of solutions, with one shaftline longer than the other. In this case safer can also mean space losses and more complicated maintenance access.

The new probabilistic damage stability regulations mean also additional challenges, which will only be faced several years from now: they complicate the ship’s later life. In old, deterministic calculations it was easy to check if the ship’s stability was still adequate after weight increases typical due to aging or a conversion project. In the new, probabilistic calculations weight increase or other modification can easily lead to a situation where full new damage stability calculations are required. Similarly, new rules have much stricter requirements for routing of pipes and ducts, which now need to be followed in later modifications as well. One still unanswered question is what happens in major conversions of older ships: for example, if a ship is lengthened, does she need to meet the new damage stability regulations? If the answer is yes, this may make many lengthening projects impossible.

EMISSION REGULATIONS DO NOT AFFECT ONLY ENGINES

So far the emissions regulations have been quite easy on ships: for example, the IMO nitrogen oxide limits are easily met with the new engines. However, new and future regulations mean more complicated technical solutions and may even require change of fuel type. Ships have been able to use heavy fuel oil, which is practically a waste product of the oil refining industry, but already now in many areas of world this is changing.

Today there are Sulfur Emission Control Areas (SECA) already in force in the Baltic Sea and soon also in the North Sea and the English Channel, limiting maximum fuel sulfur contents to 1.5%. On the Californian coastline, the ships' generator engines, including main engines of diesel-electric ships, need to comply with 0.5% sulfur limit, reducing to 0.1% in 2010. In the same year the sulfur limit will be 0.1% in all European Union ports. Considering that the world average of heavy fuel oil sulfur content is slightly below three percent, this is a significant issue.

The new sulfur regulations can be complied with by using low sulfur fuels: either low sulfur heavy fuel oil or, for stricter limits, diesel oil or gas oil. These all are more expensive than heavy fuel oil plus in some cases tank arrangements and fuel oil systems can become more complicated. Another alternative is to install a sulfur oxide scrubber, which scrubs the exhaust gases and transfers the sulfur in them into the sea, only in less harmful compounds. Scrubber technology for ships is still in development stage, and scrubbers will also mean significant investment costs and often space losses.

One efficient mean to reduce ship borne emissions is to use shore power, or "cold ironing". Large cruise ships can need 10 MW or more power while in port, and providing this needs investments both on ship and shore side.

One emission almost completely forgotten is the carbon dioxide: whether we reduce nitrogen oxides with catalyzers, sulfur oxides with scrubbers or clean ballast water, energy is needed to operate these systems and this again increases the carbon dioxide emissions. The only way to decrease carbon dioxides is to use less fuel or to shift to different type of fuel.

ENERGY SAVING IS TODAY'S FAVORITE – AT LEAST IN TALKS

In all today's newbuilding negotiations energy saving is a hot topic – at least until the additional investment costs are known. Energy saving possibilities can be divided into operational and technical groups. Operational practices, such as maintaining unnecessarily high speeds to secure arrival times, can be affected by training and company practices, but wrong technical solutions are much more expensive and difficult to change later.

The biggest energy consumers on cruise ships are propulsion and air conditioning. New tools like CFD-software (computational fluid dynamics) have opened new possibilities in hull form optimization: difference between today's best hull forms and a hull form ten years ago can be surprisingly high. Owner's have a big responsibility in this matter: shipyards are not too keen to improve hull form any further if the engines have been decided and the model test show the contract speed has been reached. By requiring round sterns and sharp bows, owner's architect can also have a huge negative effect on ship's performance. Longer waterline is always better for powering point of view: this means "ducktails" and more efficient bows will be more common in the future, but with creative design even the ship's outlook can improve.

In air conditioning, increasing the use of fan coils, which are almost standard in cabins today and increasingly used in public spaces has decreased the energy demand. Intelligent control systems, which adjust temperature based on demand, will further reduce the energy consumption. There are several other means to save energy: adequate size of exhaust gas boilers, reducing fresh water consumption and using LED-lighting where feasible will all help.

One very efficient way to reduce energy consumption is to reduce the sailing speed: if instead of hurrying to far away destination islands, the vessel would just slowly cruise to open sea and then return, significant amounts of fuel would be saved. As an example, reduction of speed from 22 knots to 17 knots can reduce the propulsion fuel consumption and emissions per nautical mile by almost 50%. In this respect large, resort type of ships concentrating more on entertaining passengers onboard than taking them quickly from destination to destination could be considered environmentally friendly.

ALTERNATIVE FUELS AND POWER SOURCES

Shipping is an industry which has transferred from a completely clean power source to one of the most polluting power source: from sails to heavy fuel oil. How long the use of heavy fuel oil, or use of oil in general, can continue is a big question. Already now selecting heavy fuel oil for a newbuilding can prove to be a wrong solution, if new sulfur emission regulations force ships to use distillate fuels.

There are temporary solutions such as shifting to distillate fuel and partial bio fuels, but these have only a limited effect on emissions. One alternative already possible today is natural gas, which is a much cleaner fuel than oils. Natural gas has its own problems, such as required storage space, safety aspects, non-existent bunkering facilities and the fact that it still produces significant amounts of carbon dioxide.

As hydrogen power for large ships is still far away and nuclear power is today close to an impossibility on passenger ships, we might even see large sailing cruise ships. In the meantime, energy saving and emission reduction are key items in today's ship design.

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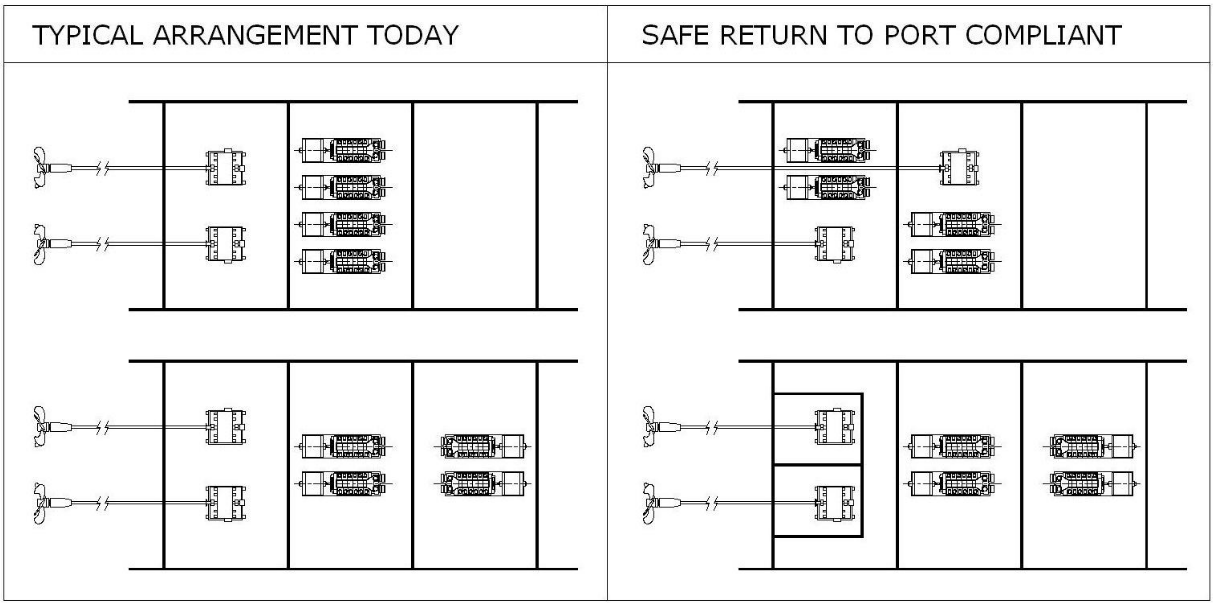

Figure 1: example how “safe return to port” requirement may affect machinery layouts on diesel-electric ship with traditional shaftline. On the left there are typical solutions today and on the right examples of new arrangements.