# Putting passengers at ease

It is not just the aesthetics of a cruise ship that interests potential passengers. Today, attention must be given to improving the indoor climate as well as environmental and safety concerns.

**BY BOB TALLING**

The cruise customer is becoming more aware of and involved in today's society through the free flow of information. As consumers travel further and their experience broadens, so too do their expectations. When selecting the cruise provider service, price and comfort are important, but other values like safety, environmental impact and green values are becoming equally crucial. In particular, younger customers give greater value to these factors.

Besides new build, refurbishment represents one of the more unique opportunities for ship owners to set new direction for the future. New and revised service features can now be added on, which in different configurations can revitalise and develop the market perception of on-board services. A successful refurbishment must include attractive and effective service functions and enjoyable interior design in combination with added safety and environmental values.

Comfort is determined by several different factors, such as level and quality of service, interior design and indoor climate.

## Looking at design

In the world of interior design, the aim is to achieve a functional and proportional design. The main elements of this are light, colour, acoustics, choice of materials, spatial geometry and distribution of interior elements.

Colour and light have a psychological influence through the interaction between colours, colour richness, light reflection, temperature, the feeling of the surfaces and so on. Background colours should be light (pale) and with little or no gloss. Overly strong colour combinations and excess gloss will cause a restless feeling. But it is important to have beautiful and interesting designs to look at.

Gypsum mouldings could help save lives and property during a fire

## Sound matters

Over the past ten to 15 years, several new demands for sound and noise reduction have been introduced, with the aim of protecting the crew from an unpleasant working environment. Furthermore, more restrictive specifications for passenger ships have been developed to ensure better acoustic conditions and increase comfort. The recommendations and increased demands for low noise on passenger ships have forced ship owners and shipyards to find suppliers of materials and solutions that comply with the specifications for airborne and structure-borne sound.

Airborne noise propagates from a noise source and is transmitted directly through the wall to adjacent rooms. It can also be transmitted through the deck and radiated from the floor surface into other rooms. Structure-borne noise propagates as vibration from the noise source through the structure of the ship and is radiated from the structure into the air. The vibrations can be radiated from floors, walls or windows.

One solution is to use the right combination and type of sound-reducing deck coverings and produce constructions that will reduce the transmission of airborne and structure-borne noise as well as the transmission of impact noise, caused, for example, by walking and running on the deck above.

The proper selection and design of visible interior elements will have a great impact on the acoustic performance in the entertainment areas. Too many hard (metal, glass, stone) and non-porous surfaces will result in a long re-vibration time and make conversations very difficult. Therefore, the use of more porous material for better acoustic performance is recommended.

## Improving the indoor climate

The indoor climate is getting more attention due to the increasing number of people who are allergic or have unexpected and sudden allergic reactions. Many of the materials used on board ships today are not tested for emissions under ambient conditions. They sometimes give off solvents, chemicals, vapour or dust, which can cause allergic reactions. Many organic resin-based materials have a tendency to decompose and disintegrate with time, while inorganic materials are much more stable.

In future projects, the indoor climate will receive more attention, and guidelines will be developed for commissioning, construction design and choice of materials. The purpose of the classification is to help the user, owner and designer to define the target levels of the indoor climate. The goal of the classification is to enhance the development and use of low-emission building materials. The classification presents requirements for materials used in ordinary workspaces, cabins and public areas. There are limits for the emission of volatile organic compounds, formaldehyde, ammonia, carcinogenic compounds and odour. Only tested products will be allowed.

The objective of the cleanliness classification of air-handling systems is to ensure the quality of the air supply flowing through a new air-handling system. Labelled air-handling components will not produce impurities detrimental to people's health, unpleasant odours or particulate pollutants into the air supply.

## Thinking about the environment

Increasing public pressure and environmental regulations have motivated the maritime industry, and the cruise industry in particular, to adopt improved technologies and practices reducing pollution. Anti-pollution legislation and the spread of tough local controls have been the major reasons for the adoption of more environmentally compatible machinery and powering systems, driving technological development in marine engineering at a faster pace than ever before.

Smokeless diesel engines are low in NOx, SOx and $CO_2$. Ships must be fitted with catalytic converters to further reduce harmful NOx emissions. There is a need for more investment in engine technology to gain further savings on operating costs caused by lower fuel consumption and producing lower $CO_2$ emissions.

A successful refurbishment must include attractive and effective service functions and enjoyable interior design

## Fire safety at sea

New regulations regarding installations on board ships have been developed in the last few years. All materials have to pass smoke and toxic gas tests or be completely non-combustible. The background is that during most of the recent ship fires the basic reason for loss of life has been intoxication from the gases created by the fire. From a safety point of view, it is of the utmost importance that the installation preserves its structural integrity and that no or little deformation
occurs during a fire. Other important properties include light weight, high impact and tensile strength, fast and easy installation, durability under marine conditions and, of course, low or zero emissions to the air during service.

Safety on board is guided by the international SOLAS agreement. Protecting human life is a challenge in today's society; protecting life on

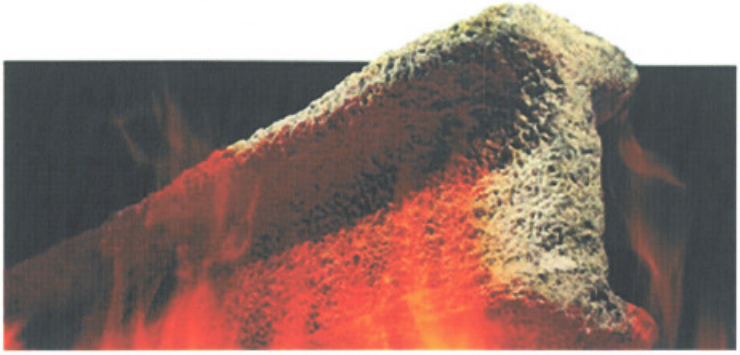
board a ship is the obligation of the designer, the architects and contractors and, not least, the ship's owner. A ship is a closed society when the ship is on the open sea. There is no way to escape in the event of an accident. The rescue teams on board must feel secure in the knowledge that all installations are in accordance with existing regulations. In case of a fire there must be enough time to bring the passengers to a safe place.

Understanding what happens with different materials during a fire is essential when planning and designing a ship and its interior installations. Of course, the most important factor is to design a ship with a high standard of passenger safety.

Steel itself is not very durable during a fire, as it already starts to lose its load-bearing capacity at 700°C. Therefore, all construction steel needs some kind of fire protection. Typically, mineral wool with low organic binder content is used. Aluminium is even worse, as it melts below 700°C. Many mineral-based boards can preserve their integrity above 1000°C.

It is essential to understand that all organic matter will burn or decompose during a fire that lasts a long while. Even small amounts, more than 3 to 5 per cent of organic modifiers can cause sudden flaming of stone-like materials if their compositions are not properly selected. It does not matter if the material has low-flame characteristics. Most organic materials will decompose below 500°C.

In most cases, the loss of life on board from fire is due to intoxication from hazardous gases formed from materials that do not meet regulations. In many cases, it is preferable to use wood instead of modified plastic materials. Wood burns from the surface, but does not melt and run, as do most plastic composites. The heat development of dry wood when combusted is about 20MJ/kg, while many organic polymers have a value in the range of 40 to 45MJ/kg. Typically, the density of wood is half, or less than that of polymers or polymer composites. Materials that burn without producing poisonous gases or soot during a typical open fire might still give off very hazardous gases when decomposing under heat in a closed environment such as behind doors, walls panels or floating floors.



Gypsum-based fireproofing for steel

An inorganic material is typically metal, stone, ceramics, glass or cement-based materials. These materials will absorb heat during a fire, depending on their material characteristics. Cement-based materials are typically gypsum, cement or silicate based. Their benefit is that when heated they will give off chemically bound water amounting to as much as 50 per cent of their original weight. During a fire, the released water will dilute the burning gases and cool the air when vaporising. As long as water is vaporising from the surface, the temperature will stay around 100°C. Due to the cooling effect, it will increase the time to escape and give the fire fighters the few extra minutes that might be needed to take control of the fire. The risk of an explosion is reduced through the dilution and cooling effect. The vaporised water will also react with toxic substances from the burning gases to form less toxic or non-toxic reaction products. Another positive effect from using water containing mineral materials is that any coating or paint on the surface will have a better low-flaming behaviour compared with painted metal surfaces.

Anti-pollution legislation has been the major reason for the adoption of more environmentally compatible machinery and powering systems

When designing the ship's interior it is important to be aware of material properties and the behaviour of materials during a fire. Never place plastic-based materials, moulding or decorations up in the ceiling, and never specify paints and coatings with unknown burning characteristics for upper parts of walls and the ceiling. A specifying architect should not recommend materials that have not been tested according to the newest IMO methods. This is one of the ways in which passenger safety can be increased.

The use of more inorganic materials containing chemically bound water is recommended. In some critical parts of a ship it would be beneficial to use a cement-based, sprayable fireproofing material instead of mineral wool because of the additional value of the cooling effect from water vaporisation. A variety of decorative gypsum and special cement-based materials and boards might save lives and property during a sudden fire. ●