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Finnish Marine Industries



**SHIPBUILDERS DESCRIBE
THE PROCESS OF MANUFACTURING
THE WORLD'S MOST ENVIRONMENTALLY
FRIENDLY PASSENGER SHIP**

VIKING GRACE

A PUBLICATION OF
THE FINNISH MARINE INDUSTRIES

THE VIKING GRACE FACTS

The Viking Grace cost approximately **EUR 240 million** and **2,600 man-years** were needed for its construction. The Grace sails under the Finnish flag and can accommodate **2,800 passengers** in a total of **880 cabins**. **A crew of 200 persons** works in the vessel.

GRACE'S SPECIFICATIONS:

Length: 218 meters
Width: 31.8 meters
Draft: 6.8 meters
Speed: 22 knots
Gross Tonnage: 57,600
Installed Power: 30.4 MW

CONSTRUCTION TIMELINE

The contract is signed between Viking Line and STX	in December 2010
Production starts	in September 2011
The keel is laid	in November 2011
Structure installation starts	in March 2012
The launch takes place	in August 2012
The ship is delivered to the Viking Line	in January 2013

The stern has two LNG tanks, each with capacity for 200 cubic meters. Bunkering is carried out at the Stockholm harbour from a small bunker ship. Bunkering can be completed during normal port visits.

The car deck was designed so that drivers can enter the lobby directly to wait for elevators.

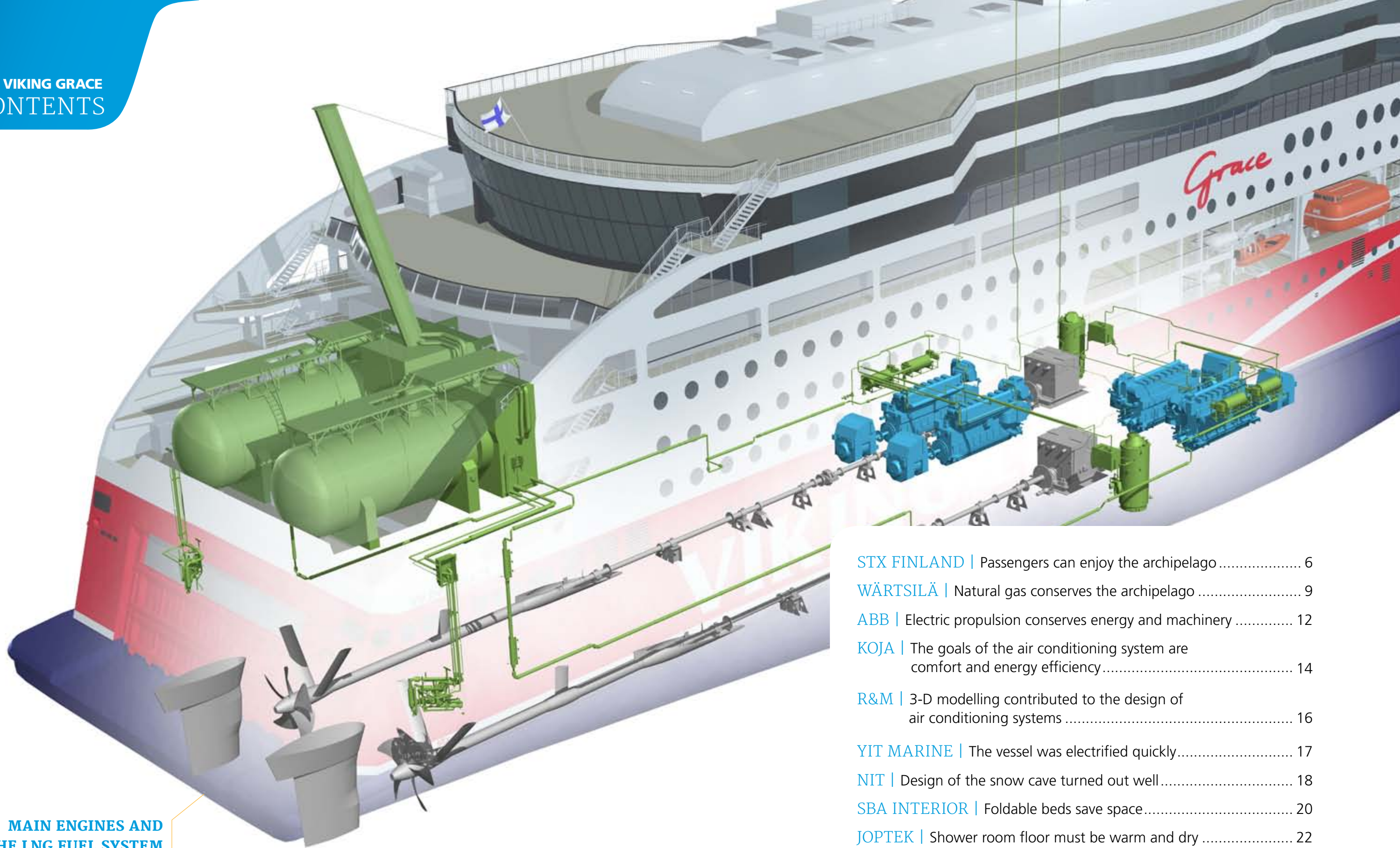
Upper decks provide more space for diners, as the food preparation kitchen is located on the lower deck along with provision storage. There are good views of the archipelago from the upper decks.

ABB has supplied generators for power plants and electric propulsion motors that powers propellers. The consumption of electricity is monitored continuously.

The system operates on only as many of the four main engines as are necessary, thereby optimising fuel consumption.

Wärtsilä's dual-fuel diesel engines use LNG as their main fuel. Natural gas meets the strictest environmental requirements and mainly vapour comes out of the chimney. The use of LNG will meet the latest environmental rules coming in force.

The crew cabins were transferred from the upper decks to a lower deck behind the lifeboats. This way, more cabins are available for passengers on the upper decks.



**MAIN ENGINES AND
THE LNG FUEL SYSTEM**

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Passengers can enjoy the archipelago

The new ship's designers were given a challenging task: to provide passengers with the opportunity to admire the archipelago while making environmental protection a top priority. In addition, the ship had to be completed in record time.

"Viking Line wanted a completely new type of ship, so our creative team was given a lot of freedom," says Head of Concept Design of **STX Finland Sami Kouvonen** when describing the early stages of the Viking Grace. The Turku

▼ THE SHIP IS FIRST BUILT IN BLOCKS AND THE BLOCKS ARE THEN JOINED TOGETHER TO FORM THE HULL. THE BOW BLOCK IS CONNECTED TO THE REST OF THE BODY IN THE DRY DOCK.

shipyard concept design team began to envisage the next generation of ferries. In fall 2009, STX Finland's sales team travelled frequently to Aland to present ideas for the Viking Line's project team.

Many new ideas were considered at those meetings. One was to move restaurants and other public spaces to the upper decks, so that passengers could enjoy the stunning archipelago of Turku.

The first version was expensive

In January 2010, Viking Line had sketched its vision of the ship concept and the company sent tenders to several yards. The design turned out to be very expensive and new solutions were clearly needed. A hectic period began for STX Finland's concept design team and later they introduced a smaller version of the

ship. Moreover, the quantity of cabins was reduced slightly so that the budget for the project could be achieved.

At the same time, STX Finland's engineering team had to determine how to meet the strict emission regulations which will enter into force in 2015. A large number of propulsion arrangements were evaluated together with fuel alternatives. Diesel seemed too expensive and heavy fuel oil would have required a sulphur scrubber, which didn't yet have a properly functioning prototype. LNG, or liquefied natural gas, was already in use, though mainly for long range LNG tankers, not for fast-paced passenger traffic.

"Just before fall of 2010, all the big pieces of the puzzle had fallen into place," Kouvonen says. >>>



>>> Small reforms towards a future cruise ship

The development of the vessel continued and a number of ideas were presented to facilitate the everyday tasks related to the ship's operation. The provision stores and food preparation kitchen were installed under the car deck so that the upper decks could be utilised for dining with more window tables.

Similarly, the crew cabins with windows were transferred from the upper decks to a lower deck, behind lifeboats. This way, passengers can have more cabins on the upper decks with an unrestricted sea view.

The car deck design was also unconventional. It was designed so that the car passengers can wait safely and comfortably in the lobby to enter the elevators, instead of standing in the car deck. "We've taken passenger comfort into account in all areas," boasts Kouvonen.

In December 2010, the contract of the construction of the ship was signed. The design work continued; the LNG system design was particularly challenging as official regulations were not yet ready for such a new and innovative system.

The design and production phases overlap

Strength calculations were initiated before the signing of contract so that the required hull classification could continue on schedule. The purchase of the largest components began with orders of ro-ro equipment such as the bow door, stern gate and ramps. Different stages overlap in shipbuilding, particularly on a tight schedule. Production had already started while the design of the upper decks was still in progress.

The production of the Viking Grace began in September 2011, when the first steel plate was cut. Critical parts of the hull were completed quickly, and the actual block assembly building began in the yard's dry dock on March 6, 2012.

During the following months, the ship slowly came together. The prefabricated components such as high elevator shafts were fitted into place. Complete cabins arrived from the Piikkiö cabin factory and were hoisted into place. Builders call this plug-and-play, as the cabins are completely ready for installation upon arrival at the yard.

"Pre-fabricated components will

speed up construction and guarantee top quality," affirms Project Manager **Vesa Airaksinen**.

New building number 1376 was launched on August 10, 2012 and the ship was docked in the outfitting quay. Construction, particularly interior work, was executed at a fast pace. At the peak of construction, there were nearly a thousand employees hard at work.

The first sea trial in early December revealed that the machinery system was working and the basic settings were correct. Now the ship was at sea – a ship made of durable materials and optimised for sailing in the Turku archipelago, a ship which could be unloaded, serviced and loaded in less than an hour, and which ran on an environmentally-friendly LNG gas. The fact is that this ship had been completed in record time, just nine months.

Thousands of builders were relieved but also sad to see her go when Grace was delivered to Viking Line on January 10, 2013. ■

TURKU SHIPYARD is the largest shipyard in Finland, specialising in cruise and car passenger ships, as well as technically demanding offshore projects. The shipyard has built the world's largest cruise ships, such as the Oasis of the Seas and the Allure of the Seas. Shipyard employs about 1,500 workers.

The yard is owned by STX Finland Oy, which has another yard in Rauma. The company also owns half of the yard in Helsinki. STX Finland employs 2,500 people. STX Finland is owned by STX Group.

www.stxeurope.com



Natural gas conserves the archipelago

The technology company Wärtsilä faced a challenge: how to use natural gas as a fuel. Natural gas had never been used in fast-paced maritime passenger traffic before.

Four 8-cylinder Wärtsilä 50DF dual-fuel engines were selected as the main engines for the Viking Grace. Reliable, environmentally sound engines meet the requirements of passenger comfort such as unnoticeable noise and vibration.

The noise limit in Stockholm port is particularly strict: it should not exceed 40 decibels measured at a distance of hundred meters. It was easy to comply with this requirement thanks to Wärtsilä's Compact Silencer System, which optimises the entire exhaust system for low noise.

"At port, you can't hear any noise of running engines – only the sound of ventilation," explains General Manager **Mika Ojutkangas**.

The demand for unnoticeable vibration was easy to fill as well. Engines were placed on rubber mounts, which made the vibration disappear.

Challenging environmental requirements

The challenge was to meet increasingly strict environmental requirements. The main alternatives would be either an exhaust gas cleaning system or liquefied natural gas (LNG). Both techniques are new. Exhaust gas scrubbers were just under development and LNG had not been used in fast-paced passenger transport.

When using gas as a fuel, emissions of sulphur oxides are practically zero, and nitrogen oxide emissions are at least 80 percent lower than the requirements set by the International Maritime >>>



>>> Organization (IMO). Particulate emissions are 90 percent lower than those of conventional diesel engines, and the carbon dioxide emissions are reduced by 20–30 percent as well.

There were several design issues associated with the use of LNG. Refuelling, or bunkering in maritime terms, has to be done as quickly as possible, as the ship stays at port for only an hour or so.

The Viking Grace was designed so that it is feasible to bunker on both sides of the vessel, which increases flexibility.

For practical reasons, LNG tanks are round. However, a round tank requires more space than a rectangular one. This was not a problem for the Viking Grace, as the tanks were placed on the aft deck.

Double piping and ventilation ensure safety

The system has to be safe, as there are passengers on board all the time. “The outer tube of the double piping prevents gas leaks,” Ojutkangas says.

Natural gas is lighter than air so in case of leakage, it disappears with proper ventilation. LNG does not remain on board like propane gas would do, since propane is heavier than air. LNG is flammable only if its concentration is between 5 to 15 percent. Ventilation starts automatically if the gas concentration begins to rise.

However, gas is not the only fuel option. The engines can also be run on traditional diesel fuel. “If a failure occurs, engines can be turned to run on diesel fuel in the blink of an eye,” explains Ojutkangas.

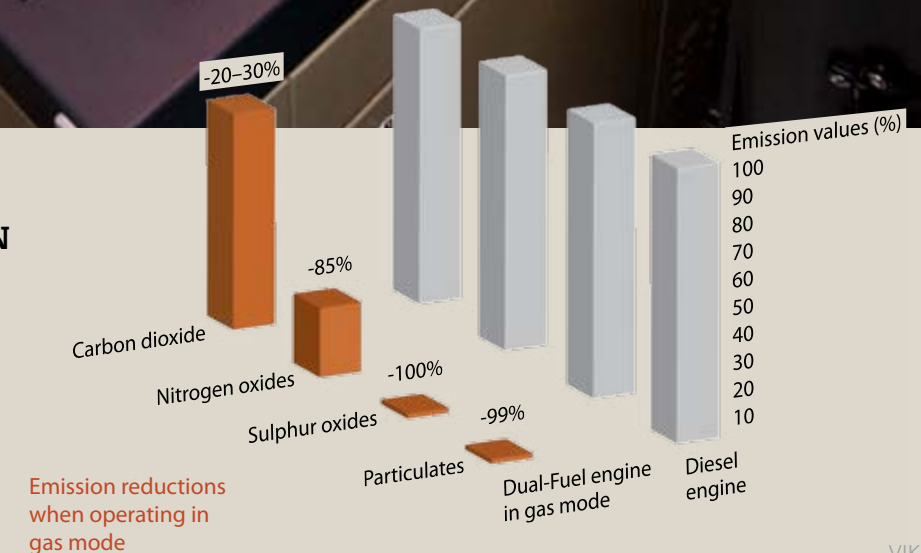
Natural gas engines are economical as well, since they are more fuel-efficient than engines running on diesel fuel. Globally, there is still plenty of LNG available, so the price is expected to be affordable in the future. However, the most important advantage is that LNG is an environmentally sound alternative to fuel ships. ■

WÄRTSILÄ is a global leader in lifecycle power solutions for the marine industry and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers.

In 2012, Wärtsilä’s net sales totaled EUR 4.7 billion with approximately 18,900 employees. The company has operations at nearly 170 locations in 70 countries around the world. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland. www.wartsila.com



LNG USE AND EMISSION REDUCTION



Electric propulsion conserves energy and machinery



One of the most important objectives today for ABB's engineers is energy efficiency.

The operational profile of the Grace meets quite a challenge: the four prime movers are dimensioned for the 22 kn race across the Baltic Sea. In restricted waters she has to navigate slowly, forcing the engines to run at loads outside their "comfort zone". Viking Line and ABB continue working to reduce on-board energy consumption to this day.

"A few years ago STX started work on the next generation cruise ferries," says **Thomas Hackman**, business responsible of **ABB Marine's Ferry segment**. "We compared different ferry profiles of STX and Viking Line."

In the spring of 2011, ABB Marine won the contract to deliver the power plant and propulsion system for the Grace. In a nutshell, ABB's contract included the transmission of power produced by Wärtsilä's LNG main engines through a power distribution system. Most of the electricity is transmitted to the ship's propellers. The rest is used for other functions of the ship.

Production capacity reserved in advance

Actually, the project had gotten started before the contract was signed. Project Manager **Tapio Valminen** had already begun to ask subcontractors to reserve

production capacity, also known as slots. The tight construction schedule of the yard called for accuracy from each supplier.

Most of the subcontractors were ABB subsidiaries. The ABB Pitäjänmäki plant manufactured most of the rotating machinery, such as the two 10 500kW propulsion motors, the generators and the thruster motors. Some of the main components were produced by ABB units abroad, such as the propulsion frequency converters, which were manufactured in Switzerland. Still, more than 80 percentages of the components were made in Finland.

"Most of the outsourced components had standard specifications and were thus readily applicable for this project," Valminen recalls.

At the same time, a team of five engineers led by Valminen had started working on the plant design at the ABB Marine House in Vuosaari.

Electric propulsion conserves energy

The electric propulsion system based on the "power plant" principle is one of the key contributions to energy efficiency aboard the Viking Grace. In each loading situation, the system operates only as many of the four main engines as are necessary, thereby optimising fuel consumption. At the same time, service intervals for the LNG main engines are longer than normal because the engines

accumulate less "mileage."

ABB started component deliveries at the turn of 2011/12. Components were installed directly into the building blocks, making their installation easier than at a later stage. Deliveries were completed in March 2012. "We were even a little ahead of schedule," boasts Valminen.

The first Grace's sea trial began in December 2012. ABB technicians adjusted the system's performance for all thinkable situations. After that the ship operator and the authorities tested the ship's safety and performance. The final tuning was done in the second sea trial just after Christmas, and the Grace was delivered to Viking Line in January.

Energy conservation will continue

This was not the end of project Grace for ABB. The company installed an energy measurement and advisory system called Emma, which continuously collects data on the ship's operation such as the operational profile, trim, speed, energy production and consumption on board, like air conditioning. The aim is to determine the optimal use of the main engines and thus save on fuel, since all the power will come from the LNG main engines.

"The system could reveal issues – for example, if the head chef is using the stoves too much," Sales Manager **Tomas Michelsson** says. "Savings may be only a few percentage, but that could add up to tens of thousands of euros a year." ■

ABB MARINE & CRANES develops electrification and automation solutions for the marine industry. The company is renowned for its Azipod propulsion system. The Marine & Cranes unit in Vuosaari, Helsinki is responsible for many of the marine industry solutions within the ABB Group. The ABB Marine & Cranes business unit employs more than 1,000 people in 19 countries. www.abb.com

The goals of the air conditioning system are comfort and energy efficiency

Designers of the air conditioning system were instructed to focus on energy efficiency as much as possible while keeping passengers' comfort levels high. Koja's designers were using nanotechnology, the sorption effect based on anotech in AHU energy recovery wheels and the direct driven fans.

After a tough competition, Koja Marine was awarded the contract for air conditioning on the Grace in January 2011. The contract included air conditioning for all passenger and crew spaces and cargo space ventilation together with automation design.

"We have worked with numerous projects at the Turku shipyard, so they know what they are getting," says Director **Esko Nousiainen** of Koja Marine.

According to him, the product portfolio and quality are most important. "The product range of a marine industry company must be carefully designed. Price comes second."

The benefits of 3-D design

After the contract was signed, a dozen or so of Koja's designers began their work, which lasted until the spring of 2011. They used 3-D design for the first time. "The design went without a hitch. We will use this method in other projects as well," Nousiainen states.

The deliveries began in late 2011. Koja's Jalasjärvi plant had produced components for 33 air conditioning units. The components were trans-

KOJA LTD is based in Tampere and has two plants. In Jalasjärvi the company makes sheet metal components, while the Tampere plant focuses more on heavy equipment that needs welding work. Koja has four divisions: air handling products for buildings, air conditioning systems for ships, process fans for industry and services. In 2012, the net sales of Koja Ltd reached 39 million euros while the Koja Group sales totalled 45 million euros. The company employed 230 persons at the end of 2012. www.koja.fi

ferred from Jalasjärvi to the Tampere plant for assembling, electrification and testing. Koja manufactured almost all the units itself and only some of the components were obtained from suppliers.

Koja used all available energy conservation methods in designing the air conditioning system. For example, the air flow is different in summer and in winter. In addition, the system includes energy conserving frequency converters, plenty of direct driven fans and nanotech sorption wheels for cooling recovery. The sorption effect occurs when building materials attract substances from the room air and release them back into air.

Developing a new cabin supply air box

During the project a new cabin supply air box and diffuser was developed to create a new type of air distribution inside the cabin. The device is fitted into the ceiling and only a neat perforated plate is visible. It diffuses air evenly.

"Our proprietary product development is important to keeping up with the pace," Nousiainen says. ■



THE AIR CONDITIONING SYSTEM IS NOT VISIBLE AND IT CANNOT BE HEARD BUT IT CONTRIBUTES SIGNIFICANTLY TO THE COMFORT OF PASSENGERS AND GUESTS. A PLEASANT TEMPERATURE AND FRESH AIR ARE ESSENTIAL FOR THE SUCCESS OF A TRIP.



3-D modelling contributed to the design of air conditioning systems

The challenge of installing air conditioning systems to air conditioning rooms was the lack of space. Every component had to fit through the doorway.

"Negotiations with the subcontractors for the Grace were tough and many companies placed bids. We participated in several meetings," explains CEO (Managing Director) **Andrus Junolainen**.

Junolainen runs **R&M Ship Technologies Finland Ltd**, which deliver air conditioning rooms installation work for the Viking Grace.

The Viking Grace contract began in early 2012. The first half was spent on planning and preparatory work. R&M took advantage of 3-D design, which was little used at the time.

Subcontractors began supplying components and Koja Ltd. of Tampere, Finland, manufactured the air conditioning units. All of R&M's own employees were involved in the project, but as more planning staff was needed, R&M subcontracted additional designers.

Lack of storage facilities

The main challenge of the project was the lack of space. Any mistake could

cause a chain reaction and a small deviation could later turn into a big one. Similarly, designers had to keep in mind that all components needed to fit through doorways. The components could not be brought onto the ship at once, as there were not storage facilities.

Machine room installation began in the spring of 2012. A total of 23 air conditioning machines were installed on the Grace on R&M areas together with some 1,500 smaller components such as pipes and fittings.

Thanks to good planning and the experienced staff, the installation was a success. R&M's air conditioning system was put into service two months before the delivery of the ship, which took place in January 2013. Fine tuning was done until the very end.

"The project was challenging, but we got through it smashingly," Junolainen says. ■

R&M SHIP TECHNOLOGIES FINLAND is part of the German R&M Ship Technologies Group. R&M Finland is a turnkey supplier for the marine industry. Projects include designs for pre-fabricated and completely furnished cabins, as well as total solutions for wall, floor and ceiling. R&M has a staff of nine employees, and the company is based in Turku, Finland. www.rm-group.com

The vessel was electrified quickly

YIT Marine had to pull the cables and get them connected in order to power up the vessel on a tight schedule.

"We started the installation when first sections of the hull were laid down and the weldings finished," recalls Installation Manager **Antero Heinonen** of YIT Marine about the hectic early fall season of 2012.

YIT Marine was responsible for the power installations of several technical areas of the Grace, including the wheelhouse, radar mast, engine control room and engine rooms, along with 6.6 kV cabling and all necessary connections.

Moreover, the contract included the commissioning of engine systems and assistance with some other systems such as the LNG. A few installers also worked on interior systems.

"Work began with installations in the foremost engine room, and proceeded gradually to the aft-located engine room. After installation was complete on both engine rooms, electricians proceeded to the separator rooms and beyond," recounts Heinonen.

Electricity subcontractors worked in close cooperation with each other. ABB brought power to intermediate voltage boards, and YIT then installed cables to every part of the ship.

New work practices

The contract also included experimenting with new work methods related to remote-controlled valves. The challenge with the electrical installations was the tight schedule.

YIT Marine industry had up to 55 installers in the yard but the average number of workers was around 40.

YIT's contract for the technical areas needed to be completed before the sea



trial began. Work on the engine systems continued until the delivery.

Heinonen participated in the second sea trial just after Christmas. "Everything worked well, even though the new LNG technology was involved," he explains.

After the final delivery, Heinonen felt a little "empty". At the same time, he was pleased with the outcome of the project, as there were only a few remarks. ■

YIT INDUSTRY LTD was founded in 1920 and employs 3,000 people. In 2012, turnover amounted to 280 million euros. In the marine industry, the company provides power installations, steel and pipe outfitting, commissioning works and turnkey projects of technical areas, such as ventilation rooms and tank spaces. The company participated in building the Oasis and Allure cruise ships, as well as the Tahiti Perdido and Lucius oil platforms, to mention some of its projects. www.yit.fi



Design of the snow cave turned out well

The two-story theater, the snow cave and the aroma sauna had to be designed to attract passengers.

"STX Turku shipyard signed a contract with Viking Line just before Christmas 2010. During the following month we started to calculate accurate proposals for several areas of the ship," CEO **Jari Suominen** of **NIT Naval Interior Team** Ltd recalls.

"The competition was tough, and we finally won a couple of areas: the two-story restaurant and dance theater called Club Vogue together with one of the main staircases, and later the designing work of the spa, too."

NIT and the STX signed a contract in April and planning began immediately. The first task was to make a project plan, after which the design team was set up. The HVAC and piping design began in the following summer. The design work included a lot more, like walls, ceilings, floors, the electricity and stairs and landings, "from steel to steel", as Suominen puts it.

There was only an empty shaft

Some sections of the restaurant and the staircase could be constructed using standard components, while others were customized and dismantled into smaller pieces before assembling. The components that required plenty of work, such as welding and painting, were fully com-

pleted before assembling.

"Initially there was only an empty shaft and we filled it with a decorated main staircase," Suominen says.

NIT employed some ten designers. The spa consisted of a variety of different saunas such as a steam and an aroma sauna. In addition, the spa department included a snow cave, therapy rooms and private cabinets. "The spa design was very successful, the concept ended up very functional," Suominen says.

The construction of the restaurant Vogue and the staircase were started in early 2012. A portion of the task was carried out prior to the launch of the vessel in August 2012 and the remainder thereafter. The rigidity of the installations was tested during sea trials. Shaking the vessel by powerful braking was essential to find out if the interior is firm and silent enough.

Made in Finland

NIT's contract was completed on January 3rd, 2013. Suominen remembers well the celebration of the delivery, which many ministers and MPs attended. The celebration was characteristic for Finland. "Previous delivery celebration events have been more like those in the US."

All in all, this story had a particularly happy end. The shipping company and the shipyard expressed their satisfaction with NIT. Actually NIT was happy as well, as its budget exceeded so little, not even worth mentioning. ■

NIT NAVAL INTERIOR TEAM is based in Kaarina, Western Finland. The company is an Interior, HVAC and Piping solution provider for cruisers and passenger ferries. In addition to Viking Grace, NIT has participated in construction of Oasis class ships together with tens of cruisers and other passenger ships. The company employs 32 people. www.nit.fi

NIT DESIGNED THE SPA DEPARTMENT FOR STX FINLAND CABINS.



CLUB VOGUE IS A TWO-STORY RESTAURANT AND A DANCE THEATER.



NIT DELIVERED THE FULLY OUTFITTED MAIN STAIRCASE.



"The spa design was very successful and the concept turned out to be highly functional," CEO Jari Suominen says.

Foldable beds save space

The Grace's cabins needed 2,500 foldable beds, also known as Pullmans. Every corridor needed sustainable walls that are easy to keep clean. Famous for their ironworks tradition, the people in Mustio rolled up their sleeves and got to work.

At the turn of 2010-11, **SBA Interior** was first contacted regarding the new Viking ship project. The Mustio-based company has developed and delivered foldable Pullman beds, panelling systems and other supplies for ship cabins and corridors for many years.

After several months of negotiations, SBA received the first orders including a request for 2,500 Pullman beds in November 2011. The Pullman foldable bed is used for sleeping at night

but can be folded up towards the wall during daytime, providing more space in the cabin.

The deliveries of the aluminium beds to the STX Cabins plant began in January 2012 and the last one left Mustio just before midsummer.

A panel for almost every corridor

In addition, the company was awarded a contract for the JMC 1 Panelling system, and the order consisted of approximately 15,000 square meters of PVC coated steel panel. These panels were to cover almost every corridor wall of the ship. In addition, the company received an order for 700 service doors that were installed between cabins to give access to water and drain valves.

"PVC coated steel panel is very durable and ideal for public spaces like corridors," Sales and Project Manager **Thomas Pökkelmann** of SBA says. The

corners of the recess walls received stainless steel profiles to protect them from dents and scratches.

One of the advantages of SBA panels is their flexible size, as the maximum width is 1150 millimetres. "Architects particularly prefer the wide panels, as they usually want to avoid seams," explains Pökkelmann.

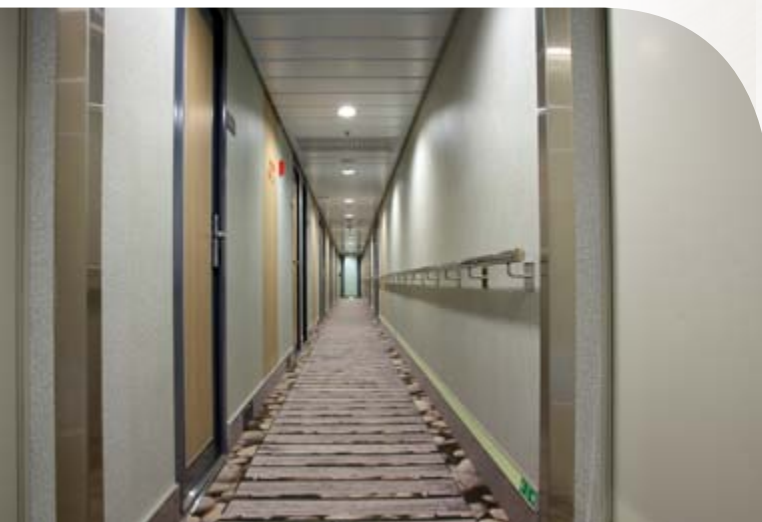
The panels insulate against noise and are extremely durable thanks to a rock wool layer between metal sheets. The panels are also fire-rated and available in numerous shapes and colours, even in digital printing.

The coils of steel needed to manufacture the panels arrived from Sweden and Italy. The first deliveries, which were heading directly to the shipyard, started in mid-June 2012, and trucks drove to Turku until November.

"Overall, these contracts were good and orders and deliveries went smoothly," recounts Pökkelmann. ■



Founded in 1985, SBA INTERIOR has production facilities in Mustio, Southwest Finland. The company's main products are the JMC 1 Panelling system and furniture such as beds. In addition, SBA works as a subcontractor for the metal industry. Turnover is around ten million euros annually, half of which comes from the marine industry. SBA's products have been installed on hundreds of ships around the world, including the world's largest cruise ships, the Oasis of the Seas and the Allure of the Seas. The company employs some 70 people.
www.sba.fi



Shower room floor must be warm and dry

Cabin toilets and shower rooms needed a warm floor that dries quickly.

"We made model wet room floor elements for the cabin manufacturer STX Cabins in November 2011," CEO of Joptek Ltd **Aku Lampola** recalls.

Joptek received an order for 800 pieces of wet room floor elements, in practice for each passenger cabin and crew cabin. Only some of the special cabins got a different floor for the toilet unit.

Joptek has also manufactured balconies for cruise ships, but Grace, which cruises in the cool north, does not need balconies. The visible part of the floor is black and white. The center of each floor has attractive imitation tile, which is easy to keep clean.

"Black and white are the colour chart extremes. They look nice, but they are quite challenging to produce," Lampola says.

Light weight and durability

Joptek's floor elements are made of

fiberglass composite. They benefit from a sandwich structure and are therefore light-weight, high-strength and corrosion-resistant. The elements are compact and functional products and designed to easily fit in to the ship's cabin. One essential floor feature, full water tightness, has been developed by Joptek, which has more than ten years of experience making floors of this kind.

Beneath the beautiful surface, floors include plenty of technology. Each element of the floor contains the necessary draining and heating elements. Their design takes into account air-conditioning ducts. The composite material also meets fire regulations.

After the approval of the floor model, delivery began rapidly from Joptek's factory in Lieksa to the cabin factory in Piikkiö, Western Fin-

land. All the elements were delivered by summer 2012.

"This was kind of a medium-sized contract for us," Lampola says. ■

JOPTEK COMPOSITES LTD. is an expert in composites and light-weight construction technology. The company designs and manufactures custom-made lightweight constructions and composite construction systems for customers in transportation, technology and the marine and construction industries. Joptek is based in Lieksa, Eastern Finland and it employs 100 professionals. www.joptek.fi



Ceiling panels must be lightweight

Cabins and corridors needed attractive ceiling that must also be firesafe and lightweight.

"We made our first offers for the suspended ceilings at the end of 2011," Sales Director **Jarno Soinila** of Lautex Oy says.

Lautex won contracts to supply suspended ceilings to a number of locations inside the Grace. The company's ceilings were needed for cabins, cabin corridors, crew stairs, the wheelhouse, the engine control room, and the spa area.

Some of the ceilings, like those in cabins and cabin corridors, needed a fire-rated ceiling panel. The Lautex B-15 class panel ceiling is made of steel and filled with fireproof rock wool.

Lightweight for easy installation

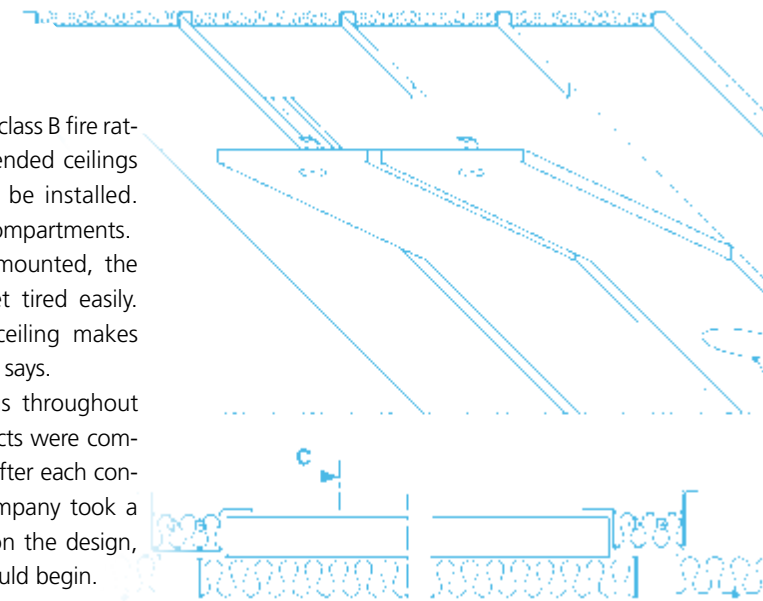
In compartments where a class B fire rating is not required, suspended ceilings made of aluminium can be installed. The spa is one of these compartments.

"When the ceiling is mounted, the arms of the installers get tired easily. Lightweight aluminium ceiling makes installation easier," Soinila says.

Lautex supplied ceilings throughout 2012, and the last contracts were completed in autumn 2012. After each contract was signed, the company took a couple of days to work on the design, after which production could begin.

Most of the ceilings could be built using standard parts. The suite ceilings located on the bow, however, were particularly challenging. "The ceilings were curved and had a special shape, which meant some extra work," Soinila recalls.

Despite the challenges, Lautex managed to deliver the ceilings on schedule. The last truckload of suspended ceilings was sent to the shipyard around the end of 2012. ■



LAUTEX OY from Nummela, Finland manufactures metal suspended ceilings for the ship-building and construction industries. The company has delivered ceilings for large cruise ships such as the Oasis of the Seas and the Allure of the Seas. Lautex's turnover is around eight million euros annually and it employs 70 people. www.lautex.com



IN COOPERATION WITH

- Aalborg Industries Oy • ABB Oy, Marine • Aker Arctic Technology Oy • STX Finland Oy • STX Finland Cabins Oy
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