Goltens

InService

Goltens Worldwide Newsletter | Issue 01.2016

The Independent Alternative

Across industries, Goltens' investments in advanced tooling, technical training and technologically advanced repair processes continue to save customers money and downtime all around the world

Royal Netherlands Navy Gets Proactive

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Goltens and Optimarin team up for turnkey retrofits on 10 naval vessels.

Closer Ties with Woodward

p. 9

Goltens is now a key distributor and partner for the company in the Middle East and Africa.

Service Expansion in the Offshore Sector

p. 10

Goltens' services are in increasing demand as the offshore oil & gas sectors continue with a challenging market.

COO's message

The Independent Alternative

The Challenge Continues

The recession continues to plague businesses around the world. With the subsequent meltdown in the oil and gas sectors and a slowing Chinese economy, none of this looks to be a short-term event, but rather, the new normal.

Businesses around the world are struggling to stay afloat. Many have succumbed to the extreme market volatility in bankruptcies or fire sale acquisitions and mergers. Others have proactively and aggressively restructured and adapted their business strategies to survive in this new situation.

Waiting for the market to "come back" is a luxury few businesses have. Now more than ever, pressures on operators' O&M budgets and insurers' loss runs are extreme. Neither of them can endure the costs of lost production and unnecessarily long and expensive repairs. These tough times call for strong partners and changing behaviors and approaches to repairs and maintenance.

Finding a lower cost alternative to the OEM is easy. Finding one that can provide support globally with the highest quality repair methods and a demonstrated track record of cost efficient delivery is more of a challenge.

OUR FOCUS

At Goltens, we constantly focus on improving our products and services and streamlining our operations to keep the costs to our customers as low as possible. Because we are not a maker, we have no stock to turn over. Instead, we are motivated to repair rather than condemn items that can be salvaged efficiently and minimize downtime and costs for our customers in the process. We pride ourselves on innovative approaches and work closely with owners, operators and insurers to offer the most cost-effective and expert solutions.

OUR INVESTMENTS AND CAPABILITIES

Throughout the crisis, we have continuously advanced our capabilities by forming and expanding strategic partnerships with select OEMs and acquiring specialized service capability and expertise. We have also continued to invest in R&D targeted at improving the accuracy and speed of our repair processes, procedures and tooling.

To address the expanding demand of the offshore community for our services, we have dramatically expanded the offshore certification of our technical resources and maintained our focus on our quality certifications and standards.

OUR PRESENCE

During these challenging times we have also made strategic investment decisions about where we need to be and how we service our client base. Looking critically at the globe, we have decided to exit certain markets while opening new service centers in regions where we feel our clients need us most while maintaining an ability to respond in short order to customer requirements anywhere in the world.

Additionally, we are continuing to expand Goltens' agent network to facilitate a closer touch to our customers in certain regions where we cannot be present. The ability to reach a Goltens representative in local language and local time zone is critical.

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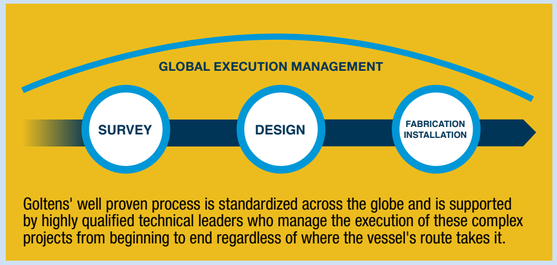
THE GLOBAL ALTERNATIVE

In this issue, we want to show you how we are improving our strengths and methods and the corresponding results for customers across the markets we service. We sincerely hope that our existing clients will learn about, and take advantage of, our expanding range of services and products. If you are not yet a customer, we hope that you will find the information in this newsletter a compelling reason to consider Goltens as a trustworthy and reliable alternative to the OEM and other service providers. ■

Roy S. Strand
Chief Operating Officer
Goltens Worldwide

The Power of Dealing With a Global Player



Goltens' well proven process is standardized across the globe and is supported by highly qualified technical leaders who manage the execution of these complex projects from beginning to end regardless of where the vessel's route takes it.

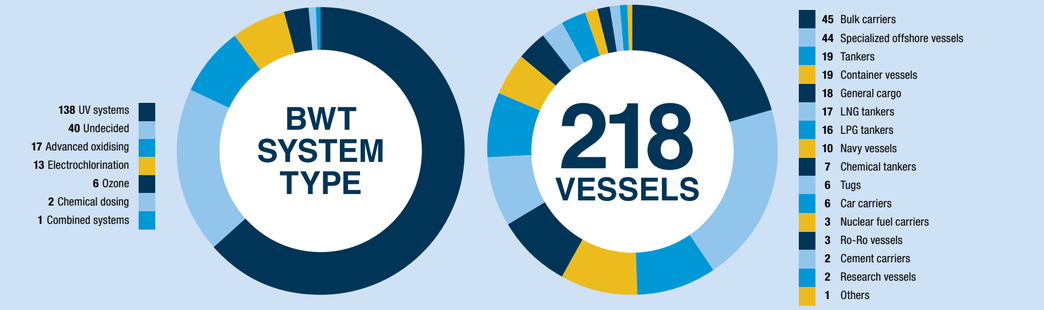
Goltens' Global Retrofitting Capabilities Introduce Efficiencies for Owners

Planning and executing ballast water retrofits for a global fleet is a challenge for ship owners. Having a service partner in their own region for contracting and communication is critical but so is the ability to cost effectively complete the field preparations and retrofit wherever the vessels are located at the time. While there are many service companies and shipyards performing ballast water retrofits around the world, most of these market players are single location companies. The global reach is why many choose Goltens as their partner, because they can service fleets wherever they operate.

The advantages of working with a global partner are significant. Ship owners can engage Goltens in one region and have another Goltens station visit the vessel in a location on the ship's trading route to perform the ship check and laser scanning of the engineering spaces. While the vessel remains operational, Goltens takes care of all modeling and detailed engineering and prefabrication work with no interference to the vessel's schedule. Finally, the installation or installation supervision can be completed by whichever Goltens station is the most conveniently located.

These carefully coordinated intercontinental projects are executed according to Goltens' standardized process without the excessive travel costs and communication issues associated with dealing with smaller local companies.

The benefits are not theoretical and the results speak for themselves. The case studies below illustrate how customers have leveraged resources from Goltens' Green Centers of Excellence around the world to plan and execute retrofitting projects for a more efficient result. ■



Turnkey Team up in Asia

Three stations collaborate for turnkey Optimarin retrofit In Asia.

Optimarin Japan contracted Goltens Singapore to perform a turnkey installation of Optimarin's OBS onboard a container vessel operating in Asia. The team followed Goltens Green Technologies' process to verify the system fit, model the layout, perform detailed engineering, prefabricate all piping and install and commission the system prior to the vessel finishing its upcoming yard period in China.

SCANNING, MODELING AND ENGINEERING

Goltens performed extensive 3D scans of the engine room while the container vessel was in normal operating condition over six hours while berthed in Singapore.

The 3D model of the Optimarin system was overlaid onto the 3D scan of the engine room to show how the system would fit and be used as the basis for the detailed engineering for all piping, foundations and steel work. Goltens Singapore then carried out an inspection during the voyage to verify the drawings and create a detailed plan for the retrofit.

PIPE PREFABRICATION

Thanks to the accurate models from the laser scans, all piping could be prefabricated by Goltens Vietnam, saving a tremendous amount of installation time compared to welding and fitting the pipes onboard. All prefabricated piping along with other materials and tooling required for the installation were shipped to Goltens Singapore and brought aboard the ship.

RETROFIT INSTALLATION

To avoid a chaotic situation in the 18 day drydock period and avert any unplanned delays, Goltens completed most of the installation on a seven day voyage to Yiulian Shipyard in Shekou, China with a five-man riding crew. The final steps to remove and replace the existing ballast pipes with the prefabricated ones and connect to the ballast system were completed before the vessel left the dry dock.

COMMISSIONING

Goltens Shanghai and an Optimarin engineer carried out commissioning when the vessel was alongside the pier. They also trained the ship's crew on how to operate the system during various conditions. ■

Optimarin Filter Installation during drydock

3D scanning in the engine room

A Truly Global Project

Five Goltens stations partnered up for a Turnkey BIO-UV Bio-Sea installation while the vessel remained in full operation.

One of the world's leading container companies approached Goltens Green Technologies in Groningen to propose a project plan to carry out the complete scope for the retrofit of a BIO-UV Bio-Sea 1000 m³/hr ballast water treatment system on one of their 8,500 TEU container vessels. As the vessel covered global routes, the ability to cost effectively engage the vessel in different regions around the globe while the vessel remained in operation was a key consideration in the award of the project.

SCANNING IN THE US / DESIGN IN EUROPE

Goltens Green in Groningen arranged for laser scanning to be completed by Goltens in the USA while the vessel was alongside during a scheduled port call. The scan data was then sent back to Goltens Green in Groningen for the completion of system modelling and preparation of the detailed engineering package.

PREFABRICATION IN DUBAI

Once the design was developed and approved, Goltens planned the prefabrication and installation work. As the vessel was calling Europe, the initial plan was to prefabricate and install in Europe but trading routes shifted to the Middle East. As a result, Goltens Dubai engaged to prefabricate all piping to specification and package the retrofit kit for the installation.

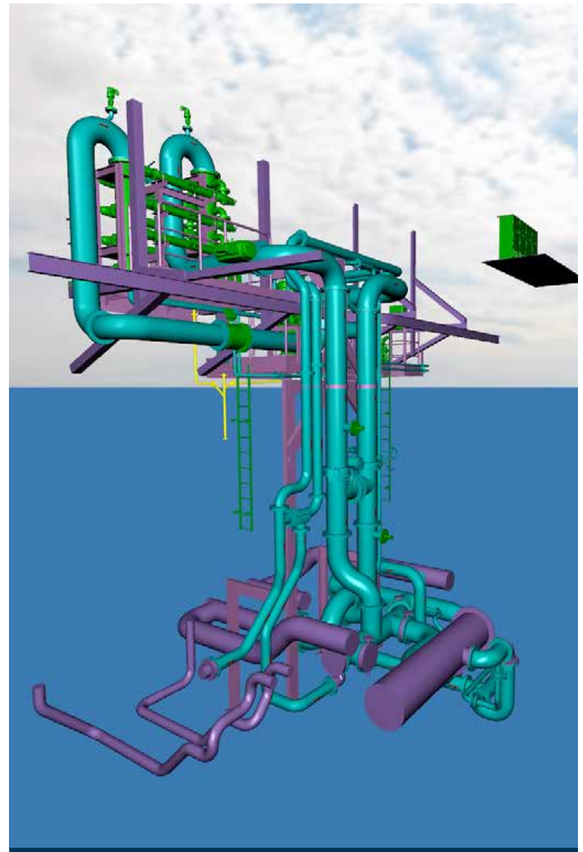
RETROFIT INSTALLATION IN ASIA

Once again, the vessel schedule changed and responsibility for the installation was then passed to Goltens Green in Singapore and an evaluation of the vessel's schedule was done to determine the best location to engage the vessel. The retrofit package was shipped directly to Port Klang in Malaysia where the kit was brought onboard and a team of 6 Goltens technicians joined the vessel for mechanical and installation work. When the vessel reached Shanghai an additional team of 5 electricians from Goltens Shanghai joined the vessel and completed the electrical work in parallel with the remaining piping work prior to commissioning the system.

COMMISSIONING

A Service Engineer from Samsung joined the vessel at anchor in Shanghai for the purpose of integrating the new BWTS system into the existing ship's ballast control system. The BIO UV engineer validated all electrical connections prior to performing commissioning checks and testing on the installed system. ■

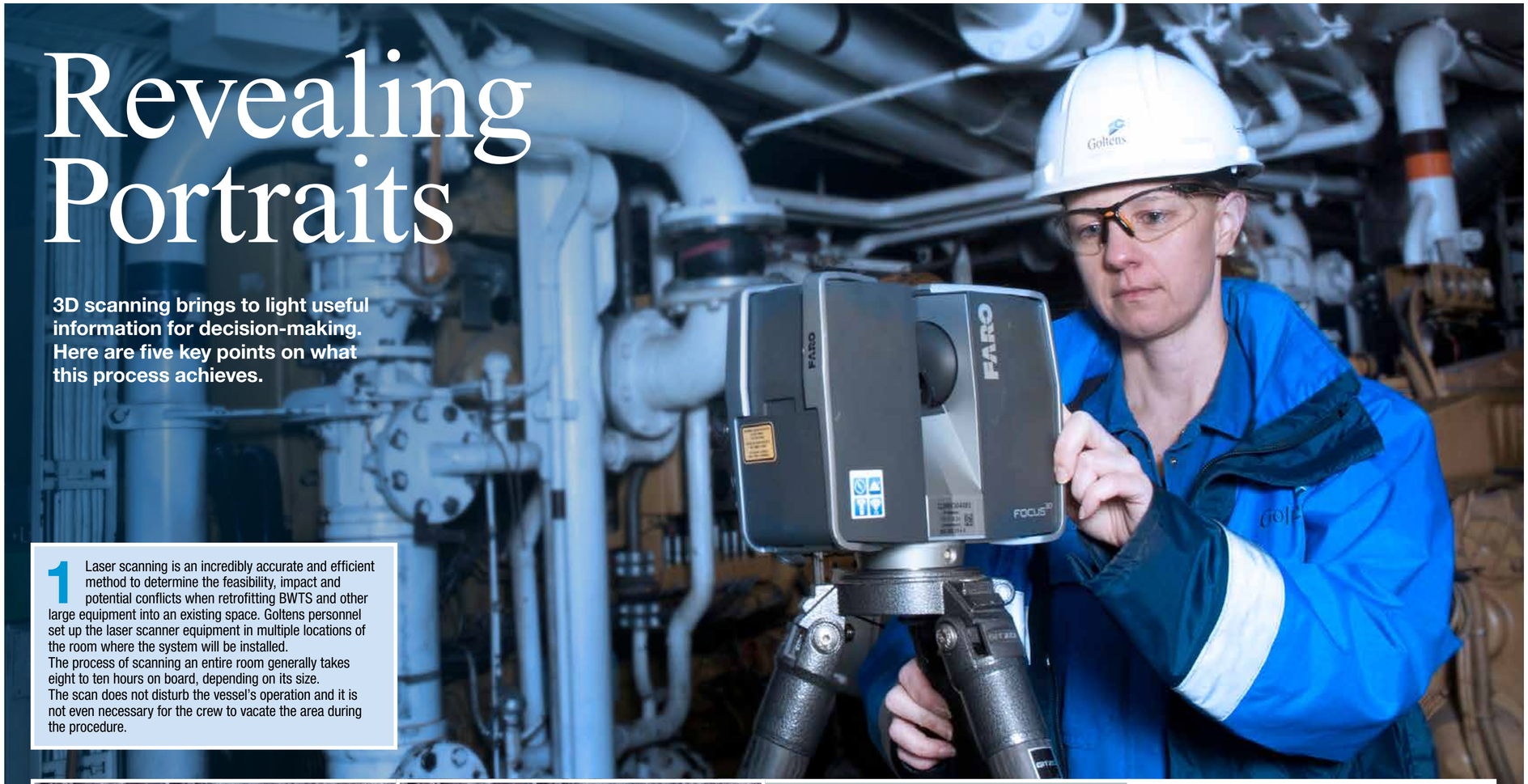
A portion of the BIO-UV Bio-Sea ballast water treatment system installed on a container ship



A 3D model of the BIO-Sea treatment system integrated in the vessel

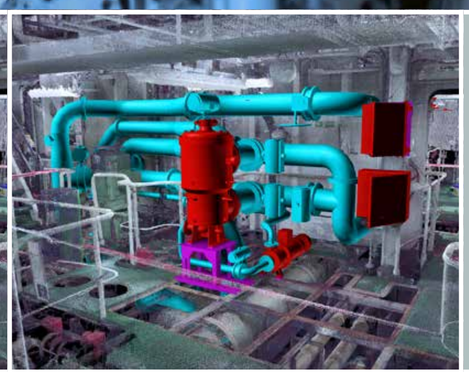
Revealing Portraits

3D scanning brings to light useful information for decision-making. Here are five key points on what this process achieves.

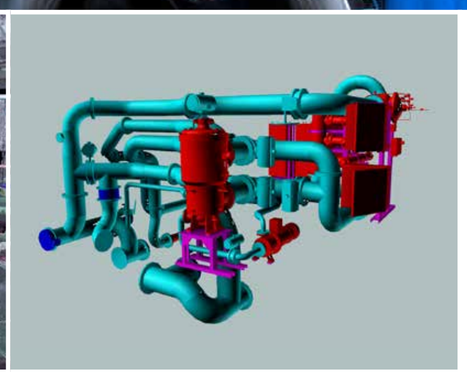


1 Laser scanning is an incredibly accurate and efficient method to determine the feasibility, impact and potential conflicts when retrofitting BWTS and other large equipment into an existing space. Goltens personnel set up the laser scanner equipment in multiple locations of the room where the system will be installed.
The process of scanning an entire room generally takes eight to ten hours on board, depending on its size.
The scan does not disturb the vessel's operation and it is not even necessary for the crew to vacate the area during the procedure.

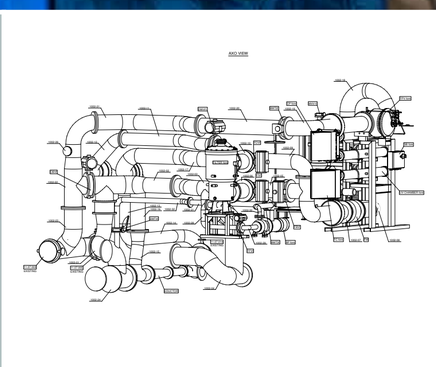
2 The scan produces a point cloud of over ten million data points. For an average installation, 15 to 35 scans are made. These point clouds are stitched together and used by a 3D CAD program to create a fully three dimensional and highly accurate image of the area and all details inside it.



3 The next step is to model the BWTS into the rendered room. At this point, it becomes possible to see exactly how the system would fit, evaluate rigging restrictions, locate power supplies and determine whether there will be sufficient space to walk around the system and service it.



4 Several systems can be modeled to show which one would fit best. The ship owner and crew can provide feedback and suggestions, and Goltens Green Technologies experts will look into the options for implementing their requests. After the concept is agreed upon, detailed engineering can begin. Detailed production drawings are prepared for all piping, supports and foundations.



5 The accuracy of the process allows for the prefabrication of a complete kit, ready for installation. Piping (including its pre-galvanizing), connections and foundations can also be precisely prefabricated, which eliminates the time-consuming, on-site pipe fitting process. This process is particularly attractive for sister vessel retrofits. Because the design can be re-used on sister vessels, overall costs will decrease for each vessel beyond the first.

Saving time and effort

Goltens' approach dramatically streamlined a retrofit process for a UK shipyard.

Impressed by the accuracy and efficiency of work Goltens Green Technologies had done on retrofits for Komaya Shipping, A&P Group didn't hesitate to recommend Goltens for similar work to Serco.

"The seamless way the installations fitted on these vessels gave the yard the confidence to recommend Goltens to Serco for the installation of a ballast water treatment (BWT) system on the SD Northern River," says Jez Littlejohns, Sales & Marketing Director at A&P Group, referring to work Goltens undertook for the LPG tankers Knightsbridge and Chelsea.

The SD Northern River is a multi-purpose auxiliary ship operated by Serco for the UK navy, the vessel is currently the largest operated by Serco Marine Services, both in terms of dimension and gross tonnage.

As with Knightsbridge and Chelsea, Goltens did laser scanning, design, detailed engineering and preparation of all materials for the installation of a BWT system, after which A&P Group's Falmouth yard fitted the system both mechanically and electrically.

Jurrien Baretta, Business Development Manager at Goltens Green Technologies, says the company's relationship with A&P Group started by chance, when Komaya Shipping took a Goltens installation package to the yard comprised of an installation guide plus all the required materials.

A&P quickly discovered the benefits of the Goltens' approach. Laser scanning makes pre-engineering and prefabrication, as well as finding the optimal positions for piping and equipment easier than doing everything on board the vessel.

EASIER APPROACH – FASTER INSTALLATION

Littlejohns estimates the yard saved about two weeks by using prefabricated installation packages from Goltens' compared with the time it takes to build and fit pipes to a design.

"The drawings and worded spec were very good to use," says Littlejohns. "The imaging DVD was also excellent as a guide demonstration of the completed image for all." Goltens produces materials such as piping and foundations to accurate size and Littlejohns says there were very few modifications to the pipes provided.

"The BWT installation, which could easily have been the critical path, became something that happened in the background with very minimal input required. This allowed Serco to concentrate on the rest of the refit and make sure other issues were addressed," says Littlejohns.

He adds that A&P Group did not hesitate to recommend the Goltens approach to Serco because offering the full package of design, class approval, manufacture and supply was a big advantage.

"The detailed information provided by Goltens also allowed A&P Group to give Serco an accurate price and minimal time scale for the installation. This allowed Serco to accurately budget and minimize the costly out-of-service time for the vessel," says Littlejohns. ■

SD Northern River

Sulphur Emissions:
Legislation and Compliance

The sulphur emissions control legislation has come into force and will be phased in to tighten standards globally by 2020. While some shipowners still weigh their options, others take action.

A variety of compliance options are available to owners to address these regulations, and Goltens Green Technologies has demonstrated experience with them all.

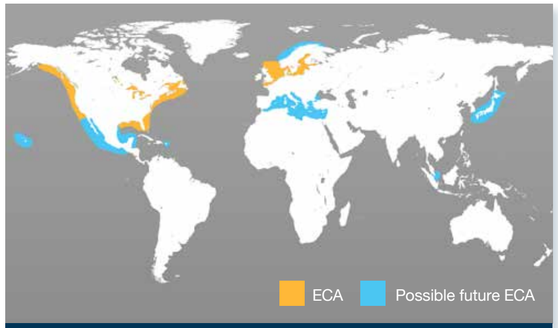
The options range from the installation of scrubbers to remove sulphur emissions from low-cost heavy fuel, to modifications to the fuel system that allow the vessel to run effectively on low-sulphur gas oil (LSGO). Fuel system modifications generally involve the installation of LSGO coolers to increase the viscosity of the fuel to prevent long-term wear damage to the engine. For LNG vessels, many operators pursue a full boiler retrofit to allow for operation on tri-fuel.

A variety of considerations are affecting decision makers' choices on which path to pursue to comply.

- Vessel age versus capital investment
- Amount of sailing time spent in the Emission Control Area (ECA) zones
- Falling oil prices reducing cost impacts of operating on LSGO
- Unknown long term impacts on engine wear from running LSGO which generally is known to have less viscosity and lubricity and higher acidity
- Global supply and bunkering of LSGO
- Potential for increased oil prices driving LSGO price and operating costs back up

Perhaps the biggest driver keeping owners who are not operating regularly in the ECAs from taking a more deliberate step is the potential for a delay in implementation of the 0.5% Sulphur limit from 2020 to 2025. The decision lies with the IMO review scheduled for 2018 and is based on the availability of required fuel oil for compliance.

While the drop in oil prices has certainly slowed the adoption of scrubber technologies outside the passenger and ro-ro industries, it is unclear how or when owners in other sectors will begin preparations for the scheduled global limits reduction in earnest. At present, it appears that most merchant categories are choosing the LSGO option as it requires minimal investment in vessel infrastructure when compared to exhaust scrubbers. ■



Sulphur Emission Control Areas

Sulphur emission control legislation related to MARPOL Annex VI has been in effect for quite some time within designated Sulphur Emission Control Areas (SECAs). These SECAs are areas where strict controls to minimize sulphur emissions from vessels were established. The SECAs in effect are the Baltic Sea (2005), the North Sea (2006), US and Canada (2011) and the U.S. Caribbean (2013). Within these areas, sulphur limits for fuel have gradually been reduced from 1.5% prior to 2010 to a limit of 0.10% starting in 2015. To date, these regulations have largely affected only vessels trading within the ECAs, but that will begin to change over the next four years.
The rest of the world's fleet will feel the impact of the legislation in 2020 when sulphur limits are scheduled to drop globally to 0.5%.

Sulphur Emission Limits

Outside an ECA established to limit SOx and particulate matter emissions	Inside and ECA established to limit SOx and particulate matter emissions
4.50% m/m prior to 1 January 2012	**1.50%** m/m prior to 1 July 2010
3.50% m/m on and after 1 January 2012	**1.00%** m/m on and after 1 January 2010
0.50% m/m on and after 1 January 2020	**0.10%** m/m on and after 1 January 2015

Three Paths to Emissions Compliance

EXHAUST GAS SCRUBBERS – THE LONG TERM SOLUTION

Goltens Green Technologies installed two 10 meter long exhaust gas scrubbers on a large cruise vessel equipped with four GMT/Sulzer 16ZA40S and two GMT/Sulzer 12ZA40S diesel electric generating sets.

Due to extensive project planning and detailed surveys using 3D scanning, the installation project was completed over an 18 day period with preparatory work completed on voyage and installation completion in a drydock in the United States. Goltens subsequently completed the installation of two more scrubbers on another vessel for the same owner.

Rigging scrubber section into the ship

FUEL OIL COOLER INSTALLATION – THE MID-TERM SOLUTION

Goltens Green Technologies retrofitted seven Q-Flex LNG carriers with LSGO cooling systems and controls to meet emissions standards and maintain a minimum viscosity of 2 percent in the LSGO fuel, optimizing engine reliability, operability and maintainability.

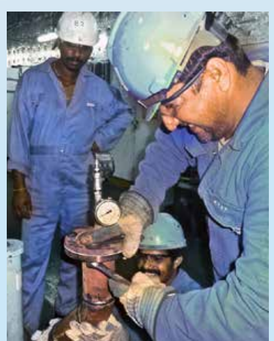
The cooler installation and piping modifications leveraged 3D laser scanning and onboard surveys to generate design drawings and prefabricate piping prior to installation. Installations were completed at anchorage or during ballast voyages between Asia and UAE as well as Europe and UAE with no operational downtime.

LSGO Cooler installed on board

FUEL TANK AND PIPING MODIFICATION – THE SHORT TERM SOLUTION

Goltens fitted 15 Q-Flex LNG carriers with modifications to support their fleet-wide Low Sulphur Gas Oil (LSGO) bunker and transfer modification project to ensure compliance in the SECA regions and to provide flexibility with trading routes and fuel selection.

The modifications consisted of piping modifications that enabled the operator to switch over from heavy fuel to LSGO when required but did not include the LSGO cooler installation to increase the viscosity of the fuel. These installations were a short-term compliance solution as they would not optimize engine reliability, operability and maintainability without the eventual installation of an LSGO cooler. Goltens completed the work on all vessels while they were in service and without any loss or delays of cargos. ■



Preparing for fuel system pressure testing

The Royal Netherlands Navy
– A Proactive Approach to Protecting the World's Oceans

Goltens and Optimarin team up for turnkey retrofit of 10 naval vessels.

The Netherlands ratified the IMO Ballast Water Convention in 2010. Despite being eligible for an exemption from the IMO Ballast Water Convention, the Dutch Ministry of Defense put plans in motion to evaluate the feasibility to outfit their vessels with treatment systems.

The Ministry of Defense's plan was to be comprehensive with all newly built vessels outfitted with treatment systems during construction and a feasibility study performed on the rest of the fleet. The Ministry of Defense decided to approach this upcoming regulation in a proactive manner and not to wait until the date of ratification. The Ministry foresaw that this approach would provide for solid preparations within the public tendering regulations and allow them to execute a proper solution and avoid the supply bottlenecks that are projected post ratification.

THE TENDER PROCESS – THE "BEST VALUE" METHOD

It was concluded that 11 ships would be considered feasible for retrofit and the first of these was completed during a schedule drydocking. For the remaining 10 ships, three public tenders would be raised, one for each class of vessel with the end objective of retrofitting the vessels before the end of 2018.

In 2013 the Ministry of Defense appointed a 13-year experienced, Mr. van Kruisbergen as the project manager for the retrofit program. Prior to joining the Ministry, Mr. van Kruisbergen started his career as a technical officer with the Royal Dutch Navy.

The team assembled by van Kruisbergen decided to move forward with the "Best Value" procurement method. This method was seen as the one where business knowledge is utilized to the maximum while minimizing the effects of the lack of specific ballast water treatment expertise that was available on the team. In the end, the procurements were structured to identify the most economically advantageous solution that met the technical requirements to comply with IMO and US Coast Guard regulations with the least negative effect on performance, maintenance and shipboard operations.

SELECTION PROCESS

Goltens Green Technologies, together with system supplier Optimarin, tendered retrofit proposals that met the Ministry's goals for all three classes of vessels and was judged to have the most economically advantageous proposal. "Clear statement of work flow", "Smart answers to questions" and "ambition and commitment" were all highlighted items in the documentation and interviews, the Ministry of Defense noted.

Goltens subsequently completed the specification phase and executed the final of the three contracts on May 25, 2016 at the Ministry's headquarters in The Hague.

2018 COMPLETION AND COMPLIANCE – A SHARED GOAL

Goltens Green Technologies and the Ministry of Defense are focused on meeting the objective set. Execution of the project is well underway and retrofit of the 10 vessels and compliance with the IMO and US Coast Guard regulations is on track to be completed before the end of 2018.

According to van Kruisbergen, the Ministry of Defense is enthusiastic about working together with the Best Value method and that "from both sides the right people work together from the early beginning of the specification phase."

Because of this early cooperation, solid momentum was built in the procurement phase and still exists in the execution phase. "I see enthusiasm from people working with this project wherein different people with different backgrounds work together to meet the same goal. It is really motivating to see more and more people getting involved and putting energy in this project" says van Kruisbergen. ■

Maarten Jeronimus, Vice President of Goltens Europe and Captain RNLN J. F. Kwak, Head Projects Procurement Division at the contract signing ceremony May 25, 2016 in The Hague for turnkey installation of sixteen Optimarin Ballast Systems (OBS) on 10 Naval vessels

The HNLMS De Zeven Provinciën (F802), one of the 10 retrofitted vessels

Twice as Nice

Al Nisr and Al Kaser docked stern to stern in Dubai Maritime City

Goltens Dubai converts two platform supply vessels to well stimulation vessels – at the same time.

Since moving to a new purpose-built facility in Dubai Maritime City in the first quarter of 2013, Goltens has substantially increased its service portfolio to the offshore marine sector. In addition to the significant investment in the new facility, the company also invested in additional management, planning, and safety resources. Further specialized equipment was also added, namely, hydro-blasting, generator sets, scaffolding materials, man-lifts, and all other ancillary tools and equipment to support the expanded operation.

Since that time, Goltens has roughly doubled the number of dockings per year compared to what it handled in the previous location and now averages more than 30 per year, the vast majority of which are offshore support vessels.

Their services range from hull painting and steel renewal to complex damage repairs and vessel conversions. One of the more complex projects was the conversion of two platform supply vessels, the Al Nisr and Al Kasr, into well stimulation vessels for Al Mansoori Production Services.

THE PLANNING

The project required the removal of the existing cement tanks and installation of new acid tanks. To access the tanks, a twenty by five meter opening needed to be cut in the main decks. This was best accomplished in drydock to maintain the structural integrity of the vessels and minimize any dynamic forces from being afloat. Doing both dockings in parallel increased the challenge even more.

Goltens management laid out detailed project and logistical plans and completed structural calculations on the impact of the steel removal and mitigation plans before drydocking the vessels in Dubai Maritime City.

EXECUTION

Once planning was complete, the vessels were docked stern to stern to increase work efficiencies and the access holes were reinforced prior to cutting. Goltens installed additional stiffening around the newly cut openings to ensure there was no distortion to the hull and to ensure easy reinstallation of the removed sections afterwards. Once the sections were removed, four cement tanks were rigged out of each vessel along with all piping, pumps and associated electrical connections.

As the newly modified compartments held the carbon and stainless steel acid tanks and associated piping for the vessels' operation, the compartments needed to be fully coated in a special acid resistant paint to ensure the acid would not corrode the steel.

As a further modification, all electrical wiring and equipment had to be re-routed to newly made tunnels running under the acid compartment to avoid any possible corrosion as well.

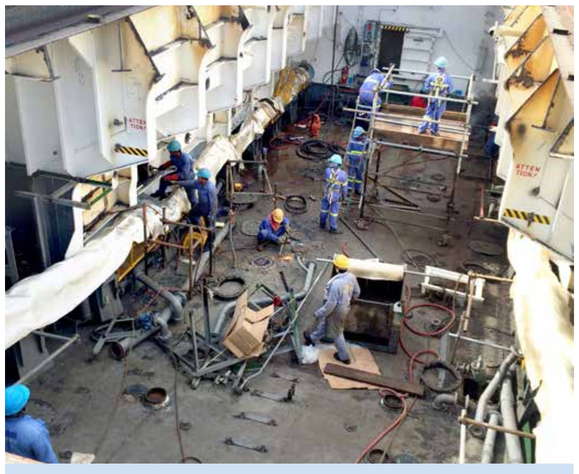
CONVERSION SCOPE (EACH VESSEL)

The conversions involved the installation of more than 250 tons of steel and 1.1 km of pipe on each vessel and the application of 2,700 m2 acid resistant chem-flake coating inside the newly fabricated acid compartments. Goltens Dubai also upgraded all electrical components in the acid compartment to explosion-proof standards and installed all PVC piping and penetrations from the acid tanks to production equipment on deck.

Lastly, Goltens completed the installation of eight different systems on board (including bilge system, flare lines, deluge system, water curtain system, acid compartment ventilation system, acid tank ventilation system, compressed air system and shaft bearing temperature monitoring system) and the fabrication and installation of a 12-meter/six-ton King post as well as the installation of a flare boom for safe burning of the natural gas.

RESULTS

After the successfully completed conversions and before returning to service, the vessels underwent a full cosmetic docking to have its paint scheme changed to customer-required colors. All modifications and repairs were fully inspected and accepted by vessel's class ABS. ■



Deck plate and tanks removed

Tank install in process after compartment sealed with acid resistant coating

Installation of acid tanks

Installation of the flare boom to the king post

Expanded Relationship with

WOODWARD

Woodward appoints Goltens Dubai as Engine Systems and Controls Distributor and Recognized Engine Retrofitter.

Goltens stations around the world have had a long-term relationship with Woodward products acting as Authorized Independent Service Facilities (AISFs) in UAE, Bahrain, Saudi Arabia, Indonesia, Vietnam and The Philippines. These relationships have always been indirect with Woodward through their authorized distributors in the region, but recognizing Goltens' focus on diesel engines, Woodward decided to change that relationship in 2016.

"We realized we needed a distribution partner that was focused on the diesel engine in certain markets around the world," noted Bryan Snyder, Woodward's Director, Aftermarket and Services. "Goltens has an outstanding reputation for its comprehensive diesel engine services and is focused on, and committed to, developing new business with our systems and products. They are active in markets where we need a focused approach to engine support services and engine retrofits. The Goltens global station network provides excellent reach and support for the installed Woodward systems and can efficiently build a basis of systems upgrades."

Woodward has appointed Goltens Dubai as the distributor for its Engine Systems and Controls product range and also as a Recognized Engine Retrofit (RER) partner for nine countries in the Middle East and the entirety of the African continent. As the Woodward authorized RER partner in these regions, Goltens will deliver mechanical hydraulic governors and state-of-the-art digital control systems to upgrade engines to the latest technologies for emissions, alternative fuels, reliability, and efficiency. These systems include full electronic engine controls, ignition systems, knock systems, and key system components.

"We see this as a tremendous opportunity and appreciate the confidence and trust that Woodward is placing in Goltens with this appointment," states Roy Strand, Goltens Worldwide Chief Operating Officer. "Woodward's brand is synonymous with quality, and they have an excellent range of products that offer operational efficiencies to our customers. We are looking forward to working more closely with Woodward and growing the business dramatically for both companies."

Goltens stations in Vietnam, The Philippines and Indonesia will continue to function as AISFs under Singapore based PM Control Systems Pte. Ltd. and will be working with PM Control and Woodward to achieve RER status in these regions as well. Goltens stations in Oslo, Rotterdam, UK, Korea, India, Singapore and China have all been appointed as Authorized Woodward Sales Representatives and will be working with their respective regional distributors to uncover and prosecute Woodward related opportunities in their respective countries as well. ■

Clockwise from bottom Right: Woodward Engine Systems President Chad Preiss, Goltens Worldwide Chief Operating Officer Roy Strand, Woodward Aftermarket and Services Director Bryan Snyder and Woodward Aftermarket and Services Sales Director Gordie Daig complete the contract signing at Woodward Engine Systems headquarters on June 1, 2016.

Changing Behavior
in the Offshore Sector

The oil & gas meltdown is changing behaviors in the offshore sector and presents expanded opportunities for Goltens.

Since oil prices plummeted in late 2014, the offshore industry has been scrambling to adjust to the new market conditions. With continued slow growth in the Chinese economy and continued oil production at levels exceeding demand, experts suggest that the market is unlikely to begin a serious recovery before the second half of 2017.

Around the globe many rigs have been stacked and scrapped as a result, which has reduced the need for offshore supply. Companies have been slashing capital spending and operators have been looking for new ways to stretch shrinking O&M budgets to maintain the high levels of quality and availability required to operate in the sector.

Many offshore support companies and drillers have historically shown a preference for the OEM as their default service provider, with many having an "OEM only" policy. When the market was at its peak, few companies second-guessed the relatively high cost of maintenance charged by the OEMs. Now, faced with tighter budgets and a continuing oil price pressure, many are seeking alternative service partners like Goltens.

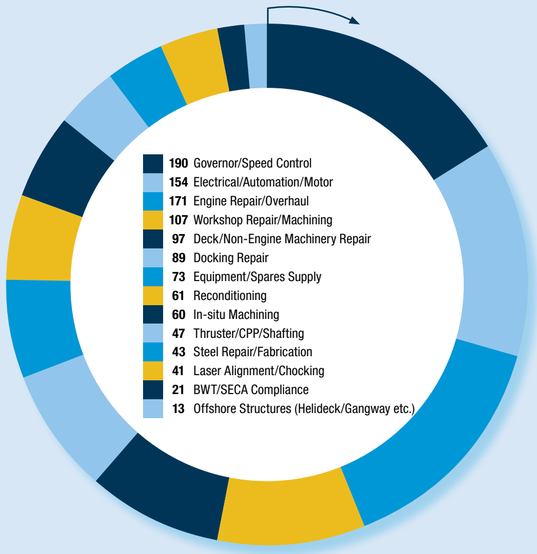
GOLTENS – THE ALTERNATIVE

Ever since the market contraction, Goltens has experienced an increase in business with many offshore operators who recognize that they can get OEM level service at a lower price and with a fast response to critical needs. "We were focused on expanding our business in the offshore sector prior to 2014 and were already gaining some increased traction before the downturn," says Roy Strand, Goltens Worldwide Chief Operating Officer.

"What we did not anticipate when the market collapsed was just how the big the increase in business in the offshore sector would be."

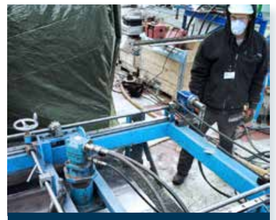
Roy Strand,
Goltens Worldwide Chief Operating Officer

"What we did not anticipate when the market collapsed was just how the big the increase in business in this sector would be. Operators that previously favored OEMs for service were now actively looking to work with us because of the level of quality we provide as well as our global network that allows us to be right where our customers are. We have continued to invest in strengthening our offshore certifications and are optimistic about our future expansion in this sector." ■



2014-2015 - GOLTENS COMPLETED OVER 1,100 OFFSHORE / OIL & GAS PROJECTS AROUND THE GLOBE

Floating Production Unit - MaK M282
Goltens shipped a replacement engine that had been rebuilt in its workshop to the vessel and completed the installation, alignment and operations testing in 18 days to restore the plant to full operation.



Offshore Supply Vessel
Goltens' in-situ technicians performed X-Y milling on a deck crane pedestal in a yard in Norway.

MPOV – Wärtsilä 8L32
Goltens diesel team completed a complete overhaul on a multi purpose offshore vessel's main engine while berthed in Gibraltar.

AHTS Docking Repair – Dubai
Goltens undertook a comprehensive docking inclusive of all underwater maintenance and mechanical maintenance for a 60 meter/1,830 ton AHTS in a 28 day period.

AHTS – MaK 8M32
Goltens diesel technicians completed a complete crankshaft replacement on main engine #2 on an 92 meter, 4,600 DWT AHTS in Singapore.

Icebreaking Platform Supply Vessels - Bergen B32:40 L9A
Three main engine overhauls for SCF Swire Pacific Offshore on three sister vessels. The overhauls were completed while the vessels were in full operation on round trip voyages from Sakhalin port to the rigs in Russia.

25 offshore certified engineers

13 offshore certified engineers

57 offshore certified engineers

49 offshore certified engineers

MODU – HiMSEN 9L32/40 & 18V32/40
Goltens technicians completed 7 - 8,000 hour HiMSEN engine overhauls in the Gulf of Mexico onboard a MODU for a major drilling operator with zero downtime for the vessel's drilling operations.

Special Purpose Offshore Construction Vessel - MAN 9L32/40
Diesel technicians performed full disassembly, crankshaft replacement, rebuild, alignment and operational testing over two weeks in Ciudad de Carmen Mexico.

Offshore Supply Vessel - Yanmar 6EY26LW/6EY18AL
Goltens diesel technicians sailed with vessel to Equatorial Guinea to perform removal of bolts and reaming of bolt holes for new fitted bolts.

Deepwater Drillship- BERGEN KGVB12
A team of 5 Goltens diesel engineers attended the offshore vessel in Angola. The team completed top and bottom overhauls for the Bergen engine under tight timelines, overhauling all components onboard. All components were inspected, measured and tested prior to reassembly and operational testing.

PSV – Flange facing and Thruster installation
Goltens completed flange facing on 3.0M diameter thruster flanges as well as the installation of two thrusters as part of a new build PSV project in Chennai. All work from planning to completion was accomplished in 15 days.

Platform Supply Vessel – HiMSEN 8H 25/33
Goltens completed the 16,000-hour overhauls on both main engines in a two-week timeframe. The major overhauls were completed and the engines successfully tested on time for the vessel to meet its charter.

Semisub - EMD 12-645-E9B
Goltens performed complete overhauls of 2 EMD 12-645-E9B engines on a semisub rig off of Darwin, Australia. Work included replacement of major components as well as polishing of crankpin and main journals prior to installation of new bearings.

Jackup Rig – EMD 16-654E8
Goltens diesel technicians completed a full overhaul of one of the jackup rig's main engines, including the replacement of all cylinder power packs during a five-day onboard period.

Goltens Goes Nuclear

When a nuclear power plant had a crankshaft failure on one of its diesel generators, Goltens got the call.

A nuclear power plant in the Midwestern US experienced a bearing failure on one of its four Worthington SWB-VEE-12 backup diesel generators. The plant reported that the 3.5MW engine suffered crankpin journal damage to the #4 crankpin. There was concern that the high heat caused by the failure may have introduced excessive hardness to the shaft. Goltens was requested to inspect the crankshaft and advise on repair or replacement strategies if the shaft could not be saved.

THE RECOMMENDATION

Goltens' in-situ technicians mobilized immediately to conduct an inspection of the 40-year-old engine and determined that the crankpin could be repaired per generally accepted engineering standards. This would normally be well within acceptable parameters. However, discussions with the plant management and engine OEM revealed that this would be unacceptable because it would prevent the engine from operating at the nuclear plant's required 3.5MW load requirement under the plant's strict safety standards.

As the plant had a replacement crankshaft in storage, Goltens mobilized teams to work around the clock to get the crankshaft replaced and the engine operational as soon as possible.

THE REPAIR

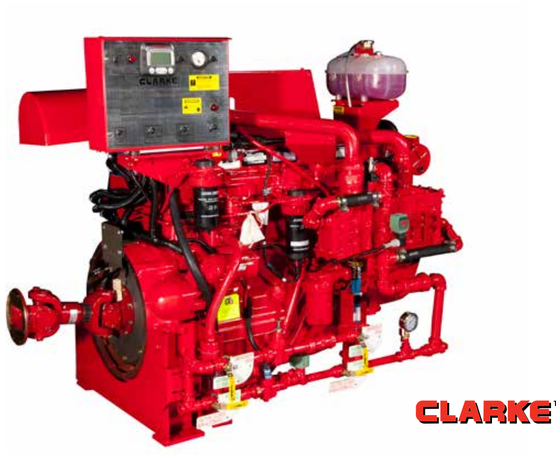
The two teams consisted of a project manager, two service engineers and five technicians each. They worked in day and night shifts to complete the disassembly, remove the crankshaft, perform bore inspections, install the replacement crankshaft and rebuild and operationally test the engine.

The engine test took place over a period of multiple days until the plant was satisfied with the results.

The extensive job took much longer to complete compared with other Goltens repair projects due to the strict regulations associated with the nuclear plant's working procedures. Working with the plant's technical resources, Goltens accomplished the replacement in 61 days.

Plant management commented "Thanks to the Goltens personnel and all the people who supported them for bringing their expertise to us. We have learned much about diesel work from them, and appreciate their engagement." ■

Replacement of bearing caps to check line bore



CLARKE™

Fired up for Clarke

Clarke Fire Protection Products appoints Goltens as Service Dealer.

Clarke Fire Protection Products, Inc., is recognized as a world leader in the manufacture and support of fire pump engines. Clarke operates two business centers in the USA and in Scotland to manufacture hundreds of different models of engines for the global fire pump market.

Clarke Customer Support Manager, John Whitney III stated "when we seek out Service Dealers we are always looking for companies with deep diesel capability and an ability to respond and tend to our customers in a professional manner. Goltens' global network and 75 year history servicing diesel engines made them a perfect choice to add to our support network."

"Clarke sells the broadest line of fire pump drivers in the world based on a commitment to quality, safety and reliability and we are very happy to become part of their global service and sales network" noted Roy Strand, Goltens Worldwide Chief Operating Officer.

The agreement covers all Goltens stations globally and enables Goltens to sell and service Clarke engines in support of fire pump OEMs as well as end customers. ■

Specialist HiMSEN Skills

Goltens continues to invest in specialist HiMSEN engine training.

Hyundai HiMSEN Engine & Machinery Division is both the world's largest marine diesel engine manufacturer and shipbuilder with market shares of roughly 35 and 15 percent, respectively. Hyundai HiMSEN's manufacture of 2 and 4-stroke diesel engines and their penetration in the new building market for all types of merchant vessels, as well as state of the art Drill Ships and FPSOs for the oil & gas industry, makes HiMSEN an incredibly important partner for Goltens.

Recognizing this, Goltens sought out a closer relationship with HiMSEN and secured authorizations for select Goltens stations in Asia, Middle East, Europe and the US in 2013 and 2014 and now provides comprehensive service for HiMSEN engines in these regions. As part of our never ending commitment to delivering the highest level of service and quality to the market, we continue to invest heavily in factory training for our Service Engineers.

Eleven more Goltens Service Engineers recently completed the HiMSEN Engine Advanced Course at the HiMSEN Global Academy at Hyundai Engine & Machinery in Korea. The one-week course was completed to further educate Service Engineers and certify their level of knowledge on the particulars of the HiMSEN engines. ■

Goltens Service Engineers complete the HiMSEN Global Academy Advanced Engine Course.

Offshore Sector Gets More

Goltens Worldwide signed a global agency agreement with Rigsaver® for the SGE line of air intake shutoff valves.

Rigsaver® valves can be manually or automatically controlled to help prevent diesel engine overspeed by cutting off the air supply to the engine. Rigsaver® is a swing gate, spring-operated air shutoff device mounted in the air intake system that stops the airflow into the cylinders and positively immobilizes the engine, safeguarding personnel and equipment. It can be manually or automatically controlled, responding to a variety of fault or hazard conditions.

"We saw the Rigsaver® as a perfect addition to our product portfolio as these safety devices are in operation across many markets we service, and it enables our customers to rely on us for high quality service and support on a critical element on their engines," noted Roy Strand, Goltens Worldwide Chief Operating Officer.

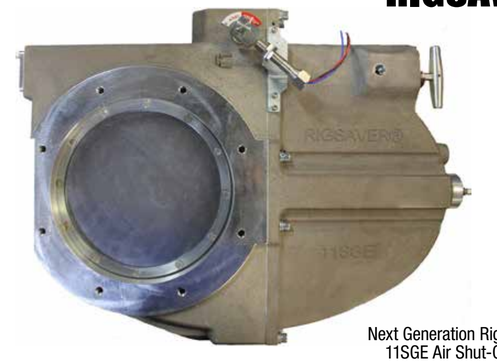
Relying solely on shutting off the engine's fuel supply can be ineffective in preventing diesel engine overspeed. Using the Rigsaver®, operators can completely shut off the air supply to prevent engine runaway and possible catastrophic failures or explosions.

Rigsaver® is installed on diesel engines from many leading OEMs. It has been used worldwide in the most demanding environments and across a full array of applications, including:

- Off-shore platforms
- Bulk fuel loading facilities
- Refineries
- Petrochemical plants
- Mining equipment
- Power generation
- Marine engine rooms

Goltens service technicians are factory trained and certified, and Rigsaver® sales and service support is available from any Goltens station globally. ■

RIGSAVER



Next Generation Rigsaver® 11SGE Air Shut-Off Valve

You Can't Save Them All

Goltens replaces crankshaft for offshore vessel in Vietnam in just 20 days.

Goltens is at the top of the list to call when a vessel has crankshaft damage, but not every crankshaft can be salvaged by in-situ machining. Such was the case for an Anchor Handling Tug Supply (AHTS) vessel's Bergen B32:40L8P main engine crankshaft. Goltens' in-situ specialists inspected the damage and discovered cracks in the crankpin that went too deep to be machined away. An immediate handoff of the project was made to Goltens' diesel specialists and planning and mobilization for the crankshaft replacement was underway.

PLANNING AND PREPARATION

Speed was critical and Goltens created a work procedure and schedule for a safe and efficient replacement of the crankshaft and rebuild of the engine. While the replacement crankshaft was being delivered, Goltens manufactured the tools required to lift the engine block and removed the condemned shaft, counterweights, pistons and connecting rods.

In the workshop, Goltens technicians refit the flywheel and damper to the new crankshaft and performed contact tests between the counterweights and the shaft. In addition, Goltens completed calibration checks and overhauled all pistons and connecting rods, replacing the two damaged connecting rods with onboard spares.

REPLACEMENT AND REBUILD

All components were packed and prepared for transfer back to the vessel where preparations to rig and install the new crankshaft had already been made. Once rigged into the engine room, Goltens installed the crankshaft and rebuilt the engine with the overhauled components.

Laser alignment was performed on the engine and the team chocked the engine with Chock-fast® Orange. Once complete, the engine was flushed and checked by the maker and dock and sea trials were completed with no issues.

The entire repair was completed in only 20 days and the vessel was returned to service. ■

AHTS Lewek Penguin pierside at PTSC in Vietnam

Replacement crankshaft being rigged onto the vessel for installation

Block lifted with new crankshaft on deck ready for installation

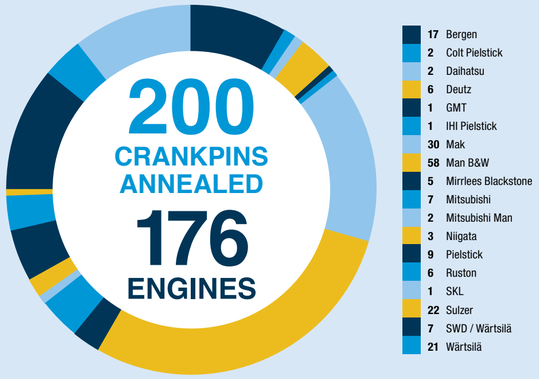
Have you heard?

Goltens' class-approved and well-proven repair process continues to save owners and insurers millions but not everyone is yet aware.

Four years after receiving global class approval from Germanischer Lloyd, today DNV-GL, for its process of annealing 4 stroke marine diesel engine crankshafts to remove excessive hardness, Goltens has crossed the milestone of successfully annealing 200 crankpin journals on 176 engines from 18 different engine makers. It doesn't take a mathematician to figure out that this amounts to millions of dollars in savings when compared to the unnecessary replacement of the otherwise condemned crankshaft.

Nonetheless, after proving this process repeatedly, Goltens still finds that there remains a lack of awareness among some in the echelons of the repair chain from ship owners to surveyors and lastly insurance underwriters about this alternative, and highly successful repair method. Broadly speaking, provided that high hardness damage does not result in cracks below the rated diameter and the shaft is not a factory hardened crankshaft, there is a very significant chance that the crankshaft can be salvaged and permanently repaired with full marine class approval. So why aren't more crankshafts being annealed?

In many major crankshaft failures, the surveyor's first call is often to the engine maker. Upon inspection, the maker often condemns the shaft after applying their inspection criteria to the damage. At this point, absent a second opinion presenting annealing as an alternative, the damage will likely be rectified through a long, expensive and potentially unnecessary replacement of the crankshaft. ■



17	Bergen
2	Colt Pielstick
2	Daihatsu
6	Deutz
1	GMT
1	IHI Pielstick
30	Mak
58	Man B&W
5	Mirrlees Blackstone
7	Mitsubishi
2	Mitsubishi Man
3	Niigata
9	Pielstick
6	Ruston
1	SKL
22	Sulzer
7	SWD / Wärtsilä
21	Wärtsilä

Turning up the Heat in Cameroon

In-situ annealing and machining saves Wärtsilä 18V50DF generator crankshaft for Kribi power plant.

The Kribi Power Plant in Cameroon was commissioned in 2013 and operates 13 Wärtsilä 18V50DF natural gas generating sets supplying 216MW of power to the grid. During normal operation, it experienced a bearing casualty on one of its generators, taking it out of service.

INSPECTION AND REPAIR PLANNING

Goltens diesel experts were asked to inspect the damage and determined that the crankshaft could be salvaged within the rated diameter with in-situ machining and annealing. Crankpin journal number 7 (450mm diameter) and main journals number 7 and 8 (450mm diameter) all had damage, but the most significant was to crankpin number 7. As in most cases of excessive journal hardness, an engine bearing failure caused the journal to absorb a large amount of heat. The emergency stopping of the generator introduced uncontrolled cooling which changed the journal's metallurgical characteristics. In this case, the hardness was exceptionally high, measuring 653 Brinell (HB), and covered a large section at the bottom of the crankpin.

EXECUTION

The plant's major concerns were downtime and loss of power production. Goltens was asked to work 24 hours a day to rectify the casualty. Two teams from Dubai and Rotterdam were mobilized to Cameroon along with single point cutting tooling and annealing equipment to begin the project.

As the radius of the journal on number 7 had been damaged, Goltens machined a new radius to ensure the running surface for the journal machining was true. The crankpin journal was then pre-machined to -3.50mm to remove all surface cracks prior to annealing.

Once the heating pads, control equipment and insulation had been installed, the computer controlled heating and cooling process was executed to return the hardness to acceptable levels. Once the crankshaft returned to a normal temperature, Goltens measured the hardness and found that it had been successfully returned to a safe operating range around 300 HB.

The in-situ teams then finish machined the radii and machined and super polished the crankpin to -5.00mm at 0.03 Ra. The minor damage to the main journals was rectified by hand polishing.

RESULTS

The machining and annealing work was completed over an 11-day onsite period and avoided the potential for a costly and time-consuming crankshaft replacement. Goltens finished the job with two five-man diesel teams to rebuild and operationally test the engine prior to returning it to service. ■


Checking journal diameter during finish machining


Kribi power plant in Cameroon


Machining the radius post annealing

A Matter of Millimeters
– no Room to Spare

Annealing saves a main engine crankshaft after a failed attempt to machine away the hardness.

Resistance to new repair methods can prove costly. A bulk carrier operator almost learned this lesson when they chose a traditional machining method to address excessive hardness. The 13-year-old bulker's main engine, a MAN B&W 6S50MC-C (11,421 HP), suffered a lube oil failure resulting in heavy damage to crankpin number 6. Goltens advised that the journal had significant hardness at levels that could, and should, be rectified by annealing and machining. Goltens believed that the hardness would extend below the rated diameter of the journal and that traditional methods to machine below the hardness would result in a condemned crankshaft.

DANGEROUSLY CLOSE TO THE LIMIT

The owner opted to go with a competitor and allowed them to machine more than 5.00mm, dangerously close to the 6.00mm limit, from the 600.00mm crankshaft diameter. With less than half a millimeter remaining within the rated diameter, the hardness levels were still too high for either class or the maker to accept. Machining the journal beyond -6.00mm with hardness still present would condemn the shaft. At this point, looking for a solution, Goltens was requested to engage to try to salvage the crankshaft with only a fraction of a millimeter to work with.

THE PROVEN PROCESS

Goltens deployed its tooling and machinists to the vessel and inspected the condition of the shaft and found a significant section with excessive hardness still present. Goltens executed its proven annealing process to remove the hardness and carefully machined and final polished the journal to remove the final few tenths to finish the job within the rated diameter at -6.00mm. The team completed the process in seven days time.

THE LESSON

By ignoring a proven alternative method, the owner almost lost the main engine crankshaft. In addition, he would also have incurred the enormous costs associated with the purchase, transport and installation of a replacement, not to mention the significant avoidable downtime from such a time-consuming undertaking. As a result of applying annealing before it was too late, the crankshaft was salvaged and the vessel returned to service, albeit with less remaining shaft material than would have been, if the owner had pursued annealing from the start. ■


Installation of the annealing tiles on the damaged journal


Finishing the machining of journal to -6.00mm


Final blue fitting of the repaired journal

Large Scale Capabilities

Goltens' in-situ machinists in action at Sembawang Shipyard in Singapore

Goltens demonstrates its large-scale capabilities on two VLCC to FPSO conversions by removing 36 metric tons of steel across 17 meter diameter.

FPSO KAOMBO is part of a $484 million project undertaken by Sembawang Shipyard to convert two Very Large Crude Carriers (VLCC) into turret moored Floating Production Storage & Offloading vessels (FPSO) for work off the Angolan coast.

THE CHALLENGE

The machining had to be done for weld preparations in four locations on each of two casing rings on the top and bottom inside diameters (ID) and top and bottom outside diameters (OD).

The primary challenge, beyond the 17-meter diameter, was the requirement to remove 36 metric tons of material from the 170mm thick rings with the chamfer machined at specific angles (5.2° for the OD and 8° for the ID). The 170mm thick rings had to be machined down to 30mm thickness to weld the turret rings with rings of the structures.

CAREFUL PLANNING FOR PERFECT RESULTS

The start of a job like this is very critical; after many meetings with the shipyard, turret designer, operator and the owners, all parties were on the same track to ensure the project was executed to expectations. Careful considerations such as the distortion/expansion effect of solar heat were all carefully considered as well as the complex logistics associated with the staging and set-up of the work site.

THE PREPARATIONS

The rings were positioned in the yard and welded into an elevated position with sufficient clearance for the self-leveling milling machine. They were then carefully measured using total station instruments, and the reference point was given for Goltens to align the radial milling machine.

To machine the bottom of the rings, support rails had to be installed to support the wheels of the buggy on the machine. For the top part, the turret ring itself was used to support the buggy wheels.

MILLING 36 METRIC TONS OF STEEL

The machining was done working around the clock shifts to keep to the project timeline. With the work location so close to the equator, thermal distortion from the solar heat had to be taken into consideration. Extra care was taken to eliminate these effects by completing all final machine cuts at night, when the affects of the sun expanding the ring could be controlled, to ensure the results were well within the finite tolerances required. Each stage was checked and approved by Total (Operator), Saipem (Owner), Bluewater (Designer) and the shipyard.

As a result of the project's success, Goltens has been asked to propose for a follow-on project of the same dimensions. ■


Two milling heads working at same time to maximize material removal


Machining top inside diameter at 5.2°


Quality checks on top OD machining

In-Situ Machining for New Build Jackup Drilling Rig

In-Situ technicians performing calibration checks on one of the lower gear box bores

Goltens Vietnam tapped to perform In-Situ boring and milling as part of the TAM DAO 5 new build project.

Petro Vietnam Marine Shipyard JSC contacted Goltens Vietnam for their in-situ machining expertise. The six jack case structures for project TAM DAO 05 required extensive surface machining (lathe machining, milling machining and line boring) as well as the boring of six holes each: from 915mm to 925mm on the lower gear casing and 420mm to 440mm on the upper. The bore holes needed a surface finish of 1.6Ra and very tight machining tolerances as well as machining of the bore faces. In addition, each of the six structures required 10 wear plate foundations measuring 1,016 x 520mm to be milled as well.

PREPARATIONS

With 36 bores and 60 wear plates to complete, Goltens deployed multiple sets of boring, flange facing and milling machinery to the site to be able to work multiple pieces in parallel. With the jackcase leveled and supported, Goltens used its laser alignment equipment to check for flatness prior to beginning the machining on each piece.

After finish machining, each bore and wear plate was inspected and accepted by the shipyard's quality control inspector and the owner. The complex job was completed over multiple months on-site. ■


Boring equipment installed one of the six jack case structures for TAM DAO 5


Flange facing in process on one of the 925mm lower gear box bores


Multiple sets of boring equipment were used to speed the machining of the 36 925mm and 440mm top and bottom gear casing bores

'Is a Repair Even Possible?'

Laser scanning, metal stitching and in-situ machining restore a badly damaged Mitsubishi-MAN 6L 40/45 main engine after a catastrophic engine faliure.

A main engine casualty by itself causes stress for engineers, owners and charterers, but when engine components seize and debris flies through the protective barrier of the crankcase, it is another matter altogether. When staring at the interior of an engine through a hole that is not supposed to be there, the sight of extensive damage often leads to despair and thoughts of "what are we going to do now?" and "is a repair even possible?"

Goltens was called to answer these questions, when this nightmare turned reality aboard a 34-year-old rail vehicles carrier. Goltens specialists surveyed the engine and discovered, in addition to the large hole in the engine block, damage to the lower liner landing surface, the crankpin, the counterweight mating surface and bolt as well as the oil sump.

Under other circumstances, the engine block may have been replaced. However, because of the age of the vessel, absorbing the massive cost of a replacement block was not an economically viable solution for either the owner or the insurer. Goltens' proposal and demonstrated engine repair capability gave the owner the confidence to move forward.

LASER SCANNING AND PRE-FABRICATION

Stitching cast metal damage is a routine repair for Goltens but due to the size of the hole and the angular or "stepped" surface of the block, Goltens performed 3-D laser scanning to provide the exact dimensions of the damaged area and performed extensive crack testing to ensure there was no damage extending farther into the crankcase. Drawings were then generated from the scan data and the large section was cast and milled along with an identical wooden dummy.

PUTTING THE PIECES BACK TOGETHER

While waiting for the cast piece to be fabricated, Goltens technicians cropped out the damaged section of the block to create smooth surfaces along the edges suitable for metal stitching. As the cast metal section was quite heavy, the wooden dummy was cut and shaped into the exact dimensions of the cropped section and used as a template to machine the cast section.

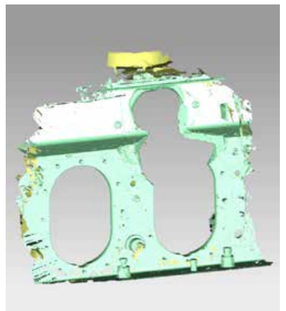
Once machined, the piece was rigged into place and Goltens' In-Situ machinists began the long process of drilling and tapping the metal stitching pins along the long seams, drawing the mated surfaces together. Once this was completed, precision hole patterns were drilled and locks were inserted across the stitched joint line to reinforce the repair and distribute load stress away from the failure point.

THE OTHER "STUFF"

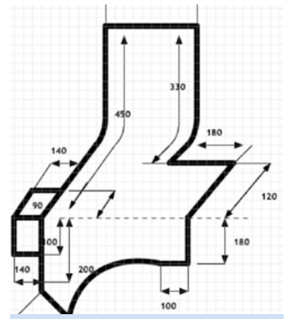
After the complex stitching process, handling the rest of the extensive damage appeared more straightforward in comparison. Goltens tackled each area in turn, repairing the lower liner bore damage by line boring the surface and fabricating and installing an insert ring to return the section to standard dimensions. Goltens also repaired the damage to the crankshaft by machining the counterweight mating surface and installing the counterweight with a fabricated pin and new studs and nuts. Additionally, Goltens repaired the damage to the crankpin journal surface by machining 1.00mm from the crankpin surface. Lastly, Goltens welders repaired the sump damage that was caused by the flying debris and welded a replacement section into place.

Under other circumstances, the engine block may have been replaced. However, because of the age of the vessel, that was not an economically viable solution

Once all of the repairs were completed, Goltens' technicians rebuilt the engine and completed dock trials before the engine was turned over to the ship's crew and returned to service. All repairs were reviewed and accepted by the vessel's class society. ■



3D laser scan of the damaged portion



Design for cast insert and crankcase cropping

Crankcase exterior damage

Cropping damaged section from crankcase

Crankcase damage cropped to insert dimensions

Cast and milled insert rigged into position

Drilling holes for stitch inserts along seam

Stitching complete ahead of lock insertion and finish machining

Final machining of crankcase surface after locks have been inserted

Goltens' new small range cutting tools in action on a 140mm diameter alternator shaft with 130mm between the rings. The shaft was machined to 130.00mm and a sleeve insert was installed to oversize at 141.00. Shaft was then finish machined to 140.00mm. The job was completed in only five days.

On the Cutting Edge

Goltens' next generation of cutting tools goes to market. It's Research and Development that keeps Goltens' crankshaft machining on the cutting edge.

Goltens revolutionized the engine repair industry in the early 1950's when it was the first company in the world to complete in-situ crankshaft grinding on a diesel engine. The repair process and innovative tooling dramatically reduced the costs and downtime of crankshaft repairs when compared to the practice of removing the crankshaft from the engine for workshop repair.

Since then, through constant and focused R&D and field trial, Goltens has developed and refined the most cutting edge crankshaft/journal machining tooling in the industry. For the past decade, this tooling has been used on larger crankshafts where the crank webs are more than 175mm apart from each other. On smaller engines however, traditional grinding was the standard method due to size and access constraints – up until recently.

The advantages of machining or single point cutting a journal as opposed to grinding are many. Firstly, the speed of repair due to the rate of material removal is far superior with single point cutting. The repair time can be reduced by anywhere from one half to two thirds compared to traditional grinding. Secondly, the ability to machine the entire surface of the journal from fillet to fillet without having to move the tooling provides a much more predictable result with higher levels of accuracy. Lastly, because there is no dust from the grinding stone or metal flakes from the crankcase, it is a significantly cleaner process. This protects the engine and significantly reduces cleanup.

That is why Goltens has developed a new range of single point cutting tools that will enable Goltens' in-situ machinists to cut smaller crankshaft journals with distances between crankpin webs as small as 110mm. These tools have been successfully tested in workshop trials and field-tested on multiple types of smaller crankshafts. The tooling is now being manufactured for all Goltens' in-situ stations and will be in use on a global basis within the year. ■

10-Meter Boring Bar put to the Test

Thanks to line boring tooling built just for large engine repair, main engine bore damage was fixed.

Diesel casualties don't always result in only the loss of, or damage to, the crankshaft. Often, these casualties cause a deformation of the block and bedplate requiring a more extensive repair. Such was the case with a 39-year-old cruise vessel that lost one of its four B&W 7U50HU main engines.

TOOLING INVESTMENTS PAY OFF

Having disassembled the engine with a local repair company in Athens, the owner recognized the need to have a specialist check the alignment of the engine. Goltens attended the vessel and checked the bore alignment only to find that the main engine required all of the main bearing pockets to be bored. Luckily, Goltens has invested in line boring tools that are purpose built for in-situ line boring of larger engines and have an extendable shaft length up to 10 meters. Rarely do jobs call for all 10 meters but in this case the full length was required. In the hands of expert machinists, the tooling worked exactly as designed and the two-man team completed the machining of all nine of the 395mm diameter x 220mm long main bearing pockets in only seven days to within 0.03mm. ■

Keeping it clean

HURTIGRUTEN
With over 1,700 units sold globally, the Wågene Purifiner has proven itself over extended periods of use. A prime example of this would be long time customer Hurtigruten who installed 10 units on two cruise vessels in 2002 for use on the vessels' thrusters and stern tubes. In 2013, the vessels went into dock for maintenance and the oil was changed for the first time in 11 years and still found to be as good as new.

The Goltens Group has signed an agreement with Wågene Purifiner Technology to distribute their oil maintenance system around the globe. The Wågene Oil Purifiner is a "bypass" oil maintenance system that connects to a hydraulic or lubricating system to continuously remove water and particles.

As a mechanical service company, Goltens sees damaged machinery on a daily basis and the root cause of many of these failures is contaminated oil. "We saw an opportunity to not just repair damaged machinery but also to offer our customers a product that would proactively reduce the incidence of mechanical failures, minimize downtime and associated costs of repair and reduce oil consumption" says Maarten Jeronimus, Regional Vice President for Goltens Europe and Managing Director for Goltens Green Technologies B.V.

"The Purifiner product was a very logical addition to our Products & Systems product portfolio and one that has been very well received by our customer base," he added.

The Wågene Oil Purifiner is designed for continuous maintenance of hydraulic and lubricating oils. It does this by continuously removing particles, free and emulsified water, sludge and acids in a two stage process; Stage one utilizes natural, 100% long-strand cotton fibers to capture particles >1 micron and sludge. Stage two is a patented flash evaporation process that dehydrates the oil, removes chemical contamination and cuts the water content to 100-200 ppm (0.01-0.02%).

Customers note that the Wågene Oil Purifiner is a minimal investment that offers savings over the short term. In the longer term it provides significant savings by prolonging the interval for oil changes and reducing maintenance costs. There is also minimal consumption of filter cartridges since the water is not absorbed in the filter cartridge but rather evaporates away. ■

Light Structures

– Fiber Optic Condition Monitoring Systems

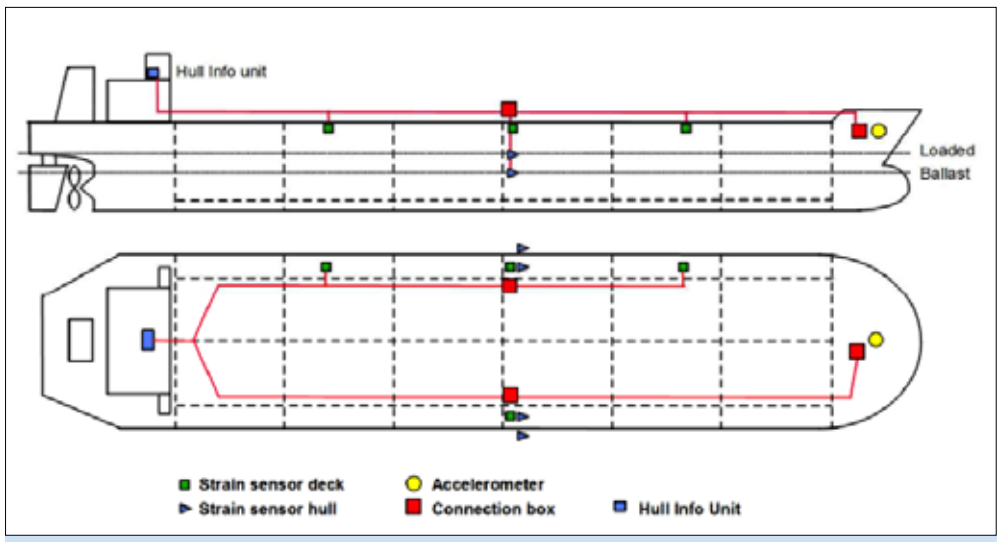
Goltens partners with Light Structures to deliver cutting edge monitoring solutions to the market.

Goltens has signed an agency agreement with Oslo based Light Structures AS, the world's leading supplier of Hull Stress Monitoring (HSM) systems. The agreement covers sales of the Light Structures product line throughout the U.S., Caribbean, Mexico, Central America and South America (except Brazil) as well as Singapore.

With more than 170 systems sold to commercial ships, navy and offshore units the Light Structures products are gaining solid traction with operators proactively seeking to monitor and limit damage caused by stresses on their vessels, floaters and platforms. The company's products are targeted at shipping, offshore, naval and wind power applications and include:

- Hull Stress Monitoring Systems (HSM)– acquires data from fiber optic sensors and integrated systems to monitor structural stresses and calculate fatigue accumulation
- Sloshing Monitoring Systems (SMS) - monitors the pressure and force exerted by liquid cargo sloshing inside cargo tanks providing information about the condition of hard-to-inspect parts of the containment system for LNG tanker applications
- Ice Load Monitoring Systems (ILM)- monitors the ice loads on the hull dynamically, making it the perfect tool for both experienced and unexperienced navigators.
- Integrated Marine Monitoring Systems (IMMS) – a comprehensive system for offshore units, combines Hull and Fatigue monitoring solutions in a single package giving the operator an objective measurement of current conditions
- Active Fatigue Management – onshore data management services to help the maintenance planners and other onshore personnel manage the assets

Goltens and Light Structures have already teamed up to complete the installations of the Hull Stress Monitoring system on 14 of the U.S. Coast Guard's Sentinel-class cutters as part of their Deepwater program. Light Structures is delivering Hull stress monitoring systems to all 58 cutters and the program will most likely completed over the next five to six years. ■



Representative component placement for hull condition monitoring components

BENEFITS OF ACTIVE FATIGUE MANAGEMENT

- Improved maintenance planning
- Tools and reports accepted by leading class societies
- Reduced docking schedules
- Improved hull lifecycle
- Improved fleet scheduling
- Attractive return on investment
- Possible reduction in hull surveys