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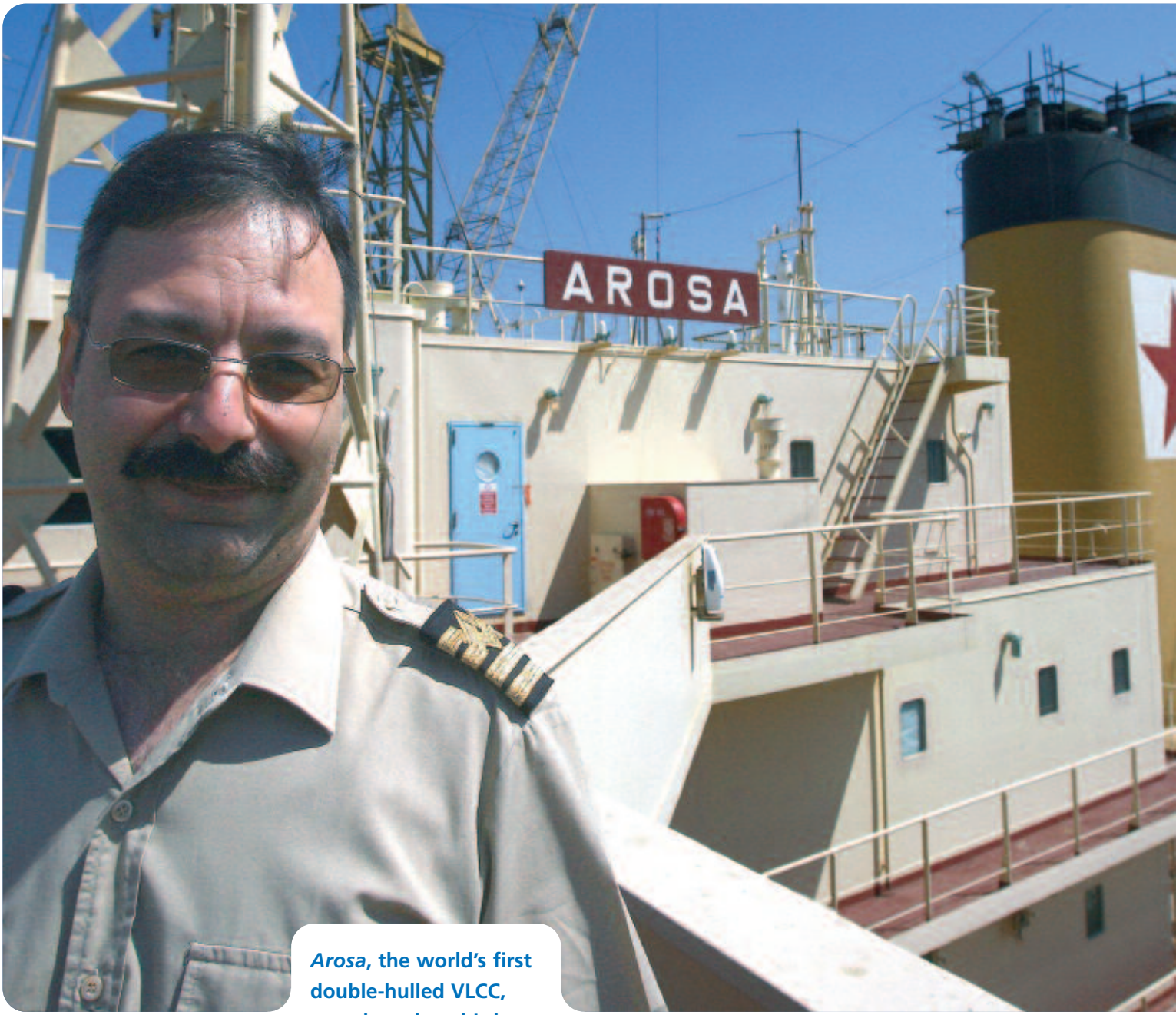

***Arosa*, the world's first double-hulled VLCC, completes her third Special Survey, marking fifteen years at sea**

Lloyd's Register

Arosa

At the start of 2008, a decade and a half after ushering in a new era in tanker design, the Lloyd's Register-classed *Arosa* presented herself for her most searching 'health check' to date.

At just after 12:10 hours on 28th February, the MT *Arosa* entered the Number 1 dry dock at Drydocks World-Dubai to complete her third Special Survey.

The 291,400 ton dwt VLCC, managed by Neda Maritime Agency Co. Ltd, of Piraeus, was handed over to the repair yard's ship manager, and work began preparing the ship for scrutiny by Lloyd's Register EMEA's marine surveyors.

It was the culmination of a rolling programme of surveys begun in August 2007, that saw work carried out at sea, in Singapore where *Arosa*'s cargo tanks were surveyed, and in Fujairah, where the ballast tanks were subjected to close examination.

On the face of it, everything that had, or was about to happen to *Arosa* was routine. But what has made this drydocking special is that *Arosa* is the first double-hull VLCC ever built. The eyes of the tanker industry were always going to be on this event, to see how *Arosa* had borne up after 15 years at sea.

Delivered by Hitachi Zosen in February 1993, *Arosa* was the shipping industry's answer to the Exxon Valdez oil spill. Initial US reaction took the form of OPA 90, a piece of domestic legislation that established double-hull requirements for newly constructed tankers and tank barges operating in US waters. It also set down a phase out schedule for existing tankers.

At the time the IMO was still undecided on a standard for double-hull construction. Also, the double-hull concept was being met with considerable resistance. Cracks had been experienced in large single-hull tankers, and it was assumed that cracks in double-hull tankers would result in leakage of oil from cargo tanks to the ballast tanks, with all the attendant risks of pollution, or even explosion.

Also, there was the issue of how the confined double-hull spaces would be maintained or properly inspected.

Arosa's master, Captain Costas Koulouris

Against this background, in 1989 Neda had placed the order for *Arosa* with Hitachi Zosen in Japan. The original specification was for a single-hull tanker, but with an option to change it into a double-hull. Meanwhile the IMO had set itself a deadline on resolving the single-hull vs double-hull debate of 1991. Before work could start on the ship, Neda was faced with the unwelcome challenge of second-guessing the regulators on which way they would jump regarding future tanker design specifications.

But Neda could get no clear signal on IMO thinking. The company was left to pore over the US stance on the issue, particularly the recommendations of the report, "Tanker Spills: Prevention by Design", issued at the time by the US National Research Council's specially formed Committee on Tank Vessel Design. In the end Neda decided to back the double-hull option.

Neda Maritime Agency had a particularly good rapport with Hitachi dating back to 1952 when the Group had been one of the first foreign companies to place an order with the shipyard. But building the tanker before the world's main regulatory bodies had finally settled on the specifications they would require, set both Neda, and Hitachi Zosen, a demanding challenge.


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NEDA MARITIME

The ship was to be classed by Lloyd's Register, and the Class society's plan approval staff worked closely with the company and the chief naval architect at Hitachi to make the project work.

Gerry Vagliano, a naval architect with Neda Maritime's London agents, Lykiardopulo & Co. whose brainchild it was to go for a double hull, says that ensuring the plan succeeded, had demanded the closest team work.

He recalls: "Building the first double-hull VLCC ahead of new regulations meant taking a lot of new considerations into account. We were breaking new ground, but we enjoyed excellent co-operation with both Hitachi and Lloyd's Register.

"The yard looked at the new type of vessel as a challenge, and building a good ship meant a lot to their reputation. They therefore allowed us to incorporate many good ideas, possibly at the cost of their earnings."

Arosa, with an overall length of 328m, a beam of 58m and a draft of 21.6m would have qualified for a ULCC designation had she been of single-hull construction, but her double-hull dictated she be designated a VLCC.

> "*Arosa* carried her first cargo in 1993."

Arosa carried her first cargo in 1993. From the outset Neda Maritime was aware that they were sailing into uncharted waters with their new tanker. It was a challenge they met by subjecting the *Arosa* to a strict maintenance schedule, and even stricter maintenance standards. That regime was from the start underpinned by the ship's manning levels. A VLCC the size of *Arosa* is allowed by regulation to carry a minimum crew of 12, to man the bridge, the engine room, perform deck duties, oversee cargo control and staff the galley.

Arosa's fully-automated engine room and the well-instrumented bridge was designed to ensure safe operations even with such a small crew. However, Neda Maritime has insisted on a crew of 35 – almost three times the regulatory requirement. Both the bridge and the engine room teams have been bolstered, and additional crew positions have been created to run the beefed up maintenance requirements. As well as her basic crew, *Arosa* also sails with an additional electrician and pump man. And to keep on top of hull, tank and machinery maintenance, she also carries a 5-strong coating maintenance riding team permanently assigned to inspection and maintenance of the coating systems.

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The Naval Architect

Gerry Vagliano made a promise some time ago to the owners of the MT* Arosa, *concerning her future.

The naval architect, who above all others was responsible for designing and building the world's first double-hull VLCC says: "I assured them that Arosa *will get to her fourth Special Survey without the need of even one kilo of replacement steel."*

Arosa *has just completed her third SS, and all the signs are Mr Vagliano's promise will be fulfilled.*

But then for Arosa *to reach her 15th birthday in near pristine condition, has been no accident. Experience, foresight and a unity of purpose on the part of her owners, the builders, Hitachi Zosen, and Lloyd's Register who classed her, transformed what might have been an expensive gamble into solid success.*

"We ordered Arosa *in 1988 as a single-hull tanker", says Vagliano, "against all the uncertainty over the future of tanker design in the wake of* Exxon Valdez.

"We had an option with Hitachi to go for a double hull, but no guidance either from the IMO or the Americans as to what requirements they might subsequently demand. If we went double we would be designing in the dark.

"But what we did have was experience. So we took our courage in our hands and we took the double-hull option. And from that moment on, both Hitachi and Lloyd's Register gave us total support. In particular, Hitachi's naval architecture department looked on the new type of vessel as a challenge, and building a good ship would mean a lot for their reputation. They therefore allowed us to incorporate many good ideas, possibly at the cost to their earnings.

"We also found a champion in Alan Gavin" says Vagliano, referring to Lloyd's Register's current Marine Business Director, who at the time was Principal Surveyor and Head of Class Approval Services, in Lloyd's Register's Construction Services Department.

"Alan backed our ideas even though there were many voices in the industry raised against the double hull concept.

"It was the fact that we could demonstrate high technical knowledge that helped us in obtaining agreement from both yard and class for what we believed could be achieved. For example, all the approved drawings took as long as one and a half years, which demonstrates the work we put into it."

> "we took our courage in our hands and we took the double hull option"

The Neda and Hitachi design teams were working without knowing which way the US, and eventually the IMO, would jump on the standards they would demand for the next generation of tankers.

Vagliano says: "We made lots of unilateral decisions: for example, that the double bottom would be 3m. and the width of the side spaces 2.44 metres, which later became the norm. Stringers at three levels of the ballast tanks were arranged also to function as platforms for inspection and maintenance.

"We had to work out how many tanks you could damage before stability was affected. Not knowing what the regulations would require, we decided to build the inner hull as strong as the outer one. We specified a ship with a capability of withstanding raking damage over 75% of the length, quite in excess of previous class requirements.

"It was a nerve-wracking experience when new requirements did start being promulgated. My heart was in my mouth every time I had to read one, in case we were not complying."

To solve other problems he knew would arise, Vagliano fell back on his experience on other ship types. For example, how could you detect cracking in the cargo containment, that had allowed oil to seep into the ballast tank?

On a ship the size of Arosa, *dipping the tanks for leakage would be totally impractical. So Vagliano borrowed a technique from double-hull LNGs. He adapted their system for testing a ballast tank's atmosphere for leaks, by adjusting the device to be sensitive to crude oil gases instead.*

But on the question all the detractors were raising; that of substantial cracking between the inner and outer hull, experience, and basic physics, told Vagliano that there would be no problem.

He says: "I knew we would not have cracking problems before we started. We had the history of chemical tankers to show us. They were already double-hull, and so we had experience in attaching inner hulls to the outer hull. What we didn't have was any history of cracking along those attachments."

Theory too, was on the side of the double-hull lobby. A ship's integrity depends on the loads and stresses being continuous. Single-hull tankers had always been subject to the effects of discontinuous load, purely by virtue of their design.

On a single-hull, the run of the cargo wing tanks is broken twice on each side by four ballast tanks. When the cargo tanks are full, the ballast tanks are empty, and vice versa. This causes undue stresses on the hull plates especially in heavy weather. The plates covering the empty tanks flex, causing cracking along the bulkheads that divide the full tanks from the empty.

But on a double-hull tanker, that problem would not arise, because the run of the outer ballast tanks are either continuously full or empty.

Today, Vagliano is able to say: "In my experience of double-hull tankers, from smaller sizes to VLCCs, none of their cargo containment structures, including the outer hull, has ever suffered from any fatigue or other cracks, and that experience includes the 15 year old Arosa, *the first of her kind."*

Naval architect, Vagliano, stresses the importance Neda Maritime places on its paint regime:

"Starting six months after delivery, we have had the coating system fitters continuously engaged on board, searching for blisters and upgrading and maintaining the coating. The coating inspection is carried out under the responsibility of the chief officer. It is a never-ending job; we have a highly valuable ship to take care of."

While in service, no unpainted areas are permitted, with every rusty edge touched up as they appear. This not only applies to the deck and deck fixtures, but also to ballast tank and cargo tanks. While carrying cargo – *Arosa* can hold up to 291,000 tons of crude oil – the ballast tanks are regularly maintained. The access to all areas of the tank made possible by the stringers serving as main platforms.

To protect them from damage, removable aluminium ladders with rubber-covered ends are used to avoid scraping the tank coating. Main ladders between stringers are of strong construction, and their coating is also strictly policed for effects of corrosion.

This degree of cleanliness is extended to the pump rooms, which on most tankers usually accumulate some build up of oil residue and often end up with some sludge in the bilges. The regime on *Arosa* requires the pump room to be totally clean, and being painted entirely in white, it makes any dereliction of duty in this department immediately apparent to the chief officer.

Similar regimes apply in the engine room, which is required to sport clean deckplates and bilges, devoid of leakages. Discarded rags are not permitted. Neither are temporary solutions. Patching up, missing bolts, leaking gaskets, all have to be subject to prompt repair.

Arosa's normally pristine deck displays the inevitable dry dock clutter.

On deck, all hawsers and wires on drums are covered by canvas, protected both against the effects of the sun and spray. All pipelines are marked for last test and inspection, all valves and flanged joints are fitted with Denso wrapping for protection against corrosion – expensive but efficient. Safe lanes for movements on deck are marked by white lines, all obstacles painted bright yellow. Anti-slip paint had been applied in all lanes. The entire deck area around the anchor windlasses and mooring equipment forward is also similarly covered.

So not surprisingly, after *Arosa* had been placed in the hands of the Dubai dry dock, her chief officer could be seen pacing the ship with a look of exasperation as he was forced to endure all the attendant squalor bands of dock yard workers bring with them in the course of their essential work.

Special Survey work in the dry dock concentrates on things that cannot be worked on at sea, and the work that had required this dry docking was nearly all large scale.

Arosa's hull, blasted clean and prepared for the application of anti-fouling.

The propeller was to come off and the tail shaft tested. In the engine room, main engine fuel oil pumps, turbo chargers and air coolers were all to be stripped down.

Even the bilge water discharge system was inspected. It allows bilge water to be pumped over the side through a meter that tests for pollution levels. If the water contains oil or other pollutants at anything over 15 parts per million, an alarm is triggered and the system auto-diverts the discharge water back into a holding bilge tank.

There is a history of operators being heavily fined for failing to ensure the bilge water discharge system is functioning as it should. Mark Darley, one of Lloyd's Register EMEA's surveyors working on *Arosa*, taps the innocuous little meter and says: "That little box is a very important piece of kit. Having that on the bilge discharge pipe is what prevents you getting slapped with a multi-million dollar fine."

Arosa was scheduled to stay just seven days at the repair yard. Good news for Neda Maritime, because dry dock stays are expensive, even before you factor in the ship's time out of service and loss of earnings.

That *Arosa* was able to complete such a quick turnaround was thanks to pre-survey planning by Lloyd's Register EMEA and Asia offices in Singapore and Dubai that enabled much of the survey to be undertaken whilst the vessel was still in operation.

Arosa also benefited from a comprehensive service offered by Lloyd's Register under its Condition Assessment Programme.

Tankers, as they get older require a CAP certificate. They also have to satisfy Marpol and Solas requirements, and the requirements of major oil charterers. In *Arosa*'s case, she must also meet the Greek government regulations.

Lloyd's Register's Condition Assessment Programme provides an essential independent evaluation of the condition of a ship over and above standard class requirements and includes assessment of hull structure, machinery and cargo systems.

For *Arosa*, disruption to the operational schedule was avoided by carrying out the machinery inspections during a single operational voyage that culminated in a cargo discharge.

Lloyd's Register says: "Participation in our Condition Assessment Programme ultimately results in your ship acquiring a Lloyd's Register CAP rating. A ship which has been through the programme, and achieves a high CAP rating is easily identifiable as being well maintained, with many benefits for the owner and charterer."

In 2006 *Arosa* went through an advanced hull measurement and close up inspection programme by Lloyd's Register. No diminution of steel was found, no fractures, or weaknesses, earning her a CAP1 rating – the equivalent to a new build ship for hull machinery and cargo systems.

The method of close-up inspection for cargo tanks involves a basic, and at times hair-raising process by which every corner of the tanks' structure is accessed by the surveyor.

It is called 'rafting' and is not normally permitted in dry dock.

The Surveyors

John Etherington, Lloyd's Register EMEA's senior surveyor in charge at Drydocks World-Dubai is originally from Sunderland. *He attended St. Aidan's R.C. School, before taking up an apprenticeship at the Austin and Pickersgill Shipyard on the River Wear.*

While still employed at Austin and Pickersgill, John began studying for a degree in Naval Architecture at the University of Newcastle-Upon-Tyne, from where he graduated with Honours.

He joined Lloyd's Register in 1987 as a Trainee Surveyor and has since worked out of the Society's offices in Marseilles, Rotterdam, Varna, London, Newcastle, Nantes, and Ulsan before moving to Dubai.

John Etherington Lloyd's Register EMEA's senior surveyor in charge at Drydocks World-Dubai explains: "The procedure involves filling the tank with water, launching a dinghy into it, and paddling around in it (to carry out the survey requirements).

"You then have to climb out of the tank. The water is lowered, you go back in, and do the next level down. No-one stays in the raft, in the tank, when they are moving water."

The Surveyors

Mark Darley, one of Lloyd's Register EMEA's surveyors in Dubai, originally hails from landlocked York. He attended Tadcaster Grammar School before going up to the University of Strathclyde as a Lloyd's sponsorship student to study Naval Architecture.

After graduating in 2000 he joined Lloyd's Register to work in it's RDD (Rule Development Department). In September 2002 joined the LR Graduate Training scheme, and after a short spell with the Lloyd's Register office in the BAE Systems' Glasgow shipbuilding yards, he moved to undertake development in Dubai.

After moving off development in 2005, he remained with Lloyd's Register EMEA's Dubai Port Office, where he works as a Surveyor and a ISM lead Auditor.

The practise saves the prohibitive expense – and time – of erecting staging in the tank, but carries all the attendant risks of operating in dark spaces surrounded by obstacles that at any time could tip a less than vigilant surveyor into heavily oiled, and very deep water.

The ballast tanks pose less of a challenge structurally. Running along the length of the ship, and under the cargo tanks to the centreline, integral stringers provide safe companion ways down to the double bottom which has a clearance of 3m, making inspection easy.

That is, when the weather outside is as pleasant as it is on this day – a balmy 19C. Surveyor, Mark Darley says: "It's a different story in summer. For four months the temperature varies between 45C and 55C here in Dubai. In the tanks that temperature rises to 65C-plus. After half an hour in, you are a wet rag. Heat exhaustion is a real danger."

Surveying tanks in such temperatures requires work to be scheduled for the cooler parts of the day – early morning and evenings.

"When you come out, you have to take quite some time to recover. And to drink a lot of water", says Mark.

Down in the dock bottom, with the slab sides of *Arosa* towering over 30m above them, squads of dock yard workers are preparing the hull for a full paint job. Other teams are working below the line of the freeboard, preparing for the application of a new antifouling coating. The latest formula apparently won't even let sticky tape adhere to it, let alone a barnacle, says Mark Darley.

At the stern, the other major below-the-water-line job is being prepared – the removal of the propeller. The single cast bronze giant will be jacked off and then be tested for edge damage, cavitation damage and cracks. The blade roots are also an area of potential weakness that must receive visual and ultra sound testing.

It will be a critical time, says Mark Darley: "Minor wear and tear can simply be ground clear, but there are limits to which you can grind edge damage smooth. Beyond that, with a single casting bronze prop, you need to get a new propeller. And that is not cheap, or easy to come by. A ship can be out of service for a long time if it has to wait for a new prop to be cast."

Surveyors working in one of the central cargo tanks.

Dubai drydocks

During 2006 and 2007, 60% of the world's VLCCs and ULCCs that underwent dry-docking, did so at Drydocks World-Dubai.

Since first opening its gates to some of the largest ships in the world in 1983, the dock yard has repaired over 5,000 vessels of all types and sizes. A significant proportion of the world's tanker fleet, and almost every major owner and management company worldwide has used the facilities.

The yard, which employs over 8,500 multi-national skilled employees from 30 countries, and an on-call work force of some 1,500 workers from local subcontractors, sprawls over 500 acres of the Dubai shoreline, and is protected by an extensive breakwater.

Its three main graving docks, a floating dock and substantial berthing, makes up one of the biggest ship repair facilities in the world.

Dock Number 1 is 366m by 66m, and Number 3 is even larger, at 411m by 80m. Both are capable of holding the largest VLCCs and ULCCs, but are dwarfed by the Number 2 dock, at 521m by 100m, which is capable of accommodating up to four large vessels or barges at one time.

The floating dock is 205m by 32m, and there are 2,500 metres of repair berths capable of accommodating 8 ULCCs. The port is dredged to a depth of 11.5m.

All docks are covered by 120 ton cranes. A total of ten rail cranes are installed throughout the yard. In addition, there is a floating crane with lifting capacity of 2,000 tons, and a lift height of 70m.

Running a facility of such size and complexity demands safety has the highest priority, and management continually stresses t hat delivering safety is everyone's responsibility at Drydocks World-Dubai.

Trained, experienced safety officers and gas inspectors continually monitor all work sites and provide guidance on day to day safety issues. The safety team carry out daily safety walkabouts on vessels and audit each department or work area at least once a month.

In addition, trained OHSAS 18001 internal auditors ensure continuing compliance with the requirements of the standard against a planned programme.

Safety signage is prominently displayed in all work areas and, wherever possible, these are underlined with pictorial displays to ensure that they are understood by all nationalities.

There are procedures, work instructions and risk assessments for all generic activities. Any non-standard activity is the subject of a pre-task risk assessment and includes everyone involved in the job.

The use of appropriate Personal Protective Equipment (PPE) is mandatory in the yard for all permanent employees, sub contractors and owners' or suppliers' representatives. PPE is periodically reviewed to ensure it is providing the best possible protection for all routine and specialist functions. Training is provided when existing PPE is improved or new PPE is introduced.

The yard has a strict 'permit to work' system for all hazardous activities and operations. No hazardous work, within specified categories, can be started without a 'permit to work' being in place. Generally the 'permit to work' system is managed by the safety department but on larger projects, a central control centre is established to issue, and monitor all permits to work.

Drydocks World-Dubai's safety management system is certified to OHSAS 18001 – 1999 and the quality management system is certified to ISO 9001–2000.

When it comes to environmental impact, Drydocks World-Dubai are fully compliant with all local legislation relating to the disposal of waste, emissions into the atmosphere and discharges into the sea. The repair yard works closely with Dubai Municipality to ensure that all hazardous waste is disposed of responsibly. Waste is segregated into waste types at source, and re-cycled wherever possible.

Environmental Procedures are part of the Company Occupational Health and Safety Management System and have been developed in line with the requirements of ISO 14001 – 1996. The on site laboratory carries out third party sampling and testing. This is periodically supplemented by Dubai Municipality environmental inspectors who carry out their own audits, check records and conduct site inspections.

Also, Drydocks World-Dubai has the only tank cleaning, transfer and holding facility in the Gulf and accepts vessel wash water and slops on a regular basis.

Anchoring operations have an impact on paint coatings in the bow area, seen here after cleaning, spot blasting and preparation, ready to be coated for another five demanding years.

Then comes the tailshaft inspection. For that the dry dock uses a technique called Magnetic Particle Inspection. It involves passing a current through the tailshaft, which for a tanker the size of *Arosa* can be between 800cm to 1m in diameter.

It is then sprayed with iron filings, which are immediately magnetically trapped in any crack and show up as a dark line.

Even relatively small cracks in a tailshaft will be aggravated by the torque created by the direction of drive from the engine, and the force of the water acting against the turning propeller. Any failure in the tailshaft would be catastrophic.

Not all the work being carried out is directed at getting *Arosa* through her Special Survey.

A new requirement coming from the oil companies under their vetting process is for special chocks designed to help secure pipes serving a new vapour emissions collection system, or VECS. The system will contain all vapours from the cargo tanks, and then discharge them ashore or into another vessel, instead of allowing the vapours to vent into the atmosphere.

Panos Deligiannis, Neda Maritime's Superintendent in Dubai.

Arosa's master, Captain Costas Koulouris likens the precisely controlled activity around him to a factory floor. His ship, apart from his safety and its environmental responsibilities, is no longer his. "Even to do the smallest job, we have to ask the drydock's ship manager for permission", he says. Dubai dry dock has very strict safety standards, and it guards them jealously, adds the Captain.

Captain Koulouris has been aboard *Arosa* for over 6 months, and will have at least one more voyage to complete once his ship is back in service. *Arosa* is already scheduled to load a cargo at Kharg Island for China. After that, some leave, he hopes.

Although, there is time for runs ashore, and the dock yard teams might have full run of the ship, that does not mean Captain Koulouris' crew will be idle. He and Neda Maritime's superintendent in Dubai, Panos Deligiannis, have their time taken up with co-ordinating the dock yard workers' tasks, and the necessary housekeeping work to be carried out by the crew.

One of their tasks is to prepare for a visit by the Company Technical Director prior to leaving dry dock. All Neda Maritime's 21 ships – eight tankers and 13 bulk carriers – are visited regularly by senior Neda management.

Its part of their hands-on approach to ensure the company, although no longer small, retains the feel of a tightly-knit community. They will also be busy receiving the dozen newbuilding vessels being delivered over the next 18 months or so.

> "although no longer small, Neda retains the feel of a tightly knit community"

The Neda Maritime regime encourages frequent visits to the ships by members of the shore staff, and it ensures that each superintendent has no more than three to four ships under his responsibility. It keeps the team tight. Because crews and staff know each other, it makes communication easy, and delivers team motivation and a feeling of pride and responsibility in the entire organisation.

All the officers are Greek and directly employed by Neda Maritime Agency. When key personnel change over, the officer going on leave will remain on board for usually one further voyage, to ensure an effective handover to his replacement.

As for the crew members, they are mostly from the Philippines, and are recruited in the expectation that they will remain with the company over the long term. Because Neda Maritime works to ensure conditions on board are above average, crew members tend to stay, with many clocking up several years service.

Costas Mitropoulos, Neda Maritime's Technical Director.

The company, for example, was the first to introduce email access to all crew members to ease the pressures of long separations from family. This sensitive approach also has a commercial dimension – there is a chronic shortage of seafarers currently plaguing the marine industry, and Neda is determined not to fall victim to its fallout.

Captain Koulouris says: "With modern communications you are more in touch with the land during your voyage. We now ensure our crew are able to SMS and email their family and friends, this is essential today. This has changed how we behave as seafarers. Now we do not leave the land so far behind us."

But it also means that, "nowadays you have more contact with the office", he adds. Yes, it makes a career at sea more amenable, but it is also more pressured. There is less time to go ashore, more paperwork and more inspections. The Captain does not have much time for leisure – either in port or at sea.

Captain Koulouris is from the Aegean island of Chios, legendary breeding ground of seafarers. He has followed the long tradition of his fellow islanders in going to sea to earn his living and make his life.

But these days he is all too aware that with more choices for young people in a country like Greece, the likelihood of young Greeks following in his footsteps is receding rapidly. He, on the other hand, will be heading back to sea as quickly as Dubai Drydocks can turn his ship around.

Looking forward from his bridge Captain Koulouris can see the Arabian Gulf. It is not difficult to sense that he is looking forward to feeling water beneath his keel again.

Arosa, shows off her new paint under floodlights. Come the dawn her dry dock is flooded, and Arosa proceeds to sea.

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