

**MARITIME  
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AND  
ENGINEERING NEWS

DECEMBER 1998

# *Great Ships*

*- 1998 -*

*Staying the course*

*European shipyards are holding market share in the high-end, high-value market segments by making investment in technology a priority*

Coatings & Corrosion Control: TBT Debate Heats Up • Propulsion: Cummins, Deere Debut New Units  
Marine Literature Review

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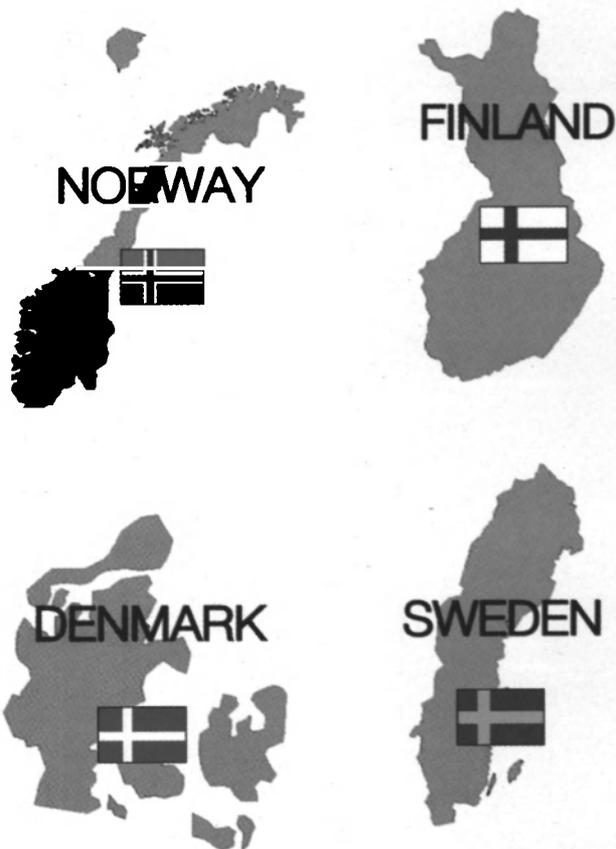
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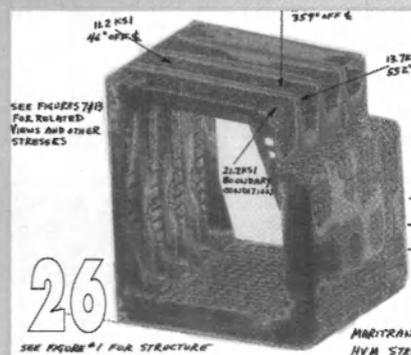
Pictured on this month's cover is P&O Nedlloyd Southampton, chosen as one of MR/EN's Great Ships of 1998. The post-Panamax containership class, with a 140-ft. beam, is able to stow 17 rows of containers across the weatherdeck and hatches. The ship also incorporates record-breaking propulsive power, as the 6,690-TEU ship is powered with a force of 89,640-bhp. Great Ships coverage starts on page 26.

- 8 Taking the High Road**  
While Korea and Japan continue to gain market share, European builders, notably Dutch ship builders, have demonstrated a level of efficiency in small-vessel construction which stems not only from technical and design skills, but from organizational methods. — by David Tinsley



## GREAT SHIPS OF 1998

- 26 Trailblazers**  
Maritrans has led the way with its unique installation of a double hull on its superbarge *Maritrans 192* at Tampa Bay Shipbuilding.



- 30 Take Two**  
Daewoo has the distinction of providing two ships in this year's Great Ships edition, the 130,000-dwt shuttle tanker *Loch Rannoch* and the ice-strengthened containership *Canmar Pride* (featured on page 50).



- 34 Sweet Home Alabama**  
Alabama Shipyard's delivery of the 16,000-dwt chemical tanker *Amalienborg* marked the first self-propelled oceangoing vessel built for export in the U.S. in more than 40 years.



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## EDITOR'S NOTE

### Plotting The Course For 2000

The maritime industry has always provided fertile grounds for the breeding of a good suspense — whether it be of the political, financial or nationalistic pride variety — and the past year proved to be no exception. Coming into 1998, most attention was squarely focused on the “clock ticking” toward July 1 and the implementation of the ISM Code. Gloom and doom sayers had a field day, predicting dire consequences regarding the ability of the world fleet to effectively acquire the necessary stamp of approval, and forecasting the literal stoppage of international trade. July 1 came and went, much like any other day of the 24 hour variety, and on July 2 the world was still spinning.

The ongoing sagas regarding subsidies, “price dumping” and excess building capacity remain just that...ongoing sagas. While it has become abundantly clear that the U.S. is in no hurry to ratify the OECD agreement regarding the elimination of shipbuilding subsidies, it has left the EU and the individual European countries in a quandary regarding the support to their shipyards. The mantra of unfair competition and “price dumping” has grown louder and more frequent, as more and more orders fall into the hands of Asian yards. China has now fortified its position among the world's most prolific shipbuilders, taking the number three slot in terms of tonnage built behind Japan and Korea. While the continuing financial crisis will surely shake-out some of the corporate weaklings, it has become clear that the balance of new ship orders is not about to shift from the Far East anytime soon.

Thus, yards with addresses outside of Japan and Korea will continue to focus on the high-value and niche vessel segments. The formation and operation of the Aker Group of shipyards, under the direction of Otto Søberg, and the expansion of Halter Marine Group in the U.S. under the direction of John Dane III, could be considered blueprints for shipyard operations of the future: a grouping large enough to withstand the financial rigors inherent in the market, yet small enough to be responsive, flexible and capable of responding to a diversity of market demands with a high degree of excellence.

#### What's Next?

It seems a necessary exercise to conjure a “deadline” upon which to focus attention, and the coming year provides the mother of all deadlines in the form of January 1, 2000 and the inevitable Y2K problem. Companies worldwide are in top gear to ensure that there is no catastrophic shutdown at the stroke of midnight on December 31, 1999. While it can be reasonably assured that there will be a number of problems — given the sheer size and inter-dependency of the international maritime market — it is similarly reasonable to assume that the shipping industry will weather the storm relatively well.

The upside of Y2K is the strong focus on technology: revealing how automated the “conservative” maritime market has become, and additionally, how many more levels of automation can be achieved. The “high-tech” side of the maritime market will be a recurring theme in MR/EN throughout 1999 (starting with an in-depth Y2K assessment feature in January) with many articles and sections dedicated to exploring the way in which companies — vessel builders, owner/operators and marine equipment suppliers — are integrating advanced solutions to save time and create new efficiencies and profit opportunities.



*Gregory R. Franthum*

### Coming Up In MR/EN in 1999

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Nav/Comm Electronics Selection Guide  
Country Focus: Norway

#### March 1999

World Ship Repair Technology Guide  
Guide to Satellite Communications  
Country Focus: Spain

#### April 1999

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World Ship Repair Atlas & Directory  
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# Europeans Hang On With Technology



by David Tinsley,  
technical editor

European shipbuilding's ever-slackening hold on the indigenous market for the larger types of cargo-carrying vessel has been emphasized by recent contracts placed in Japan and South Korea by owners from communities traditionally loyal to national industries where the capability, if not the will, has been retained to build high-capacity crude carriers and bulkers.

In the face of domestic economic adversity, Korean shipbuilders in particular have demonstrated fortitude of an order which transcends any advantageous position conferred by a weakened currency. But time will tell whether structural changes to the industry in other parts of eastern Asia, precipitated by economic crises in the region, will impact on the market and hence on the seemingly inexorable drift of business towards the Orient.

Despite Europe's loss of production of the most populous categories of deepsea merchant vessel, sectors of the industry have displayed a tremendous business resilience, maintaining markets and competitiveness through a focus on technology and production processes.

Cruise ship construction is a case in point, but world-class efficiency in turning out altogether more modest vessel types is also clearly evident.

Dutch shipbuilding, in particular, has demonstrated a level of efficiency in small-vessel construction on a scale scarcely matched in any other part of the world, which stems not only from technical and design skills, but from organizational methods, notably a far-sighted approach to outsourcing coupled with investments in areas of specialization.

While welcoming the impending abolition of EU subsidies, there is a growing feeling in those quarters that the European Commission needs to re-think its shipbuilding policies so as to better enable the more dynamic sectors of the industry to thrive and contribute to the

wider economic well-being.

It could be said that the EU would do well to nurture such areas of enterprise and competence in the face of growing international uncertainty.

"It is striking that capacity control of the European shipbuilding industry is still an issue," observes Central Industry Group (CIG), a Dutch company heavily involved in ship steel fabrication, shipbuilding, design and marine engineering.

"If the sector is to flourish and blossom, the policy to be pursued should be proactive and stimulating rather than reactive, subsidy-oriented and restrictive of capacity."

The industry in the Netherlands considers itself strong enough to maintain its position in a globally subsidy-free environment.

The manner in which firms have retained viability and competitiveness should perhaps be better appreciated by the Commission, which often models its policies on Japan, despite fundamental differences between the industries in Japan and Europe as regards generic ship type focus, unit scale, corporate diversification and shipbuilding profitability.

"It would be better if the EC were to follow the top segment of productive European shipyards and to benchmark these," suggests CIG. "From a conceptual perspective, the top segment of the European shipyard industry might well be better prepared for the future than their Japanese colleagues," it suggests.

"After all, the shipyard of the future is likely to be an assembly company with a strong business orientation on project development and a clear operational focus on project management, rather than an old-fashioned, inflexible, capital-absorbing and labor-intensive ship's plant.

This new type of shipyard makes use of a network of suppliers each specializing in his own product and often working for various shipyards."

"Such a structure of the industry will lower the risk profile of both the shipyards and their network of suppliers," asserts Groningen-based CIG. The north Netherlands, where a cluster of independent shipyards, section builders, materials and equipment suppliers, function in an integrated manner, provides a showcase for such arrangements.



Dutch fortitude: 2,800-dwt feedership Heereplein on ice passage following delivery by Tille Scheepsbouw, part of the Central Industry Group (CIG)

## Vigorous Norwegian

One of the leading proponents of an integrated industrial approach to the business, the Norwegian-controlled Ulstein Group, continues to build a presence in the international market while strengthening core activities on the home ground. By bringing U.S. propeller manufacturer Bird-Johnson and Polish marine equipment maker FAMA into the fold, it has complemented and embellished Ulstein's existing production range and commercial scope. At the same time, the group is pressing ahead with vigorous investment in cornerstone operations in Norway. One current expression of its continuing commitment to the Norwegian maritime production cluster is the NKR250 million which it has invested in the first stage of a major development of its Ulsteinvik shipyard.

Ulstein is intent on making further acquisitions and developing new alliances. It sees the Asian crisis as a challenge rather than something to be feared, as evidenced by the collaboration forged with Hyundai Heavy Industries in medium-speed diesel engine manufacturing and development, and by its efforts to identify new investment possibilities in Asia. It has an eye not only to accessing lower-cost production capacity, but also to increasing market presence in preparation for future market re-generation.

President and CEO **Baard Mikkelsen** acknowledged that any economic slowdown in the region could influence the Norwegian Stock Exchange-listed group's immediate prospects, although the short-term impact is unlikely to be significant since Asia accounts for only 10 percent of Ulstein's business. But, taking the longer-run view, he affirms that the region constitutes "an area of great potential for the sale of Ulstein products and services."

Ulstein has to be able to demonstrate agility in both commercial and production strategy in order to maintain the growth and profitability momentum it has built up. Some 70 percent of the Group's current business emanates from the offshore sector, which has seen a downturn in revenues commensurate with the drop in oil prices, while inflationary forces currently at work in Norway threaten to eat into com-

petitiveness and margins. Increased productivity must compensate for cost increases arising from wage settlements of five to eight percent in Norway, where the greater part of the group's manufacturing base is located.

Maintaining a technological edge in key product areas is also crucial to long-term competitive-

ness. After all, more efficient and new technology has significantly reduced the costs of offshore exploration and exploitation, which has in turn opened up new project opportunities and created new demand for equipment, systems and vessels. To be able to provide a single-sourcing capability also assumes greater significance as

time goes on, giving added merit to moves such as the purchase of Bird-Johnson and its manufacturing facilities. While taking the group into new sectors of the market, the acquisition has boosted the portfolio and production capacity of Ulstein Propeller, one of the Norwegian organization's star performers in recent years.

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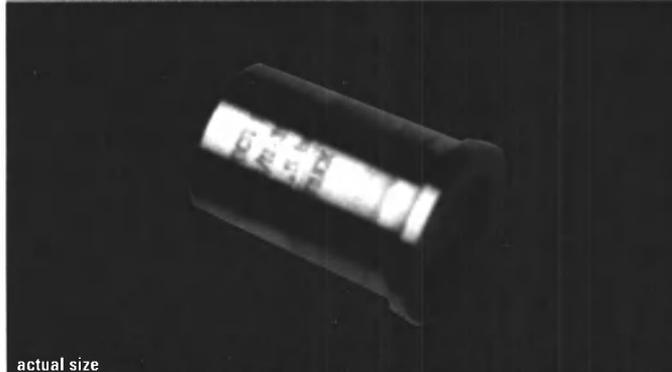
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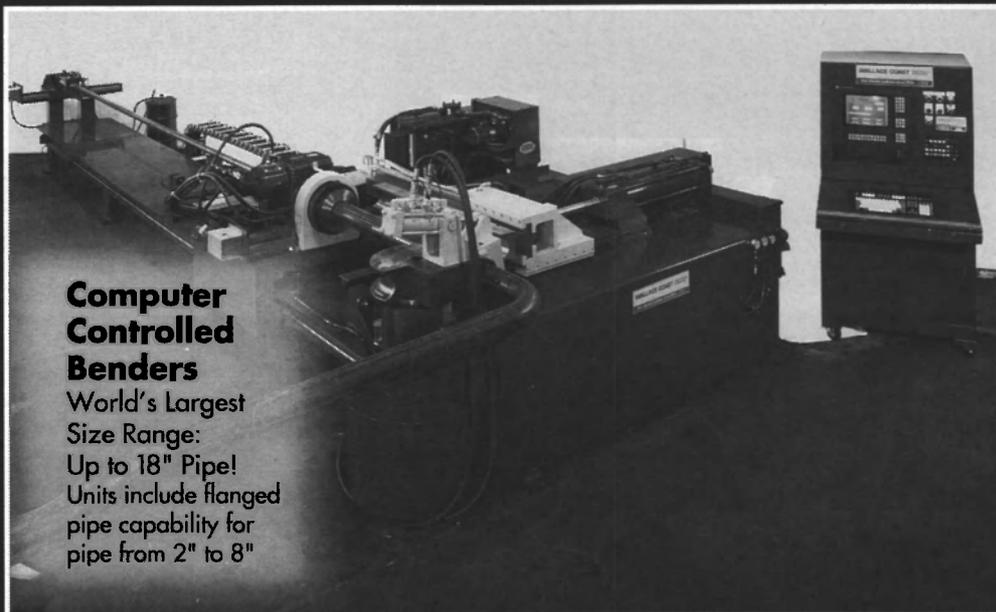
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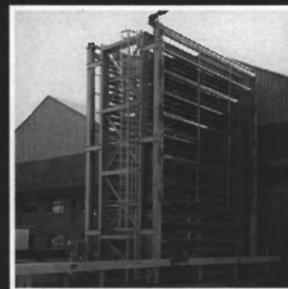
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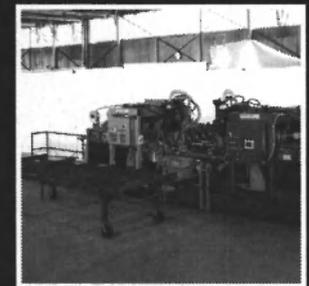
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**Cascade General Completes Upgrades To Regal Princess**

The P&O cruise ship Regal Princess was re-launched in early October after a 12 day stopover at Cascade General's Portland shipyard.

The 36,575 ton ship departed with an enlarged and modernized Lido Café on Deck 12 and a new Children's Center on Deck 14, as well as numerous other modifications.

Besides a complete bottom blast and re-coat, numerous frames supporting the double bottom were repaired. In addition, the port six-blade Lips propeller weighing 33,000 lbs was removed, and the shaft was pulled.

Passenger areas were given a complete upgrade and re-fit, with new carpets and fixtures. Deck spaces were given new ceilings, wall paneling and decor. More than 500 workers were involved in the project, working around the clock to ensure the 1,596 passenger ship would be ready to resume operations out of San Francisco to the Caribbean on October 3.

Circle 48 on Reader Service Card

**FBM Wins Order For Two Protector Class Vessels**

The Ministry of the Interior of The United Arab Emirates has ordered two 108 ft. (33 m) Fast Patrol Boats from FBM Marine Limited of Cowes, Isle of Wight, U.K. Constructed in marine grade aluminum alloy, these vessels are designed to undertake coast guard duties, and have excellent sea keeping and handling characteristics. The design is based upon the well proven Protector class hull, already in service with the Royal Bahamas Defense Force and the Chilean Navy.

Four 85 ft. (26 m) variants are operated by the U.K. Customs & Excise.

The fast patrol boats are powered by twin MTU 16V TE 94 engines each rated at 2,173 kW at 2,000 rpm, driving through conventional stern gear and propellers giving service speeds of up to 35 knots.

**Eight Australian Patrol Boats Receive Decca Radars**

Litton Marine Systems has won an order to supply radars and other bridge equipment for eight

patrol boats being built by Austal for the Australian Customs Service. These will be among the first vessels to be fitted with the new Decca BridgeMaster E series radars, which were introduced in September 1998. Each of the eight patrol boats will be equipped with

interswitched Decca BridgeMaster E S-band and X-band radars, along with gyrocompass, magnetic compass, autopilot and speed log from Litton's C. Plath division.

The first systems were scheduled to be installed in October 1998 with final deliveries by Octo-

ber 2000.

The orders were placed through Electrotech Australia Pty Ltd., Litton's licensed sales and service agents in Australia. Electrotech's nationwide service coverage was a key factor in the selection of Litton equipment.



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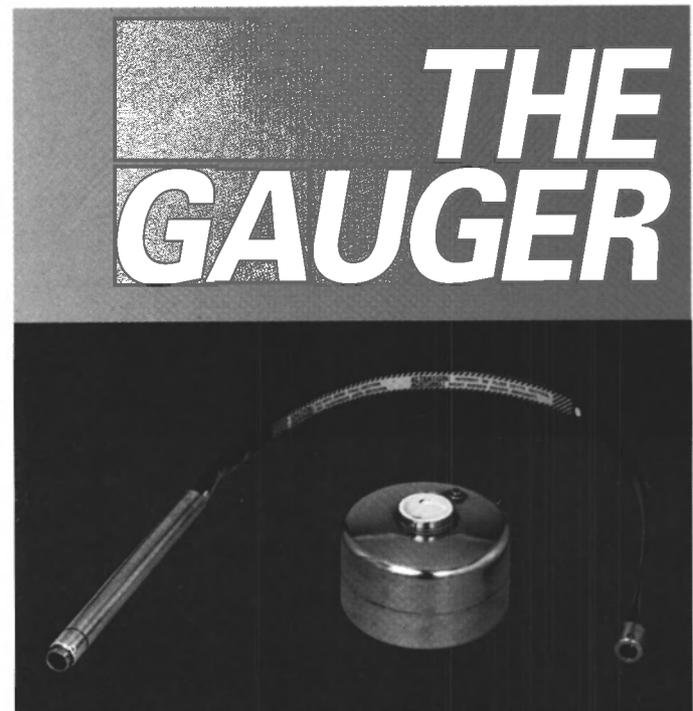
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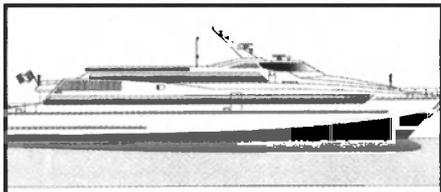
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**Austal Ships Wins New Caledonia Contract**



Western Australian shipbuilder Austal Ships has won a contract to build a 171 ft. (52 m) high speed passenger catamaran for operation in New Caledonia. The vessel is being purchased by the Loyalty Islands of New Caledonia and will be operated on routes from Noumea to these easterly islands by Compagnie Maritime des Iles (CMI). Designed to carry 366 passengers and ten cargo crates, the aluminum catamaran will be powered by four MTU 12V 4000 M70 series engines to deliver a fully loaded speed of 34 knots. The vessel, scheduled for delivery in September 1999, will be classified by Bureau Veritas.

**Cory Towage Upgrades Mersey Fleet**

Cory Towage has purchased a 48 ton bollard pull stern drive tug from Japan, Senho Maru. It was built in 1992 and is currently being dry-docked in Yokohama for modifications before making the voyage to the U.K. Renamed Ashgarth, the 3,600 bhp azimuthing FiFi tug is expected to arrive in Liverpool in December. Modifications include the fitting of bulwarks, changes to the accommodation to meet MCA requirements and the addition of a sea towing winch on the main deck. Cory Towage is also upgrading its 50 ton bollard pull tug Oakgarth with a 315 hp bowthruster providing five to eight tons sideways thrust and complementing the existing azimuthing stern drive propulsion system.

**KCS Wins Major Korean Contract**

Hanjin Heavy Industries has chosen the Tribon 4 shipbuilding system from Kockums Computer Systems (KCS) for design and production of ships at its Youngdo Shipyard in Pusan, Korea. The shipbuilding company has purchased the Initial Design, Initial Structural Design, Hull, Work Preparation, Production Data

Interface, Vitesse and the complete Outfitting applications of Tribon 4.

**Diamond Offshore Contracts Awarded**

The Red Fox Companies of New Iberia, a subsidiary of

TransCoastal Marine Services, Inc. has won two contracts from Diamond Offshore Drilling, Inc. The first project includes modifications to its semi-submersible drilling rig Ocean Ambassador. The vessel will be docked at the Michoud yard in New Orleans for

pipings repairs and modifications requiring both ABS and U.S. Coast Guard inspections. The second is for prefabrication of four transition zone column sponsons for the Ocean America. Sponsons will be prefabricated at the France Road Yard.

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**Bellingham Bay Completes USCG Contracts**



Bellingham Bay Shipyard recently completed a pair of U.S. Coast Guard repair contracts worth \$2.8 million for the 378 ft. (115 m) cutters Mellon and Midgett. In addition to maintenance and voyage repair work, both projects involved drydocking, complete blasting and painting of freeboard and underwater body, rudder bearing replacements, and cooler and piping renewals on the ships' supplementary gas turbine engines.

**Oceanering Wins Navy Contract**

Oceanering Technologies has been awarded a contract with the U.S. Navy to provide worldwide engineering, production, research, and search and recovery support to the Portsmouth Naval Shipyard. The value is reported to be approximately \$20 million. The work scope includes design, alterations, repairs and improvement activities on U.S. Navy Deep Submergence assets, submarines and surface support vessels in both dry and underwater environments.

**Sperry Marine To Supply IBS To U.S. Navy**

Sperry Marine, a Litton Marine Systems company, has been awarded a contract worth more than \$1.1 million to supply a Smart Ship integrated bridge system (IBS) for the U.S. Navy's newest amphibious assault carrier, USS Iwo Jima (LHD-7). The project involves supplying a complete suite of integrated navigation, steering and control systems for the new ship, which is scheduled to be completed in December 2000. The Sperry system on the Iwo Jima will take advantage of the latest advances in high-resolution flat-panel display technology, which will provide significant space savings in the bridge layout.

**15 Orders Confirmed For Sulzer Low-Speeds**

The Sulzer RTA96C low-speed diesel engine is steadily becoming established as the one of the leading new super-bore engine for large fast containerships. Wartsila NSD recently received 15 con-

firmed engine orders for containerships contracted in Germany, Korea and Taiwan. Five 5,000 TEU ships for P&O Nedlloyd contracted at Kvaerner Warnow-Werft and Aker MTW Werft will each have a Sulzer 10RTA96C engine of 74,700 bhp, built under license by Hyundai Heavy Industries.

Hyundai will also be building the same engines for five 5,551 TEU Yangming ships being built at Hyundai and China Shipbuilding. The five 5,600 TEU ships being built at Hanjin Heavy Industries for Conti/NSB Niederelbe Schifffahrts GmbH & Co KG will be fitted with the Sulzer engines.

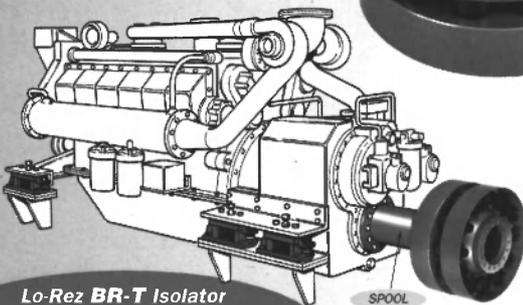
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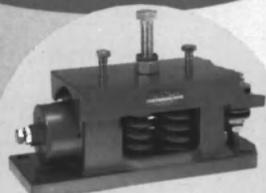
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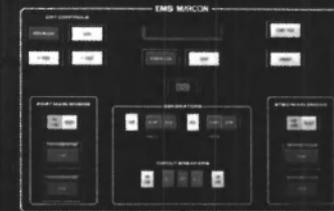
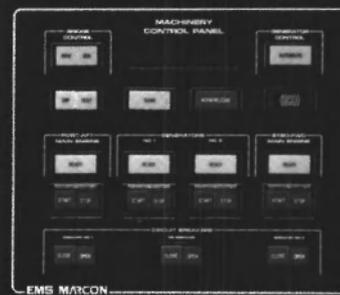
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**ECL Completes Drill Rig Conversion**

ECL of Lafayette, La. has recently completed the conversion of a matt supported, jackup drilling rig into a Mobile Offshore Production Unit (MOPU). Owned and operated by Consolidated Oil Ltd. of Lagos, Nigeria, the completed MOPU is capable of processing 80,000 barrels of crude per day along with 80 million cu. ft. of natural gas. Consolidated Oil plans to utilize the MOPU to expand production capacity with their existing fields with proven reserves. The rig, christened Auntie Julie the Matriarch, left ECL's yard in mid-October for Nigeria.

**Sunoco To Charter VLCCs**

Sunoco, Inc., formerly known as Sun Company, Inc., has entered an agreement to charter two new innovative VLCCs to bring crude oil to its Philadelphia and Marcus Hook Penn. refineries on the Delaware River. The new-design vessels will have increased safety and environmental features that take into account the unique aspects of the Delaware Bay and River. They will be built by subsidiaries of Concordia Maritime, a highly-respected publicly-held Swedish tanker company that works in close cooperation with Stena, the largest shipping company in Sweden. The two-million-barrel-capacity tankers, which will be built in the Hyundai Heavy Industries shipyard in South Korea, are expected to be completed by 2001 and will be immediately put on three-year charter to Sunoco. Sunoco Senior Vice President **Deborah M. Fretz** said the new VLCCs will provide substantial cost savings over the use of existing VLCCs as well as the smaller, one-million-barrel tankers typically used on the Delaware River. "Lightering costs will be substantially reduced because the shallow draft of the new vessels will enable them to get to Big Stone Anchorage without having to offload some of their cargo at sea," said Fretz. "In addition, the total amount that needs to be lightered will be reduced."

Existing VLCCs now lighter approximately 20-25 percent of their cargo onto other vessels at sea and another 30-35 percent in the Delaware Bay at Big Stone Anchorage before coming up the Delaware River.

Fretz said additional savings will be realized through improved fuel economy from a wider, shallower unique hull design and an increased maximum speed of 17 knots (a 15 percent increase over existing VLCCs). Several safety features are also part of the new design. These include double hulls, double engines and com-

pletely separated engine rooms, double rudders and steering gears, and double propellers. Stena developed the new design in close consultation with Sunoco to take into account the unique features of the Delaware River and Bay. "The combination of reduced operating costs and increased reliability will benefit Sunoco and reduce the risk

of transporting crude oil," said Fretz. "Stena already has an exceptional safety record, and these new vessels will only enhance their reputation for safe, efficient and environmentally sound transportation. We are very pleased to be part of this innovative venture."

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MREN-98

# TBT: The Debate Rages

*On eve of an IMO meeting to determine TBT's fate, an industry group contends that premature ban of tributyltin (TBT)-based anti-fouling paints will cost shipping companies hundreds of millions annually.*

Environmental pressures on shipping companies to toe the "green" line have been mounting for years, with new rules and regulations created regularly governing engine emissions, waste handling and other aspects of ship operations. While no one will

debate that maintaining the quality of the environment is priceless, most will contend that the number and level of mandates has started to strain the bottom line.

As the International Maritime Organization (IMO) was preparing to meet at the beginning of November to discuss the fate of TBT-based paints, a group representing the economic and scientific communities recently met in Washington, D.C. to present information which reportedly forecasts dire economic consequences resulting from a "premature ban of Tributyltin (TBT)-based antifouling paints."

TBT has been used as an effective antifouling paint since the early 1970s on ship's hulls to effectively check the growth of tubeworms, algae and barnacles. The superior anti-fouling protection afforded ships is directly relevant to the healthy bottom line of the companies which operate them, as clean hulls allow ships to operate more fuel efficiently, and require less frequent regular maintenance.

With the operational aspects serving the role of silver lining, TBT's reported effects on the environment have long filled the role as the dark cloud.

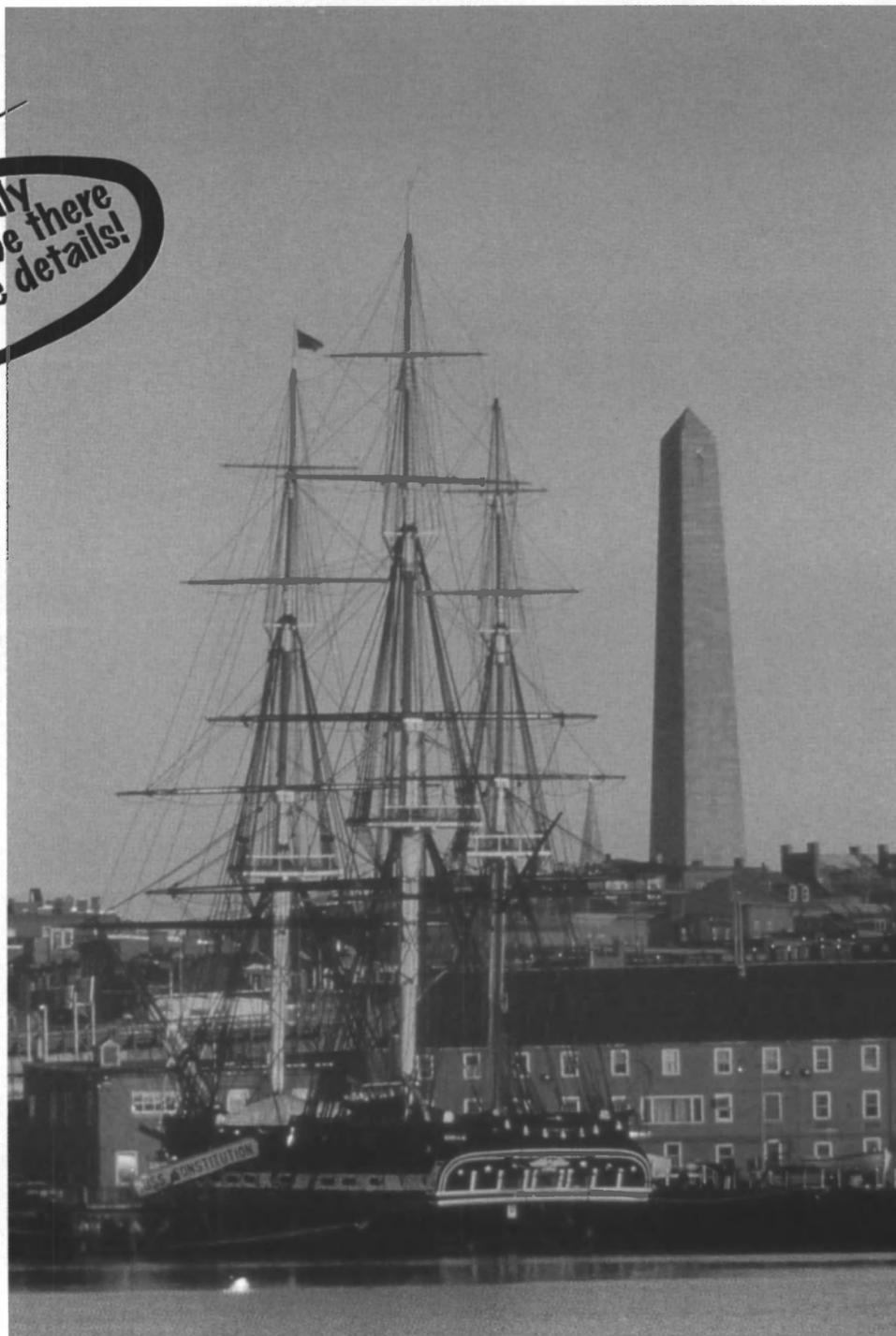
TBT-based paints are applied to ship bottoms and protect them from fouling. The TBT (tin is the primary active ingredient) in the paint slowly releases into the aquatic environment to prevent attachment of aquatic organisms. In the mid 1980s, researchers suggested that the use of TBT in antifouling paints was adversely affecting some aquatic organisms, namely oysters and snails.

This led to environmental regulations to limit the usage, and in some cases, the release rate, of antifouling paints containing TBT. The U.S. followed suit in 1988, passing the Organotin Antifouling Paint Control Act, restricting the use of TBT-containing paints to ships larger than 25 m and those with aluminum hulls.

Last month, the Organotin Environmental Program (ORTEP) Association hosted an event which delivered data which shows that estimated annual cost to the world fleet to switch from TBT-based paints to currently available tin-free products would range from \$500 million to \$1 billion.

The cost analysis was conducted by Princeton Economic Research

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"A decision to prematurely ban TBT-based paints would essentially cripple the U.S. shipbuilding industry by locking it out from the commercial business market," said Frank Losey, spokesperson for the American Shipbuilding Association.

According to an ORTEP statement, existing TBT alternatives exceed emission limits for volatile organic compounds (VOC), effectively eliminating commercial application of antifouling paints in U.S. shipyards.

At the same time, findings from Parametric Inc. — based on more than 10 years of monitoring conducted by the company and information from the U.S. Navy and National Oceanic and Atmospheric Administration — reportedly show that regulations currently geared to reducing TBT levels are working.

*Editor's Note: The preceding was supplied by the Organotin Environmental Program (ORTEP). The Consortium of Tributyltin Manufacturers was formed in the late 1980's in response to the EPA's requirement for long-term monitoring of TBT levels. The Consortium is a member of ORTEP.*

## Ameron Introduces PSX 1001

Ameron International Corp.'s Protective Coatings Group introduced PSX 1001, a one-pack topcoat designed to save time and labor costs. PSX 1001 reportedly provides weatherability, corrosion resistance, excellent color and gloss retention regularly seen in two-pack products.

PSX 1001 was developed for use with a wide variety of primers.

Circle 8 on Reader Service Card

## Environment Friendly Antifouling Paint Stripper

Safe-Way marine products offers what it is calling an environmental stripper that removes antifouling paint and above waterline coatings such as epoxies, urethanes and marine varnishes. The product can be brushed, rolled or sprayed on.

Circle 9 on Reader Service Card

## Marine Corrosion Control Dates Set

The international workshop on "Corrosion Control for Marine Structures & Pipelines" is set for February 9-11, 1999 in Galveston, Texas. The workshop is designed to define the state-of-the-art of corrosion protection of marine structures, define the state-of-the-art in testing for corrosion damage, identify the technical and non-technical barriers which hinder use of advanced methods for mitigating corrosion on marine structures and pipelines, and identify R&D projects to advance corrosion mitigation technologies.

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# Jotun Offers New Antifouling Concept

Jotun Paints, which continues to push the technical edge in terms of marine coatings development, is now simultaneously focused on

changing shipowner's mindset in terms of the successful and cost effective use of antifouling coatings.

A five-year research program by Jotun Paints has led the manufacturer to deliver a unique, customer driven solution for cost-effectively

selecting and applying antifouling paints. Jotun's research has reportedly shown that it is the formulation of the antifouling — rather than the Dry Film Thickness (DFT) — that provides the most cost-effective protection over the hull as a whole. Jotun's research program considered all vessel types and performance requirements.

Based on its results, Jotun has launched a "Menu Management" antifouling concept, a program designed to maximize the advantages of formulation-based choice for antifouling, as against the DFT system.

Simultaneously, the Jotun product range has been optimized — not only for the new concept — but also to meet anticipated future regulations on the use of tin-based formulations.

As a result, Jotun's Menu Management was designed to allow optimum protection to be achieved with less paint, less application time and lower costs.

Menu Management provides an owner with a full choice of antifouling formulations, each designed to meet certain performance criteria.

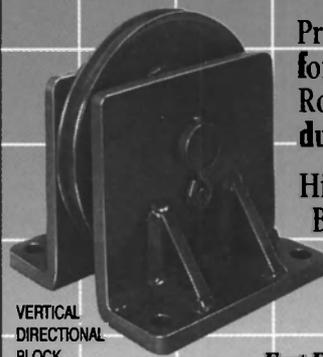
A new range of Seamate products retains its former versatility while allowing owners to specify systems which are more economical and beneficial regarding environmental impact. Seamate HB99, the manufacturer says, remains ideal for vessels with long stop-overs in port, and for laid-up ships, as its performance is designed for strongly polluted waters, or where the vessel speed is low.

New Seamate HB66 is a fast polishing product with optimized biocide package and improved polymer, reportedly well suited as a final coat in a multi-coatsystem. New Seamate SB3 is a medium/fast-polishing formulation designed for side/bottom areas, where it will provide up to 60 months protection at 10 to 22 knots.

For flat bottoms, slow polishing New Seamate FB30 is designed to combine optimum performance and cost effectiveness, giving 60 months of protection at 10 to 22 knots.

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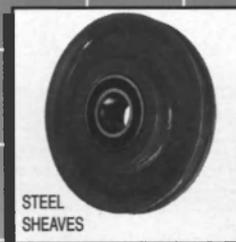
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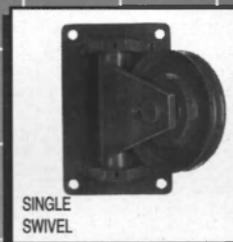
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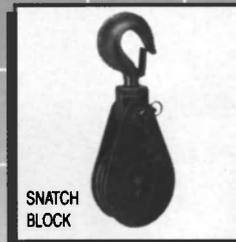
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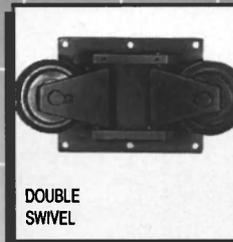
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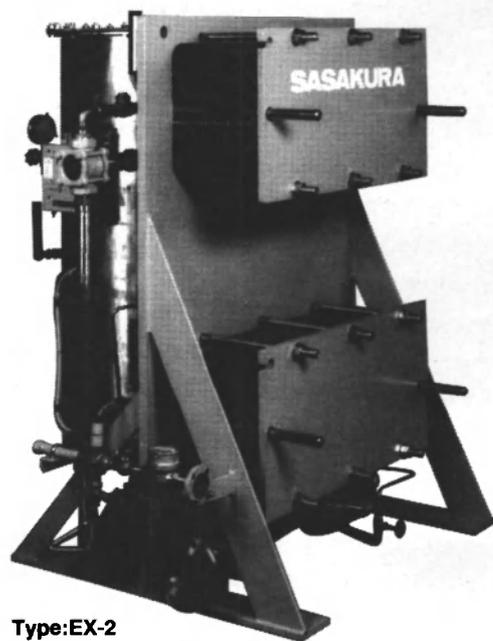
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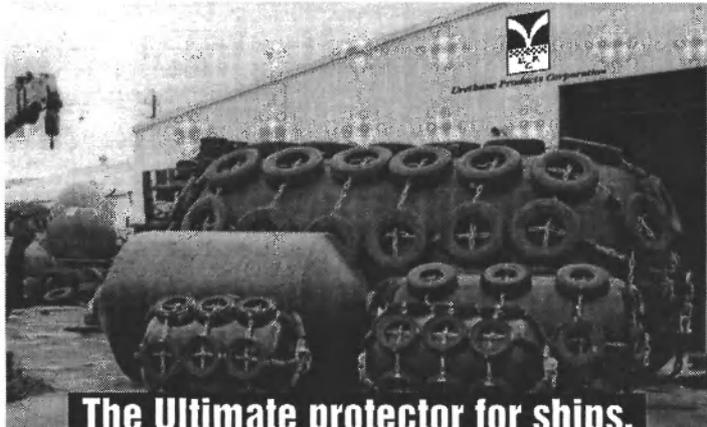
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# Mermaid Podded Propulsion Installed

Sedco Express — the first of a new fleet of DPS3 semi-submersible oil and gas drilling exploration rigs for operation in depths to 8,500 ft. — is the first use of the

Mermaid podded thruster drive in an offshore application. Mermaid was jointly developed by Kamewa and Cegelec. The system aboard Sedco Express consists of four sets,

each comprising synchronous 7 MW AC motor, pod cubicle and slipping unit, large and small pod domes, 12 pulse synchroconverter and 11 kV supply transformer.

Mermaid units reportedly can reduce required generating capacity by up to 17 percent, and cooling requirements by about 25 percent. Mermaid units are designed to save time and money on the repair and maintenance fronts as well, as the units can be fitted and replaced underwater. Shaft seals and propellers can also be changed underwater. For the project, Cegelec was tasked with a wide range of vessel power and control systems, including the overall power system, the AC drilling package, integrated control system and dynamic positioning equipment. The dynamic positioning (DP) system consists of a thruster, power system and operator interfaces, hydro-acoustic position reference system, DGPS system, anemometer, gyro compasses and vertical reference units for automated control of the vessel's position. The DP system provides joystick manual control of all thrusters.

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## Cummins Marine Debuts QSM11 Electronic Engine

Cummins Marine recently introduced the QSM11 electronic engine for light-duty commercial vessels. Producing 580 bhp (433 kW) for commercial applications, the engine features the new Quantum System, which is a full-authority marine electronic and fuel and control system. Standard features on the six-cylinder in-line 11-liter displacement QSM11 includes engine control module, electronic engine sensors, diagnostics, engine speed control and analog displays. The engine's option package includes C Cruise, which

QSM11 Specifications	
Configuration	6 cyl.,
Bore	4.92 in. (1
Stroke	5.79 in. (1
Displacement	661 cu. in. (10.8 l
Weight	2,475 lb. (1
Ratings (High Output):	
Rpm	.....
Bhp	.....
kW	.....
Metric hp	.....
Max. torque (lb./ft.)	.....
Ratings (Intermittent Duty):	
Rpm	.....
Bhp	.....
kW	.....
Metric hp	.....
Max. torque (lb./ft.)	.....

offers marine cruise control. Other C Cruise options include alternate/custom low idle, engine synchronization for twin engine applications, advanced, interactive digital engine displays, back-up throttles, prognosis and diagnostics.

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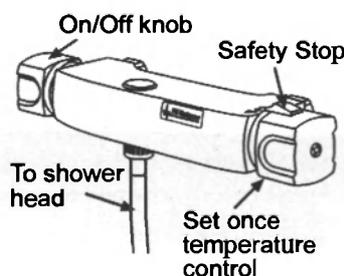
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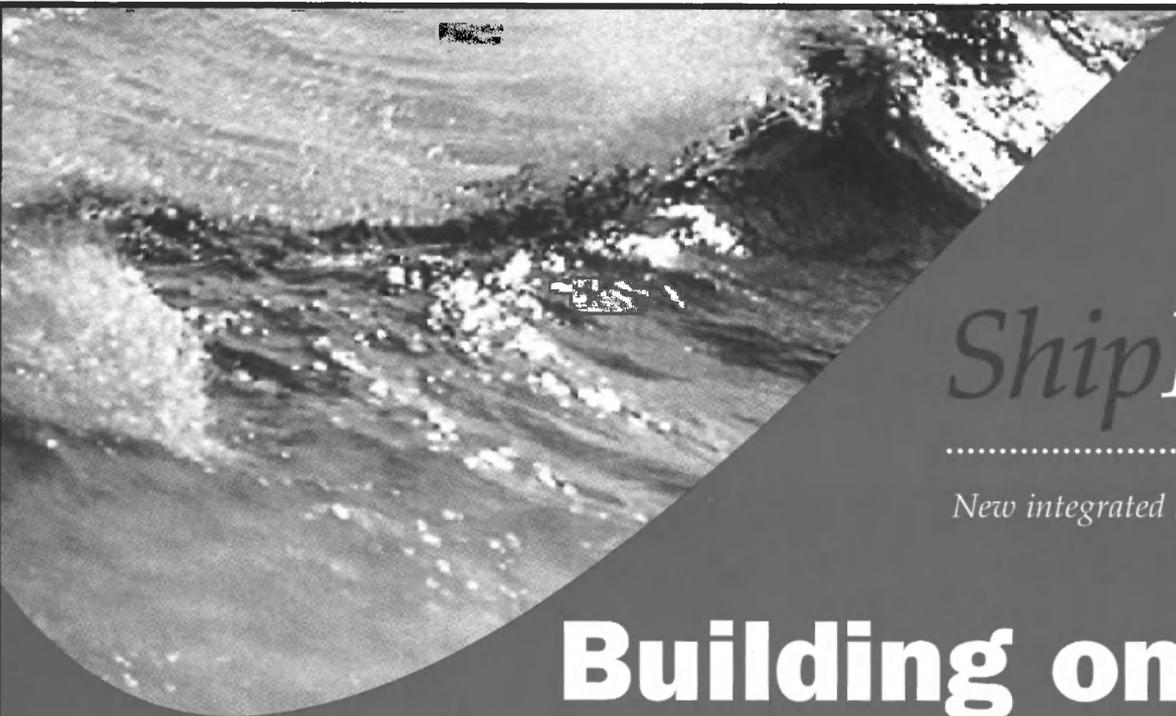


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- check design scantlings for compliance with LR's Rules and ShipRight procedures.

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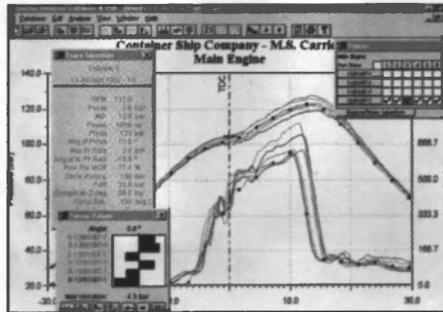
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## PROPULSION UPDATES

### Diesel Analysis Made Easier

The Doctor system from Icon Research is designed to be simple and accurate, providing the user comprehensive results. The manufacturer has recently upgraded the system to provide even better performance. The Doctor instrument has a completely revised set of



electronics which has been designed to allow the user to take engine readings and see calculated realities without having to interface to a PC at any stage. The instrument is still able to display the plot of pressure versus angle, but in addition has tabulated results for multiple cylinders

including Pmax, angle of Pmax, power (in kW and hp) and the maximum rate of change of pressure.

Circle 13 on Reader Service Card

### Deere Expands Marine Engine Line

Deere Power Systems Group introduced Powertech versions of its marine engines at the recent Fish Expo held in Boston. Deere now offers marinized versions of the 4.5, 6.8 and 12.5 L Powertech units. Deere's Powertech line features improved application flexibility, including either-side service for twin propulsion applications, flexible auxiliary drives, poly-vee belt drives and a belt guard to accommodate front driven PTO-adapted units. Performance of the line is tantamount to its success in other applications, and the engine is designed to provide outstanding fuel economy and torque rise, increased power ratings, reduced engine weight and lower smoke levels.

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#### John Deere Powertech Marine Engine Facts & Figures

Model	4.5L	4.5L	6.8L	
12.5L	(4045D)	(4045I)	(6068I)	
(6125A)				
M1 Power (hp @ rpm)	75 @ 2400	120 @ 2400	155 @ 2300	340 @ 1800
M2 Power (hp @ rpm)	85 @ 2500	135 @ 2500	175 @ 2400	375 @ 1900
M3 Power (hp @ rpm)	n/o	150 @ 2600	200 @ 2500	400 @ 2000
M4 Power (hp @ rpm)	n/o	n/o	225 @ 2600	450 @ 2100
Genset	Rating (kW)	Rating (kW)	Rating (kW)	Rating (kW)
50 hz, 1500 rated rpm	33	54	80	220
60 hz, 1800 rated rpm	40	65	99	250

#### NOTE

M1: Propulsion applications that operate more than 3,000 hours per year and have load factors over 65 percent.

M2: Propulsion applications that operate up to 3,000 hours per year and have load factors up to 65 percent. Can use full engine power up to 16 hours out of each 24 hours of operation; remaining time, at least 200 rpm below rated engine rpm. Also auxiliary power applications for dedicated hydraulic pump drives, dredge pumps on other constant load applications.

M3: Propulsion applications that operate up to 2,000 hours per year and have load factors up to 35 percent. Can use full engine power up to four hours out of each 12; remaining time at least 300 rpm below rated engine rpm.

M4: Propulsion applications that operate up to 800 hours per year and have load factors up to 15 percent. Can use full engine power up to one hour out of each 12 hours of operation; remaining time at least 400 rpm below rated engine rpm.

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### Volvo Penta Extends Diesel Engine Range

Volvo Penta is looking at 1999 as the year of its product range extension, with an aggressive growth strategy targeting market share of maritime and other markets.

A part of this growth strategy is the agreement between AB Volvo and Deutz AG under which the two companies have agreed on extensive cooperation in the development and manufacturing of diesel engines.

Circle 11 on Reader Service Card

## Company Profile

### Visund Launches New Offshore Platform Leg Protection System

A new and innovative fendering system for offshore platform leg protection was recently installed on the Visund platform operating in the North Sea. The system was designed, manufactured, installed and placed in operation through a collaborative effort between Seaward International, Fenco Engineering, UMOE Haugesund and Norsk Hydro.

The platform leg protection system, which protects against impacts from service vessels, consists of Seaward DONUT fenders mounted vertically to the platform legs with pipe stringers. The layout on the Visund platform includes 60 DONUT fenders, with 15 fenders per leg in columns of five. Because of the modular nature of the system, it can be modified to provide platform leg protection for most semi-submersible platform leg configurations and required protection areas. The heart of the platform leg protection system is the donut style foam-filled fender. These fenders are constructed of polyethylene foam-filled bodies built around steel cores. The foam-filled body provides for high energy absorption with relatively low reaction forces and maintenance-free operation. A nylon-reinforced polyurethane skin encloses the foam providing a cover that is highly resistant to tearing and punctures. The central steel core has low friction bearing pads to allow for free rotation on the pipe stringers. The buoyancy provided by the fenders can be included in the net buoyancy of the platform.

This is in contrast to traditional systems that add weight but no buoyancy. Traditional systems were attached to platform legs against buoyant chambers, then added externally to the platform legs. Since these chambers were susceptible to damage, their contribution to platform buoyancy

could not be considered.

The offshore platform leg protection system is the

Seaward's innovative fendering system was chosen to protect the legs of the Visund platform, which is operating in the volatile North Sea.

fender system of choice for Norsk Hydro's newest Troll C platform, currently under construction and scheduled to be put into service this spring. The extremely high construction and operating costs of offshore oil platforms justify the

need to provide the best protection available. This new fendering system is designed to provide improved protection by providing increased energy absorption and lower reaction forces compared to other systems. Seaward Interna-

tional, Inc. is a world leader in manufacturing plastics and elastomer technologies. For 25 years Seaward engineers have provided technological solutions offering a wide range of products and services to the marine industry.

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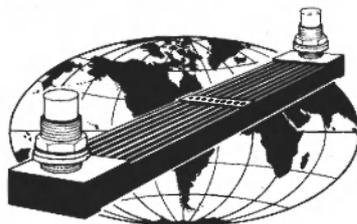


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# Maritrans Is Making Waves

First phase of innovative double hull initiative kicks off at Tampa Bay Shipbuilding



## Maritrans 192

Shipbuilder Tampa Bay Shipbuilding  
 Vessel type Double hull barge (Rebuild)  
 Owner/operator Maritrans Operating Partners L.P.

Conversions, retrofits, and rebuilds usually do not make *Maritime Reporter's* list of "Great Ships" but in this case we are pleased to make an exception.

Maritrans Operating Partners L.P. has successfully accomplished the installation of a double hull on its super barge Maritrans 192 (formerly Ocean 192). Based on an innovative design concept by the firm of Schuler and Allen, the construction was accomplished by Tampa Bay Shipbuilding in partnership with Maritrans' own technical staff. Re-christening of the Maritrans 192 was performed on November 9, 1998, by Mrs. Kay Loy, wife of U.S. Coast Guard Commandant Admiral James Loy. Admiral Loy was the main speaker at the festive occasion.

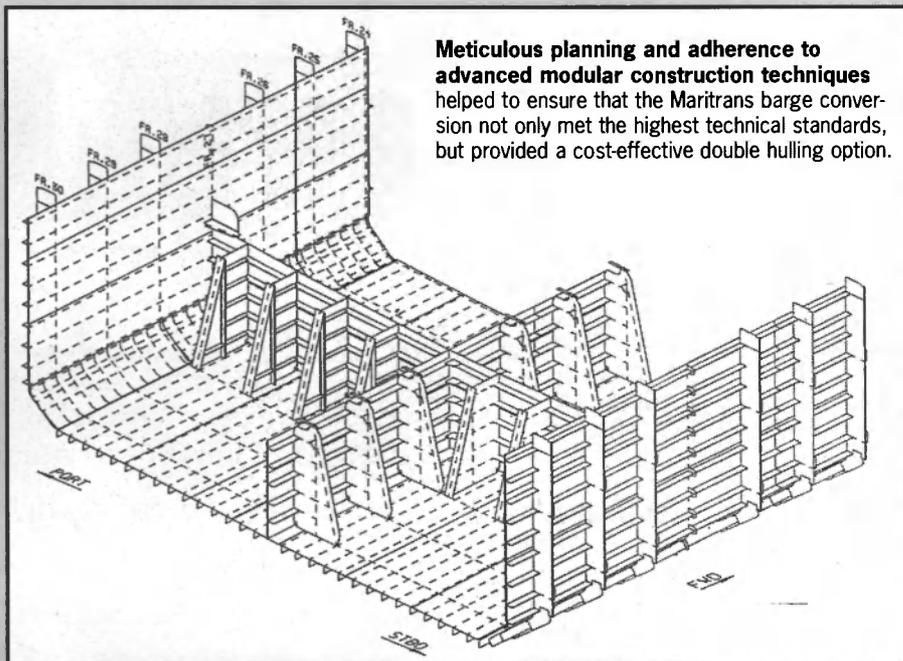
The rebuild merits coverage under the Great Ships banner as much for its economical sense as its technical merit. While an exact figure was not readily available, the cost of the conversion was in the neighborhood of \$10 million dollars, less than half the cost of a new barge fitted similarly to the Maritrans 192.

"As far as we can tell, this is the first rebuild from single hull to double hull anywhere in the

world," said Tom Hagner, double hull program manager for Maritrans. "People have talked about fitting external double hulls, but we are much more comfortable with Maritrans' internal rebuild concept. The cargo is completely protected by new steel, and we believe that many metallurgical problems involving the containment structure are avoided." Hagner adds that "the structure and coating of the original barge, which now makes up the converted barge's ballast tanks, was in superb condition. It is also useful that the major dimensions and hull hydrodynamic characteristics are unchanged so that the vessel can continue to serve the same customers."

### The Internal Refit Concept

The basic design concept is to use as much of the existing barge as possible to integrate smoothly with the entirely new internal double hull. The first step was a detailed inside measurement to detect changes from the design to



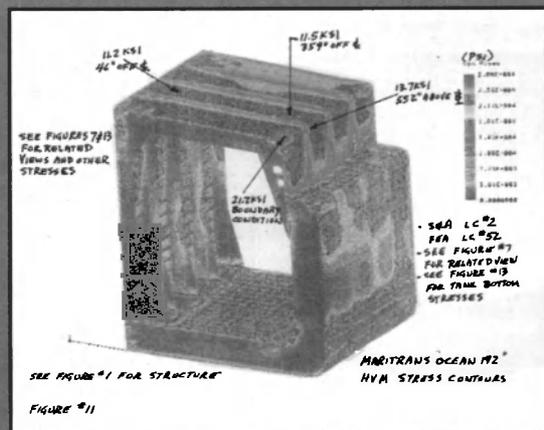
Meticulous planning and adherence to advanced modular construction techniques helped to ensure that the Maritrans barge conversion not only met the highest technical standards, but provided a cost-effective double hulling option.

"as-built." From these measurements, a significant amount of modular pre-assembly was completed long before the barge arrived in the yard. When the barge first arrived, the deck was cut into five large pieces. Those pieces with their attached transverse and longitudinal bulkheads were removed and stored separately.

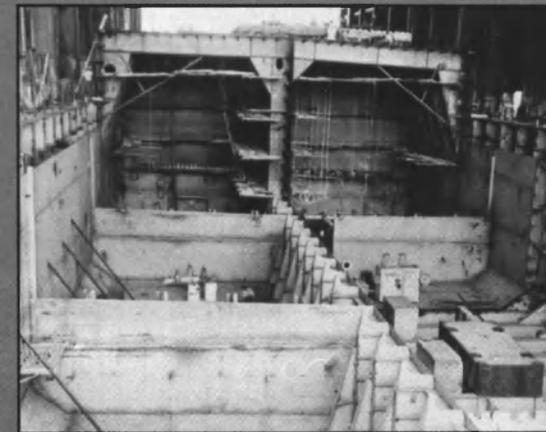
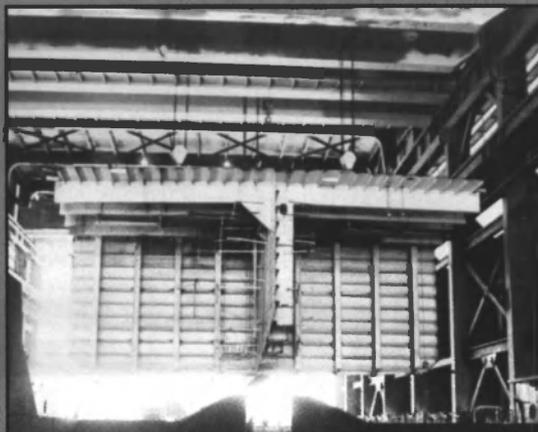
The prefabricated modules were laid on top of the existing bottom transverse frames and lapped onto the frames at the side. Forward and aft where the barge has more shape, the

(Continued on page 28)

## Breaking New Ground



Prior planning and pre-fabrication of modules helped to ensure the Maritrans double hull project proceeded smoothly. Pictured from left: Maritrans Ocean 192 HVM Stress Contours; the original deck and attached bulkhead are lifted free; and a cross section of the new inner hull.



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## GREAT SHIPS OF 1998

(Continued from page 26)

plating was installed in smaller increments. Because most of the original main deck and bulkheads were being raised to create a trunk deck, new lower portions of the transverse and longitudinal bulk-

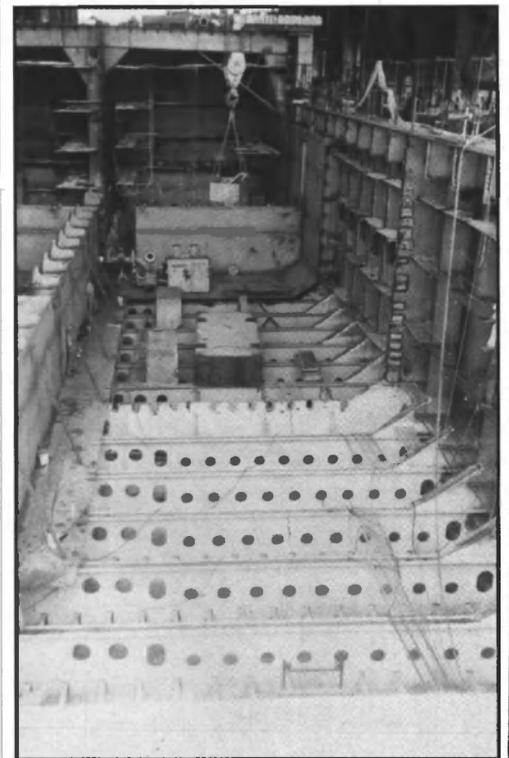
heads were fabricated and fitted. While the work was going on inside, the new side walls of the raised trunk were being fitted to the original deck and bulkheads. Finally, the completed deck and upper bulkhead assembly was installed.

In all, approximately 1,400 tons of new steel were added to the unit.

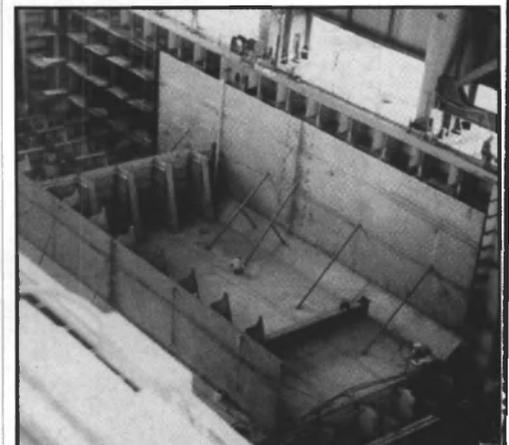
The cargo volume of the original barge was maintained approximately the same by raising a trunk from the main deck almost 12 ft. (3.6 m) using the existing struc-

ture to the maximum extent possi-

(Continued on page 44)



Maritrans and Tampa Bay Shipbuilding have broken new ground with the "internal rebuild concept."



Maritrans 192 Main Particulars	
Designers	Schuler & Allen
Flag	USA
Classification	ABS
Length, o.a.	480 ft.
Breadth	84 ft.
Depth to main deck	35 ft.
Draft	30 ft.
Capacity	approx. 180,000 barrels
Number of cargo tanks	12
Number of segregations	4
Lofters/ NC Programmers	DNC
Ballast system	Ameron
Piping installation	Global
Paint	Devoe
Blasting and coating	CCSI & IMIA

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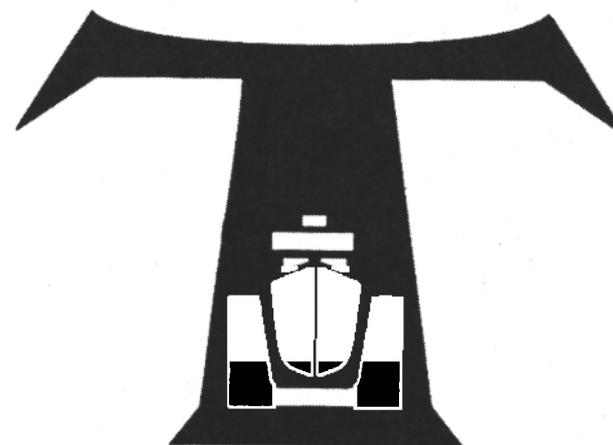
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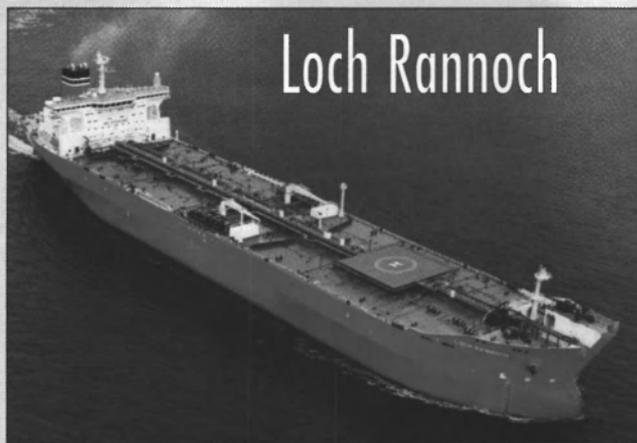
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**TAMPA BAY**  
SHIPBUILDING & REPAIR COMPANY



Loch Rannoch

Shipbuilder Daewoo Heavy Industries Ltd.  
 Vessel name Loch Rannoch  
 Vessel type Shuttle tanker  
 Owner/Operator Maersk Company Ltd.

By the very nature of their operating environment, and the long-term expectations of their users, new-generation shuttle tankers rank among the toughest yet most technically refined vessels, designed to ensure uninterrupted service in arduous conditions. Signaling the entry of both the A P Moller Group and BP Shipping to the shuttle tanker sector, the 130,000-dwt Loch Rannoch has been designed and constructed for a 40-year life in waters as rigorous as those encountered west of Shetland in the north-east Atlantic. BP Shipping will operate the vessel on behalf of BP Exploration, which has fixed her for an initial seven-year term from disponent owner A P Moller's Maersk Company.

Exhaustive attention to structural strength and reliability, state-of-the-art finite element modeling, the incorporation of significant margins in the scantlings, and the adoption of a highly compartmentalized hull configuration has been complemented by the application of the full redundancy principle to her propulsion and associated systems.

Delivered ahead of schedule and within budget by Daewoo Heavy Industries, Loch Rannoch has been assigned to continuous-cycle duties lifting crude oil in 850,000-barrel lots from the Schiehallion floating production, storage and offloading (FPSO) vessel to the Sullom Voe terminal on Shetland, some 150-km to the east. On the European offshore oil industry's Atlantic frontier, Schiehallion poses considerable demands on production and transportation by virtue of the harsh weather and sea conditions prevailing for much of the year. Indicative of what can be expected in operation, the design criteria for the tanker's dynamic positioning (DP) performance and bow loading arrangements have been based on a significant wave height of 6-m, compared with 4.5-m for similar-capacity vessels deployed in the North Sea. The forecastle and bow mooring deck height including bulwark has been raised by 3-m relative

to that which would be deemed necessary for the North Sea, which itself can be treacherous at times. A frequently large angle of divergence between wind and waves, a characteristic of conditions in the waters west of Shetland, has necessitated particular attention to the DP engineering design, given the implications for uptake operations based on the shuttle tanker maneuvering and lying abaft the FPSO.

Two low-speed MAN B&W diesels, located in separate engine rooms, and driving twin Ulstein controllable pitch propellers, with twin Schilling high-lift rudders, gives form to the redundancy concept which infuses the design. In fact, long-term risk management thinking pervades every aspect of the technical project. One expression of this has been the failure mode and effect analysis carried out on the DP system by Lloyd's Register, to which classification of the tanker has been entrusted. The exercise was undertaken to help ensure that no single failure would lead to greater than 50 percent loss of DP capability, in accordance with the DP (AA) notation.

Besides two huge thrusters of 2.5-MW apiece located in 3-m diameter tunnels in the bow, Loch Rannoch has an 800-kW tunnel thrust unit built into each skeg. DP (AA) confirms that her hydrodynamic system with automatic control is capable of moving, maneuvering and holding the desired heading and position of the ship, and that power, control, thruster and other systems pertinent to the DPS have been configured so that a fault should not result in loss of position. For such tankers, loss of position or deviation of course while on station or when approaching or departing the offshore unit could have serious consequences, from a cessation of offloading to collision.

Loch Rannoch is a remarkable ship in many respects, and her environmental features reflect not only the sensitivities of the communities bounding her trading domain, but also the corporate disposition of both BP and A P Moller. For instance, the relative narrowness of her center tanks, and the closed-loop vapor recovery system employed when transferring cargo from the FPSO, mirror a concern with minimizing the generation of volatile organic compounds (VOCs).

Circle 26 on Reader Service Card

Loch Rannoch Main Particulars	
Designer	Daewoo Heavy Industries Ltd.
Country	Korea
Flag	United Kingdom
Classification society	LR
Contract date	November 1996
Launch date	March 1998
Delivery date	August 1998
Length, o.a.	884.5 ft. (269.6 m)
Length, b.p.	840 ft. (256 m)
Breadth, molded	151 ft. (46 m)
Depth, molded	73.5 ft. (22.4 m)
Width of double-skin, side	9.7 ft. (2.96 m)
Width of double-skin, bottom	10.5 ft. (3.2 m)
GT	75,526
Lightweight	26,220.5 tons
DWT, design	127,259.7
DWT, summer	130,031.1
Draft, design	50.5 ft. (15.4 m)
Draft, summer	51.2 ft. (15.6 m)
Speed, service (85% MCR)	15.5 knots
Speed, service (alternative engine rating)	14.3 knots (78% MCR with 20% SM)
Cargo capacity (liquid)	138,381 cu. m.
Bunkers, heavy oil	3,078 cu. m.
Bunkers, diesel oil	294 cu. m.
Water ballast	60,713 cu. m.
Main engine Mfr.	Korea Heavy Industries Co.
CP Propellers	B&W 7550 MC
Diesel-driven engine	Ulstein
Diesel-driven alternator	Ssang Yong
Boilers	Nishishiba
Cranes	Mitsubishi
Mooring equipment	Hagglunds
Coating	Kocks
Cargo pumps	IPK
Cargo control system	Kvaerner
Ballast control system	Norcontrol
Complement	officers - 22; crew - 11; spare - 6
Rudder	Schilling
Bow thruster	Ulstein
Stern thruster	Ulstein
Bridge control systems	Norcontrol
Fire detection system	Consilium
Fifi system	Namyang
Radars	Norcontrol
Sat/Nav	SAIT
Loran-C	Furuno
GPS, DGPS	Norcontrol
Computer	Dall
Incinerator	Teamtec
Waste compactor	Metos
Waste shredder	Metos
Sewage plant	Taiko

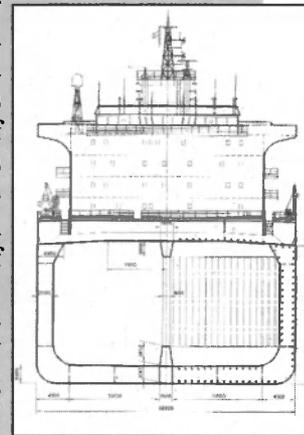


Shipyard Shipyard Trogir, Croatia  
 Vessel name Azov Sea  
 Vessel type DH Oil and Chemical Tanker  
 Owner/operator Valloy Shipping Co.

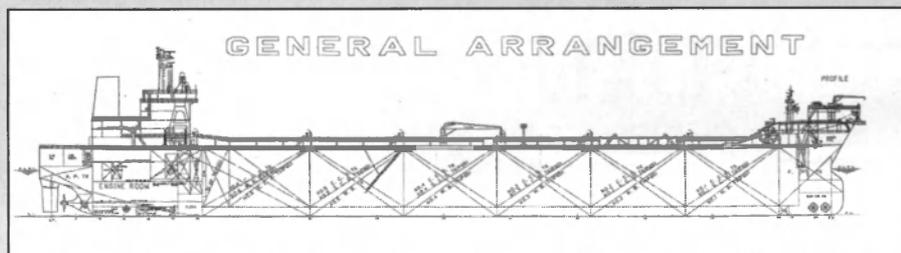
Built by Croatia's Shipyard Trogir, Azov Sea is the fourth in a series of nine 47,400-dwt double hull IMO 3 oil and chemical tankers contracted with Shipyard Trogir and two other Croatian shipyards, Split and Uljanik. The entire series is due for delivery by the end of 1999. Azov Sea and its sisterships are a direct result of more than 10 years research and experience by Shipyard Trogir in the area of double hull designs.

The ship is powered by an MAN B&W - Brodosplit 6S50MC Mark VI main engine, which develops 8,310 kW at 123 rpm.

Circle 27 on Reader Service Card



Azov Sea Main Particulars	
Designer	Shipyard Trogir Js. Co.
Flag	Liberia
Classification	LR +100 A1
Delivery date	March 1998
Length, o.a.	598.7 ft. (182.5 m)
Length, b.p.	573.4 ft. (174.8 m)
Breadth, molded	105.6 ft. (32.2 m)
Depth, molded to main deck	57.4 ft. (17.5 m)
Draft, design	36 ft. (11 m)
Draft, scantling	40 ft. (12.2 m)
GT	27,526
Displacement	57,054 m.t.
DWT, design	41,154 m.t.
DWT, scantling	47,374 m.t.
LWT	9,680 m.t.
Speed, trial (90% load)	15.4 knots
Complement	28
Cargo capacity	53,038 cu. m. cargo tanks + 1,260 cu. m. slop tanks
Water ballast	21,160 cu. m.
Bunker	1,735 cu. m.
% high tensile steel	2.5
Main engine	Brodosplit - MAN B&W 6550 MC Mark VI
Output	8,310 kW at 123 rpm
Propeller	Kamewa
Generators	Uljanik-Tesu
Generator engines	MaK
Emergency generator	Demp-MAN
Motor starter	Koncar-Elektrolux
Couplings	Flange
Engine controls	UMS
Steering controls	Porsgrunn
Bearings	Blohm+Voss
Coatings	Sigma
VHF radio	Furuno
SSB radio	Furuno
SATNAV	Furuno
Radar	Kelvin Hughes
Compass	Anschitz
GPS	Trimble
Autopilot	Anschitz
Pumps	Frank Mohn
Air conditioning	Sabrae
Life boats	Greben
Davits	Greben
Fifi system	Unitor
Waste management	Teamtec-Golar
Desalination equipment	Alfa Laval
Cargo control system	Saab
Ballast control system	Saab
Cargo hoses handling crane	Radez/Nor Marine



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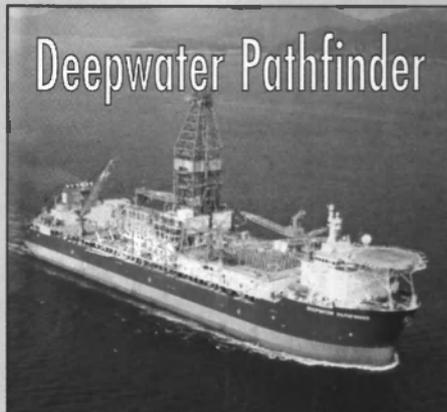
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**DAEWOO**  
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**Shipbuilder** Samsung Heavy Industries Co. Ltd.  
**Vessel name** Deepwater Pathfinder  
**Vessel type** Deepwater drillship  
**Owner/operator** Conoco/ R&B Falcon

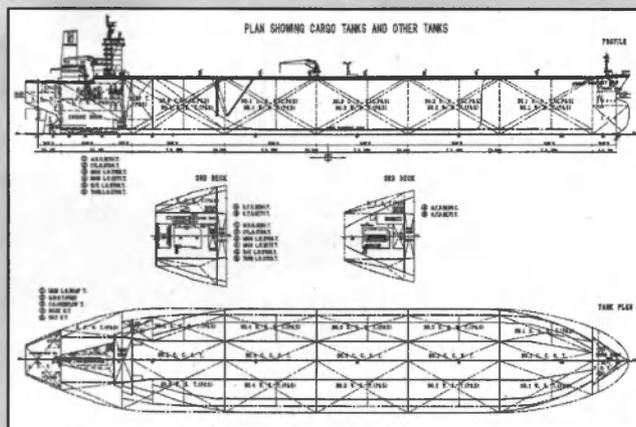
Samsung Heavy Industries has delivered what is reported to be the world's largest drilling ship. The vessel, dubbed Deepwater Pathfinder, is a 103,000-ton ship ordered by a consortium consisting of Conoco and Reading & Bates. The \$240-million price tag represents not only the technical complexity required to build such an enormous unit, but also represents the highest price for a single ship ever built in South Korea. To put the price in perspective, the \$240M price exceeds high-value LNG ships, and is equal to three VLCCs.

The ship combines shipbuilding and plant technologies, as the ship and plants were built simultaneously by Samsung. This is a break from the traditional process, in which orders were received for ship

and plant separately.

Deepwater Pathfinder measures 726.7 x 65.6 x 42.6 ft. (221.5 x 20 x 13 m), and is powered by Wartsila main engines. The vessel's drilling equipment can reach down to an oil well 3,000 m deep, 8,000 m from the sea bottom and 11,000 m from the sea level, drilling crude oil and natural gas in a depth deeper than 8,848 m.

Built in the double hull structure, the ship is operated by a floating system which is run by an electric propulsion system. It is a



next-generation ship designed for stable operation, using a Dynamic Positioning system to prevent rolling in inclement marine environment.

The vessel can move at a speed of 12 knots or higher, even with the drilling plant loaded, and is partic-

*(Continued on page 53)*

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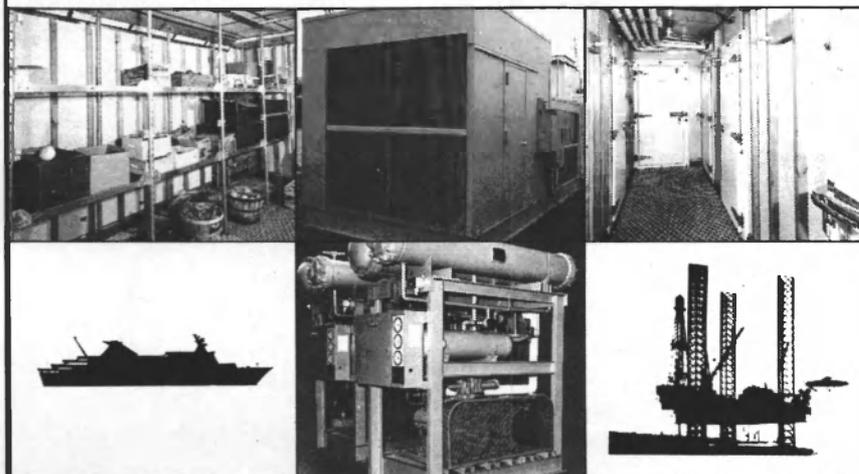
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'Deepwater Pathfinder' delivered by Samsung to Conoco /R&B Falcon in 1998

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**SAMSUNG**  
HEAVY INDUSTRIES

# Alabama Shipyard Carries U.S. Newbuild Torch

Shipbuilder Alabama Shipyard, Inc., USA  
 Vessel name Amalienborg  
 Vessel type Chemical Tanker  
 Owner/Operator Dannebrog Rederi A/S, Denmark

The first of two chemical tankers built by Alabama Shipyard for Dannebrog Rederi A/S of Rungsted Kyst, Denmark was delivered April 1, 1998. This delivery is significant for many reasons, first and foremost for the technical quality incorporated throughout the high-value ship. But this particular ship equals far more than the sum of its steel, machinery, electronics and coatings, as it represents the completion of the first self-propelled ocean-going vessel built for export by an American shipyard in over 40 years.

"Alabama Shipyard, Inc. (ASI) is the only U.S. shipyard dedicated to commercial new construction. This is the primary difference between ASI and our competitors that combine either military and commercial construction or repair and new buildings," said Mark Asbury, president, Alabama Shipyard.

Built under a Title XI loan guarantee from MarAd, Amalienborg is a 16,000-dwt IMP Chemical Carrier built in accordance with OPA 90.

The vessel is a single-decked, single screw chemical tanker with a double hull. It contains 12 epoxy-coated cargo tanks. The cargo system has stainless steel piping and deep well pumps.

Wartsila supplied the main and auxiliary power plants. The propulsion system consists of a 4,800 kW diesel engine driving a four-blade Kamewa controllable pitch propeller through a Valmet reduction gear. A single 588 kW hydraulically driven Kamewa bowthruster enhances maneuverability. The vessel is classed to Lloyd's Register highest class: +100A1 chemical tanker. It will be manned by a crew of 18 and has accommodations for 20 persons.

"While the Dannebrog chemical tankers were challenging projects for ASI, we have gained valuable experience in completing a very sophisticated vessel. In par-

particular, we have applied the lessons learned to our production engineering, planning, scheduling and material control. We are currently concentrating our sales and marketing efforts towards the OPA-90 tanker fleet replacements," said Asbury.

Dannebrog Rederi A/S was established in 1883 and has owned and operated tankers since 1952. It operates the Nordana Line, a RoRo service from the Mediterranean to the U.S. and Central America, and another service from the U.S. to Central and South America.

Alabama Shipyard, Inc. a wholly owned subsidiary of Atlantic Marine Holding Company of Jacksonville, Fla. specializes in the construction of steel-hulled vessels for the commercial market.

## Circle 46 on Reader Service Card

### Amalienborg Main Particulars

Designer	Shipskonsulent, Norway
Flag	Denmark
Classification	LR
Number of sister ships	Aggersborg
Float out date	April 1997
Delivery date	April 1998
Length, o.a.	472.5 ft. (144.5 m)
Length, b.p.	438.9 ft. (133.8 m)
Breadth, molded	75.4 ft. (23 m)
Depth, molded	40.7 ft. (12.4 m)
Draft, design	27.6 ft. (8.4 m)
Draft, scantling	28.5 ft. (8.7 m)
GT	11,290
DWT, design	15,930 tons

DWT, scantling	16,775 tons
Speed, service (85% MCR)	13.7 knots
Speed, service (alternative engine rating)	14.5 knots at 100% MCR
Cargo capacity	approx. 19,000 cu. m.
Water ballast	7,784.6 cu. m.
Main engine mfr.	Wartsila
Main engine type	6L46A
Alternators	Leroy Somer
CP propeller & shaft	Kamewa
Reduction gear	Valmet
Bow thruster	Kamewa
Rudder	Ulstein
Steering gear	Ulstein
Hydraulic cargo pump system	FRAMO
Cargo/slop tank coating	Sigma
Tank level gauging system	Autronica
Cargo control system	Autronica
Valve remote control system	Danfoss
Cargo valves	Danfoss
Tank cleaning machines	Toftejorg
HFO supply unit	Wartsila
Fuel & lube oil pumps	Leitritz/Iron
Boilers	Gesab
Auxiliary diesel engines	Alfa Laval
Emergency generating sets	Cummins
Paint	Hempel
Life boat & davit	Norsafe
Rescue boat	Norsafe
Life rafts	Viking
Fire detection systems	Consilium
Fifi system	Unitor
Fire alarm system	Autronica
Solnav	Trimble/Litton
Plate coolers	Alfa Laval
Pressure/vacuum valves	Pres-Vac
Tank cleaning pump	FRAMO
Cargo and provisioning cranes	Hydramaskin
Switchboard & electronic supply sys.	Eegholm
Alarm & monitoring	Scana Maland
Centrifugal pumps	Leitritz/Iron
Galley equipment	Beba Hedo
HVAC systems	Novenco
Air conditioning plant	Novenco
Sanitary system	Evac
Deck machinery	Aquamaster-Raumo
Incinerator	B. B. Technik



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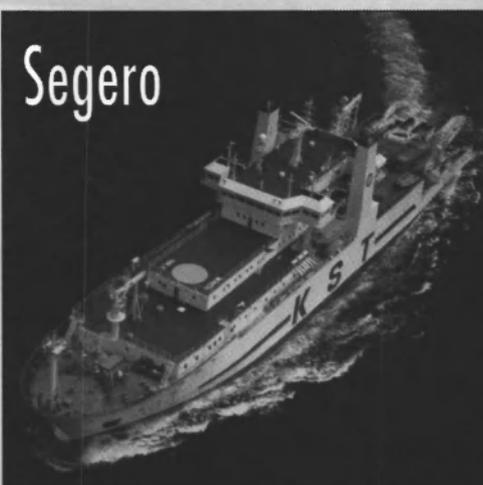
## GREAT SHIPS OF 1998

Shipbuilder Hanjin Heavy Industries Co. Ltd.  
 Vessel name Segero  
 Vessel type Cable layer  
 Owner/Operator Korea Submarine Telecom Co. Ltd.

Segero was designed to carry out the laying, burying and repair of intercontinental submarine optical fiber, with particular reference to the severe weather conditions, in terms of wind and sea state, and extremely low temperatures, of the North Pacific. The design follows the fully stern-working concept,

which permits work to continue even in the worst weather conditions, and, by allowing a conventional bow-form to be adopted, providing for a high cruising speed.

All important bridge equipment, crucial in the successful operation of these vessel types, includes a Kongsberg Simrad integrated



monitoring and control system (IMCS), which consists of dynamic positioning system, thruster control system and vessel control system. The dynamic positioning system incorporates special sensors, functions and operational modes which are related to the cable laying and trenching applications. The thruster control system incorporates lever control of each thruster, as well as an independent joystick system with common control of all selected thrusters. The vessel control system incorporates alarm monitoring and control system, including power management functions. The ship is also equipped with the STN Atlas total navigation system, including Radar, doppler sonar, echo sounder as well as JRC GMDSS. To provide more comfortable working and living conditions for the ship's complement of 63, a longer rolling period has been achieved using sufficiently large and long bilge keels, the active anti-rolling tanks.

The diesel-electric power system is based on four ABB generators, two of 3,400 kVA, one of 2,300 kVA and one of 850 kVA, driven by MAN 8L32/40 (4,800 ps), 6L32/40 (3,600 ps) and 6L23/30H (1,300 ps) engines, respectively. Electric power is distributed through two main switchboards, with four transformers, supplying two 2,700 kW ABB propulsion motors which drive two Kamewa Azimuth propulsion units. The propellers are fitted with steerable nozzles to help prevent cable fouling. Additional maneuverability is provided via a pair of Lips 1,200 kW tunnel thrusters and a 1,500 kW White Gill vectoring unit operating forward.

Most cable work is concentrated on the continuous, mainly closed, upper deck, using two 3.6-m diameter stern sheaves straddled by a 35-ton swl A-frame. This can work

(Continued on page 53)

Maritime Reporter/Engineering News

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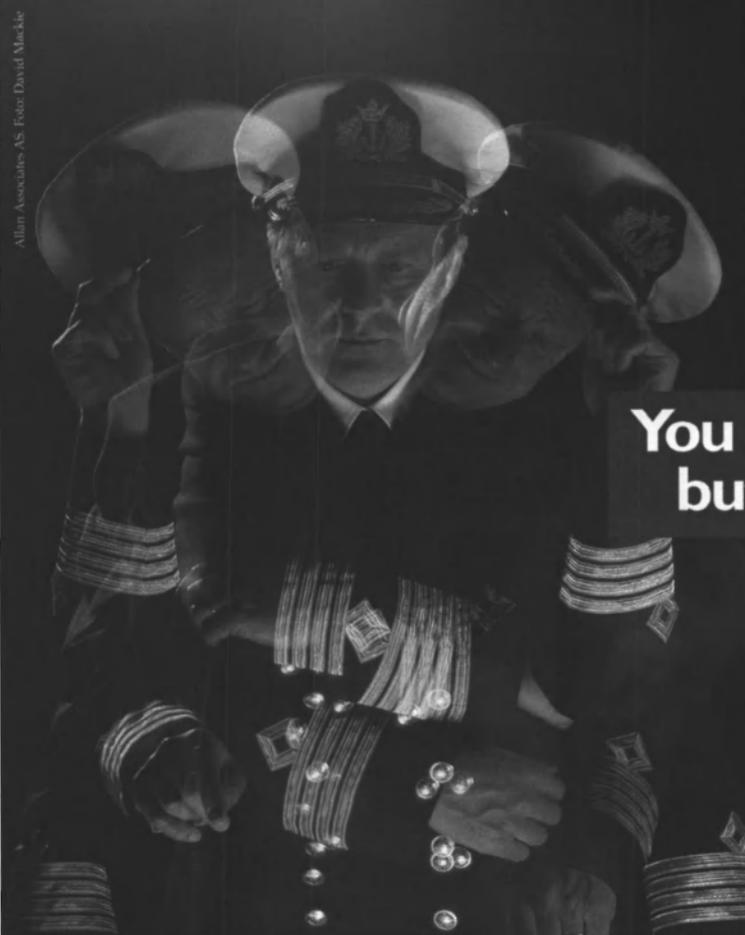
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## GREAT SHIPS OF 1998

Shipbuilder Lindenou Shipyard  
 Vessel name Mariella Amoretti  
 Vessel type Chemical Tanker  
 Owner/ operator Marichem Europe

The Northern Germany maritime market has built a formida-

ble reputation in its centuries of housing some of the more innovative maritime organizations. Lindenau GmbH carries on the tradition of quality products by consistently producing ever more sophisticated oil and chemical tankers, the latest dubbed

Mariella Amoretti and delivered in May.

Built for Marichem Europe S.r.l., the 15,750-dwt Mariella Amoretti is a double hull oil and chemical tanker IMO type 2/3. The ship was designed and built under the supervision of RINA

## Mariella Amoretti

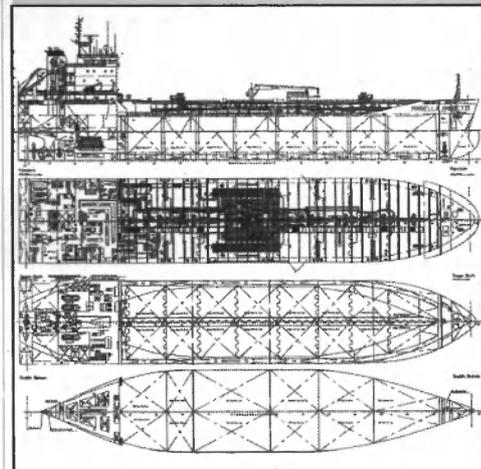


with the following class notation: RINA \*100 A 1.1, Nav IL, MN Cst (OIL/CHEM), ESP IAQ1, IAI, IAP, SC, PMS, P, NAU (OMBO), APS, IWS, TMS, MAN, IIQ, IV, EP2.

Designed jointly between the shipowner and shipbuilder, the ship was designed to set new standards for the ecological and economical transport of oil and chemicals on the Seven Seas. In order to achieve and maintain this lofty goal, the ship, among other features, is highly automated, featuring an Integrated Automation System which consists of three main parts: alarm, monitoring, power management and control on eng. auxiliary system; cargo and ballast handling control system; and control system for main engine, telegraph, etc.

The 433 x 78.7 ft. (132 x 24 m) ship features seven work stations; two work stations located on the bridge, three in the cargo control room and two in the engine control room. All stations communicate via a LAN, using TCP/IP and Ethernet standards.

Monitoring and operation is available at all work stations provided that the operator is given the access code. Therefore, operation is also available at the substations in case of an emergency situation. A special feature of the vessel is that the valve control system acts on 207 valves via mimic pictures



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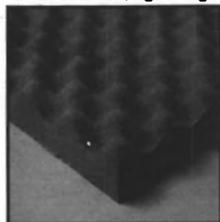
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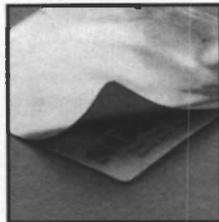
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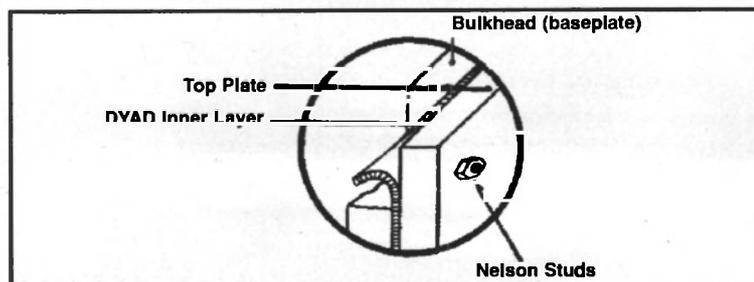
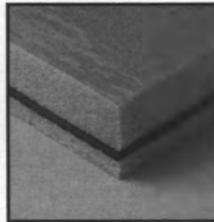
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for cargo, washing and ballast.

The ship's power management system was configured to the shipowner's exacting specifications, and offers seven modes of operation — from harbor mode to sea-going mode to discharge mode — allowing the operator the maximum possible control

over the ship's efficient use of fuel. Additionally, the cargo handling system enables the operator to select one common pressure set-point at the manifold and let the system control the speed of the electric driven cargo pumps, in automatic parallel (1 to 16), to obtain the selected set point.

In keeping with the advanced monitoring, control and communications outfitting, Mariella Amoretti has installed a Fleetmaster system which allows the shore office to call the vessel

via Satcom and receive all measuring data from the Automation System. This means that this data file is shown on the PC at the shore office as it is onboard the vessel.

In keeping with the safety theme, the ship is fitted with a shaft generator which can also be used as an electrical drive motor

for propulsion. In case the main engine fails or the master decides to run the vessel with a lower speed, the main engine can be coupled off and the ship can be propelled with the electric motor only. During sea trials, a speed of 10 knots was reached using this method, far above the three knot

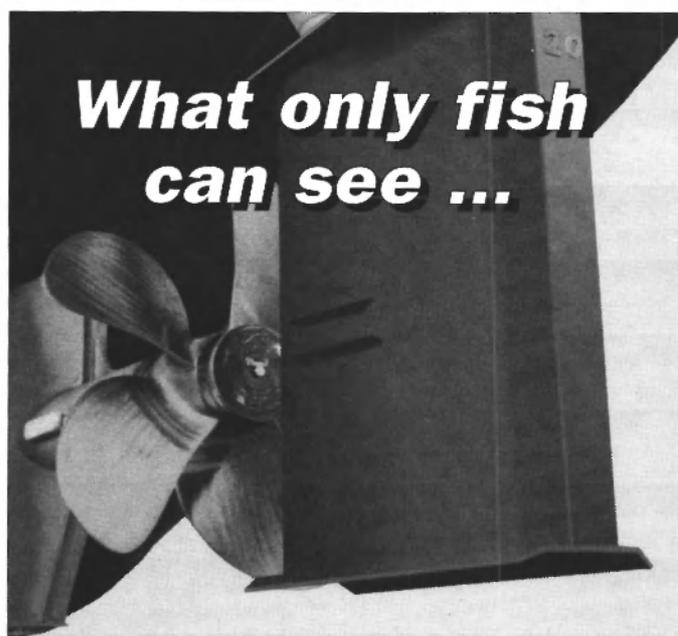
speed required by RINA. Further, the ship is fitted with a bowthruster and a sternthruster to maximize maneuverability. Sureness of ship movements is additionally enhanced with a HSVA high-efficiency rudder. The

(Continued on page 52)

**Mariella Amoretti  
Main Particulars**

Flag	Italy
Classification	RINA
Number of sister ships	One
Contract date	December 1995
Floating out date	July 1997
Delivery date	May 1998
Length, o.a.	433 ft. (132 m)
Length, b.p.	416.6 ft. (127 m)
Breadth, molded	78.7 ft. (24 m)
GT	10,900
DWT, scantling	15,750
Draft, scantling	29.5 ft. (9 m)
Speed, service	15.4 knots
Complement	25
Cargo capacity	19,005 cu. m.
Bunker	790 cu. m.
Water ballast	5,985 cu. m.
Main engine mfr.	MaK
Main engine type	8M 552
Total HP	6,000 kW (8,043 HP)
Auxiliary engines	Yanmar
Generator engines	Yanmar
Propellers	Lips
Thrusters	Lips
Thruster engines	AEM, Janssen
Generators	Hyundai
Emergency generator	AVK, Caterpillar
Motor starters	Janssen
Couplings	Vulkan
Reduction gears	Renk
Engine controls	Kongsberg Norcontrol
Steering controls	Tanfjord, Kongsberg Norcontrol
Deck machinery	Hailapa
Shafting	Lips
Coatings	Sigma
VHF radio	Sailor
SSB radio	Sailor
Radar	Kongsberg Norcontrol, Kelvin Hughes
Compass	C. Plath
GPS	Trimble
Autopilot	Kongsberg Norcontrol, C. Plath
Collision avoidance	Kongsberg Norcontrol
Pumps	Allweiler
Heat exchangers	Prang
Air conditioning	ROM
Liferafts	Schat Harding
Liferafts	RDF
Davits	Schat Harding
Fifi system	Unitor
Waste management system	Hamworthy
Desalination equipment	Sarck Como
Cargo control system	Kongsberg Norcontrol, Naval Impianti
Ballast control system	Kongsberg Norcontrol, Naval Impianti
Computers on the ship	Kongsberg Norcontrol, Saab, Kockumation
Manifold cranes	Acta
Valve remote control	Naval Impianti
Thermal oil heaters	Wiesloch
Shaft generator	A.V. Kaick

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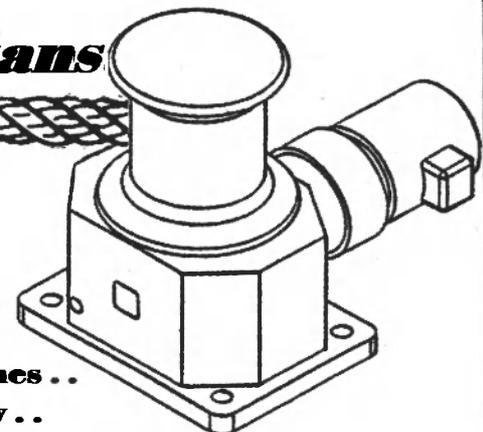
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## GREAT SHIPS OF 1998

Shipbuilder IHI  
 Vessel name P&O Nedlloyd  
 Southampton  
 Vessel type Containership  
 Owner/operator P&O Nedlloyd

With the stakes being raised the whole time in the mainstream liner trades, P&O Nedlloyd has put a new edge on its competitive endeavors in the Europe-eastern Asia traffic by introducing a post-Panamax containership class incorporating record-breaking propulsive power.

P&O Nedlloyd Southampton brought a 6,690-TEU unit capacity and astonishing force of 89,640-bhp (65,880-kW) to the Anglo-Dutch company's Loop One weekly express service, requiring extremely rapid transits and complete operational dependability to ensure 56-day round-voyage patterns. Leading a current series of four from the Kure yard of Ishikawajima-Harima Heavy Industries (IHI), the impressive addition to the P&O Nedlloyd fleet provides a technological response to the intense commercial pressures to which liner operators are subject.

Although the contract had been awarded to the Japanese builder by P&O Containers, the subsequent amalgamation with Nedlloyd has seen the second and fourth vessels of the series, P&O Nedlloyd Rotterdam and P&O Nedlloyd Kowloon, assigned to the Dutch flag, while P&O Nedlloyd Southampton and third-of-class P&O Nedlloyd Kobe bring a post-Panamax dimension to the British mercantile marine.

The extra revenue-earning potential encompassed by the new generation: the 140 ft. (42.8 m) beam is more than 32.8 ft. (10 m) greater than that to which box-ships navigating the Panama Canal are constrained. Such is the breadth that it enables 17 rows of containers to be stowed across the weatherdeck and hatches, and 15-across below-decks, albeit restricted to 13 at tank top level. The weatherdeck lattice of lashing bridges enhances freight security while expediting cargo working.

The eight holds accommodate 3,406-TEU in total, the balance of 3,284-TEU slots being above-decks. Considerable stow position flexibility is displayed by the beamy design, due to deadweight,

metacentric height and stability characteristics, and the shipowner sees scope to add a further tier to the present maximum six-high on deck given sufficient gantry clearance at the various terminals.

A new, 'intelligent' container securing, planning and monitoring

system, devised by BMT SeaTech of Southampton and dubbed Cargo Secure, has achieved its first reference aboard the P&O Nedlloyd sisters. P&O Nedlloyd Southampton is a showcase for two-stroke diesel propulsion, whereby a single 12-cylinder Sulzer RTA96C engine

delivering an unsurpassed 89,640-bhp is direct-coupled to a fixed-pitch propeller, at a through-line rotational speed of 100 rpm.

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*(Continued on page 52)*



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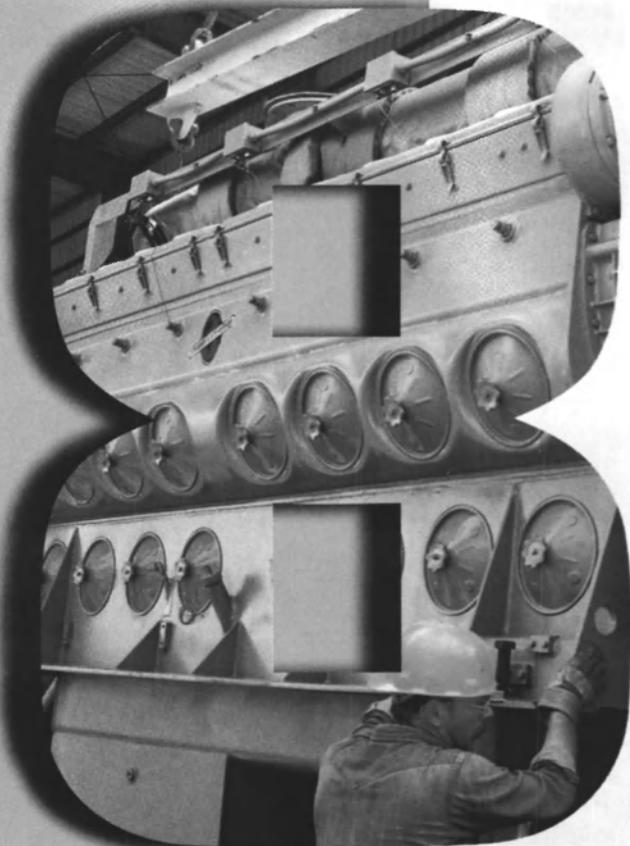
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"Agnes Candies"**

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- Bender Shipbuilding & Repair Inc.,  
Mobile, AL
- Built 1998
- Owner: Otto Candies, Inc.

*Built in modules for expedited construction, each of this new supply boat series is equipped with 6 Detroit Diesel and 2 rebuilt EMD engines. The stern houses three DD gensets and two EMD drive units. Two more DDs power bow thrusters and a third DD is housed on the deck as a backup.*





# new line built with 32 S&S engines



**8 ENGINES PER SHIP** sounds like a lot, but in this case, they're just what the owner ordered. When Otto Candies, Inc. ordered 4 of a new class of supply vessels to serve the Gulf offshore industry, it had one goal in mind: build tough, versatile, efficient boats with power to spare. That's because these ships have to deliver tons of fuel, water, and drilling muds to deep water sectors and remain on station in almost any condition.

The new ships are being built by Bender Shipbuilding & Repair, Inc. in Mobile, AL, using a computer-integrated manufacturing process that creates modular sections for expedited construction. No less than **eight** Stewart & Stevenson engines per ship are installed for a total order of 32 engines. Twin rebuilt GM-EMD 16-645 E6 engines, capable of 1,950 hp at 900 rpm provide main propulsion. Maneuverability is provided by a pair of

Detroit Diesel 16V-149 engines, each developing 900 hp, to drive twin KaMeWa bowthrusters. Three DD 12V-71W gensets each create 250kw service power, and a 75kw DD 4-71N backup genset is on board for emergencies.

Otto Candies, Inc. took delivery of the **M/V Agnes Candies** in September. It was named for Mrs. Otto Candies, Sr., who christened it in a ceremony at the Bender Shipyard in Mobile. Mrs Candies is the matriarch of the Candies family which owns and operates a fleet of tugs, supply vessels, ocean barges, river pushboats and river barges worldwide.

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(Continued from page 28)

ble. The resulting double hull barge thus becomes very similar in concept to Maritrans' purpose-built double hull barges, the Maritrans 300 and the Ocean 400.

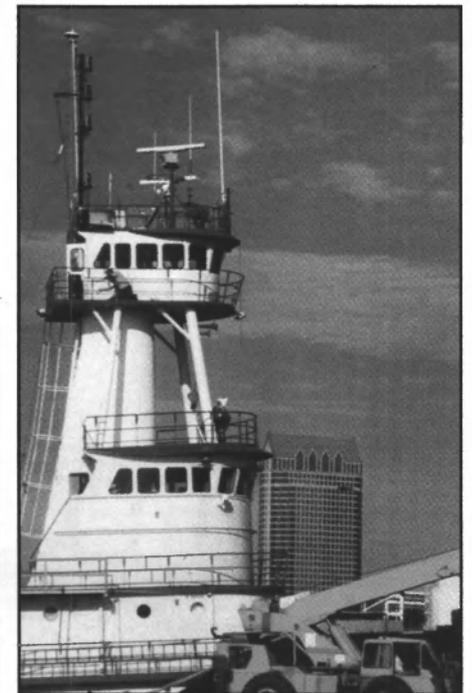
The structural design has been reviewed and approved by the

American Bureau of Shipping. Finite element analysis was employed at each stage of the design. The most modern methods of parts programming and numerically-controlled steel cutting were used to prepare the individual plates prior to assembly.

"The fit-up of the modules went

very well," said Mike Keenan, president of Tampa Bay Shipyard. "In addition we carried out a producibility study in partnership with Maritrans that promises great saving for future projects."

Tampa Bay Shipyard's re-birth is an exciting part of this story. All but shuttered in early 1997, the



Maritrans innovative barge rebuild program didn't stop with the barge. The upper pilothouse for the tug will now be the primary steering station, so it was enlarged for comfort and also raised higher for better visibility.

shipyard was able to assemble a management team and a work force that executed this complex project to the satisfaction of all concerned. Maritrans and Tampa Bay Shipyard established a strong working relationship from the first few weeks after the shipyard was selected following competitive bidding.

This was especially important since the design was owner-furnished and all aspects had to be tailored to the excellent handling facilities available at Tampa.

Advanced methodologies of partnering and association have been applied throughout. Possibly the most important challenge is maximizing production efficiency during the mating of the sub-assemblies to the existing hull.

Stephen Van Dyck, chairman and CEO of Maritrans, Inc., credits the management of Tampa Bay Shipyard with "having worked hard with Maritrans to create the foundation for a partnership that will make the expected future rebuild projects even more successful. After an appropriate trial period on the M-192, and assuming no big surprises in the industry, we will have another 10 barges to rebuild."

The OPA-90 retirement dates for Maritrans' super barges extend from 2003 to 2010. Maritrans intends to do roughly one conversion a year beginning around the turn of the century.

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## GREAT SHIPS OF 1998

**Shipbuilder** EISA Shipyard  
**Vessel name** Ever Victory  
**Vessel type** Panamax bulk carrier  
**Owner/operator** MPC Capital/First Steamship

The delivery of Ever Victory marks the return of EISA Shipyard to the Panamax bulk carrier market, after a period of construction of a series of sophisticated product carriers and container ships.

Built to a traditional design with single hull flush decked all aft configuration, there are seven holds with upper and lower wing tanks, the latter being joined with the double bottom tanks and separated at centerline by a pipe duct, and used, like the upper wings, for a water ballast.

The holds are covered by hydraulic operated side-rolling type hatch covers on the main deck. Each hatch cover has two panels, with a clear opening of 16 m wide and 14.4 m long, and it is

possible to open only one panel, if needed. The seven holds are arranged for the carriage of ore, coal, grains and other bulk cargoes, and strengthened for heavy cargoes and grab discharge. The transverse corrugated bulkheads are built on stools and the vessel is designed to sail loaded but with no. 2, 4 and 6 holds empty, or with no. 4 hold empty only.

Fuel oil is stored in deep tanks inside the engine room. A sophisticated epoxy painting system was used on the entire vessel.

The structure incorporates approximately 11.6 percent of high tensile steel, with grade AH-36 used in the main deck structure.

Ever Victory is fitted with a sophisticated machinery automation system, which was installed for control and monitoring of the machinery by a computer network with terminals installed in the engine room and accommodations.

The ship reaches a 14.5-knot service speed powered by a Sulzer 6RTA 62U main engine.

Circle 37 on Reader Service Card

## Ever Victory

Design	Protonal S-4	Generator engine	Sulzer 6S20-HV
Classification	Gammasterclass	Generators	Heets
Flag	Liberia	Propellers	Mecklenburger
Del. no.	1998	Engine controls	ABB Marine
Length o.a.	738 ft (225 m)	Engine control	Hatlam
Length b.p.	705 ft (215 m)	Hoisting winches	Brohl
Breadth molded	105.6 ft (32.2 m)	Shafting	Mecklenburger
Depth, molded	56 ft (17.3 m)	Bearings	Mecklenburger/Berk
Displacement	80,198	Coatings	International
Light weight	11,352	Radar	Selestar
Draft design	40.8 ft (12.5 m)	Compass	Anshütz
Draft scantling	43.3 ft (13.2 m)	GPS, VHF radio, SSB radio	JRC

DWT, design	64,131
DWT, scantling	69,146
GT	38,000
Speed	14.5 knots
Complement	32
Cargo capacity	82,914 cu. m.
Bunker	2,564 cu. m.
HFO	2,510
MDO	295 cu. m.
Water ballast	34,126 cu. m.
% high tensile steel	11.6%
Total HP	9,000 kW at 90 rpm
Main engine mfr.	Hyundai Heavy Industries
Main engine type	Sulzer 6RTA 62U

Autopilot	Anshütz
Collision avoidance	Selestar
Pumps	Alweiler
Heat exchangers	Alfa Laval
Air conditioning	Novenco Hi-Press
Lifboats, liferafts	Fassmer
Davits	Davit International
Fifi system	Allweiler
Desalination equipment	Alfa Laval
Hatch covers	Kvaerner
Cargo control system	Loadmaster
Ballast control system	Paul Pleiger
Computers on the ship	STN

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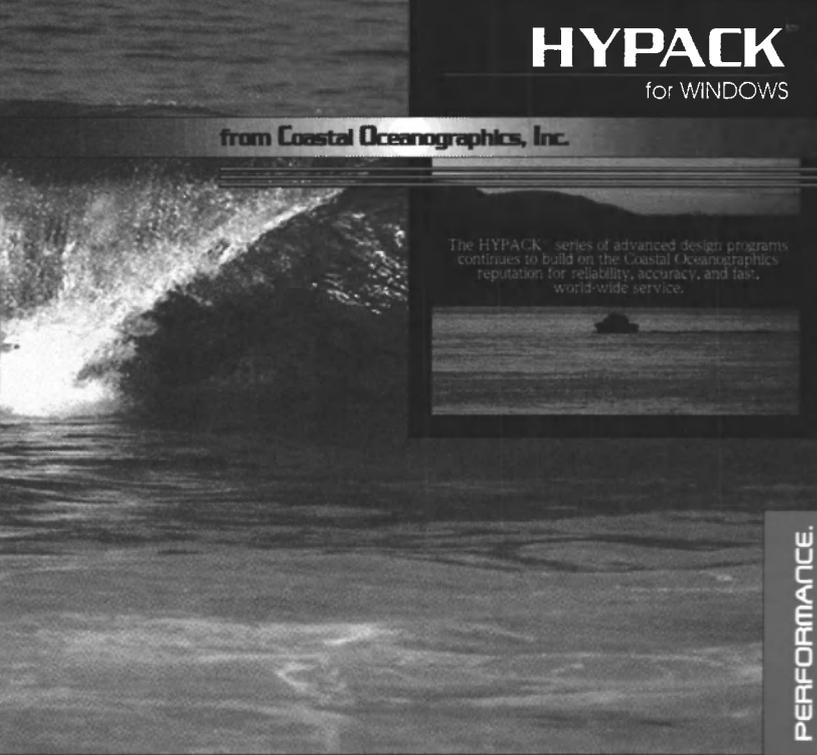
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December, 1998

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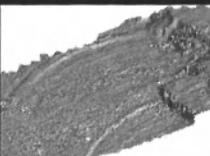
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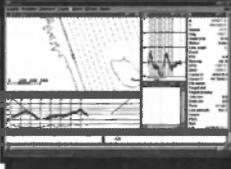
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45



**Shipbuilder** Astilleros de Sestao - Astilleros Españoles Group  
**Vessel name** Navion Britannia  
**Vessel type** Multi-purpose Shuttle Tanker  
**Operator** Statoil/Navion

Astilleros Espanoles has once again proven its prowess in the building of high quality, high value shuttle tanker tonnage with the delivery of Navion Britannia earlier this year. Built at the Astilleros Sestao yard, the ship is for Norway's Navion, which is an 80/20 joint venture between Statoil and Rasmussen.

Navion Britannia is the first of three in a series for Navion, and is the 17th overall in the company's fleet. Aside from the sophisticated BL and STL cargo systems found on the most modern vessels of this type, Navion Britannia departed the Sestao yard fully equipped with a submerged turret production (STP) system, making the ship capable not only of submerged loading operations, but of offshore oil production as well.

While the delivery of a high quality shuttle tanker from the yards of Astilleros Espanoles is hardly news — given the organization's strong history in fulfilling tonnage needs in this spe-

cialty niche — Navion Britannia is unique in that it combines the experiences of both yard and owner to deliver some interesting refinements.

For example: three loading tankers per section, with two longitudinal bulkheads instead of one, are offered to reduce the release of volatile organic compounds (VOC) during loading; a fully redundant engine room, divided by a full-height double-insulation longitudinal bulkhead; and direct automation, to receive and process 3,000 signals and act directly on the valves of the several circuits.

The ship's main propulsion is provided by twin two-stroke Manises MAN B&W 6L60MC slow speed diesel engines, with an MCR of 15,600 hp (11,520 kW) at 123 rpm, each driving a six meter CP propeller. At 90 percent MCR, the ship's service speed is 15 knots.

The dynamic positioning system, controlled and monitored from the bridge, is completed with two bowthrusters (each 2,200 kW) and one stern thruster (1,400 kW). All thrusters are retractable. To aid ship operations further, the ship features two highly maneuverable rudders driven by two rotary-vane electro-hydraulic steering gears.

Hardware on the bridge is of the latest design and technology, as the ship is controlled by several independent integrated systems, including integrated control and monitoring systems, a cargo control system, a main engines remote control system, a dynamic positioning system, a thruster control system, and an integrated navigation system. In fact, the

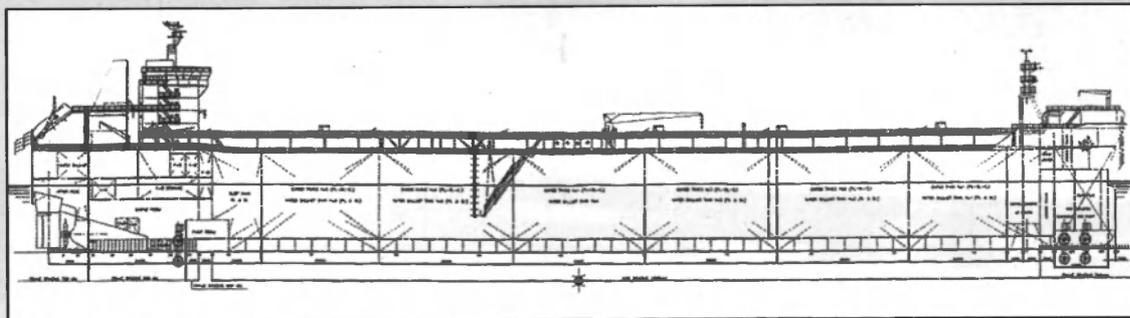
integrated bridge meets the demanding requirements of DNV notation Watch One. Navion Britannia is built with a double skin and double bottom along the cargo space, with two longitudinal bulkheads and the correspondent transverse bulkheads to from 18 cargo tanks, two slop tanks, and wing and double-bottom tanks for water ballast.

Crude oil can be loaded from an offshore

Navion Britannia Main Particulars

Designer	Astilleros Espanoles
Flag	Norway
Classification	DNV
Contract date	February 1996
Float out date	September 1997
Delivery date	April 1998
Length, o.a.	869.4 ft. (265.5 m)
Length, b.p.	841.5 ft. (256.5 m)
Breadth, molded	139.4 ft. (42.5 m)
Depth, molded	72.2 ft. (22 m)
GT	72,110
DWT, design	118,138
DWT, scantling	124,978
Displacement	152,750 tons
Lightweight	27,772 tons
Draft, design	49.2 ft. (15 m)
Draft, scantling	51.3 ft. (15.6 m)
Speed, service (90% mcr)	15 knots
Cargo capacity	139,500 cu. m.
Water ballast	52,993 cu. m.
Bunker	3,056.5 cu. m. heavy oil; 162.9 cu. m. diesel oil
% high tensile steel	28%
Main engine mfr.	Manises Diesel Engine Co.
Main engine type	MAN B&W 6L60MC
MCR	11,520 kW at 123 rpm
Ballast tank coating	Indasa
Bow thrusters/stern thrusters powered by	Lohar

Bow loading system	Hitech Marine (Norway)
Gunclean COW lines	Consilium Marine
Inert gas plant	Permae
Tank radar system	Saab
Ballast tank gauging equip.	Saab
Fuel oil level gauging equip.	Saab
Cargo pumps/centrifugal pumps/ballast pumps/engine room pumps	Kvaerner Ships Equipment
CP propeller	Wartsila
Stern tube seal shaft bearings	Blohm & Voss
Rudders	Hamworthy
Electro-hydraulic steering systems	Porsgrunn
Emergency engine	MAN-DEMPE
Oil-fired boilers	Parot
Integrated bridge	Kongsberg Norcontrol
DGPS	Trimble
Gyro and steering control system	C-Plath
Echo sounder	Skipper
GMDSS	Seilor
Weather facsimile	Taiyo
Weather station	Aanderaa
Cargo handling system	Simrad
Fire detection system	Autronica
Extinguishing system	Heien Larsen
Freefall boat/rescue boat	Norsafe
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facility such as an STL system, subsurface loading stations (UKOLS), floating storage and offloading (FSO) units, floating production, storage and offloading (FPSO) units and articulated loading platforms (APL/SPM), as well as conventional oil terminal methods. The ship can be moored at off-

shore facilities in up to 4.5 m significant wave height and 25/30 knots wind speed, maintaining position at the offshore loading facility in up to 5.5 m significant wave height and 30/35 knots wind speed, without transferring loads to the bow mooring/manifold system after the worst component

failure, as defined in the rules.

The specific loading/discharging flows are 8,000 cu. m./hr. for BL and STL systems, and 12,000 cu. m./hr. for loading/discharging via the manifold. A tank radar system and ballast gauging system are also featured.

Circle 24 on Reader Service Card



Shipyard	Hitachi Zosen Corp.
Vessel name	New Vanguard
Vessel type	VLCC
Owner/Operator	Golden Seaway

New Vanguard, a 285,000-dwt VLCC ordered by Golden Ocean Group Ltd. was completed by Hitachi Zosen's Ariake Works. It is significant in that it is the first of nine VLCCs for the company from Hitachi Zosen.

The tanker, under Hong Kong registry was delivered to owner Golden Seaway Corp. and is the eighth double hull VLCC built by Hitachi Zosen. The vessel was scheduled for service on the Middle East-U.S. route.

New Vanguard features the double hull structure required by the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), and is designed to ensure that the chance of marine pollution in the instance of an accident (collision or grounding) is absolutely minimized.

The ship features a Hitachi Zosen double-hull VLCC trademark: wing ballast tanks. This design, the builder contends, offers a good hull balance and reduces the amount of strengthening steel members needed, thereby lightening the hull weight. Also, inside the double-hull structure is an access trunk from the upper deck to the double bottom, which is designed to improve ventilation and to facilitate the checking and inspection work required by the double hull. The tanker has applied ABS Safe Hull, which enhances the structural reliability by FEM analysis, including fatigue considering dynamic loads to the vessel. Emergency towing equipment is installed, and is designed to enable the ship to be towed by a tug boat or other vessel if it is unable to proceed on its own. Emergency towing can get underway more rapidly than would be possible using conventional equipment. For propulsion

(Continued on page 66)

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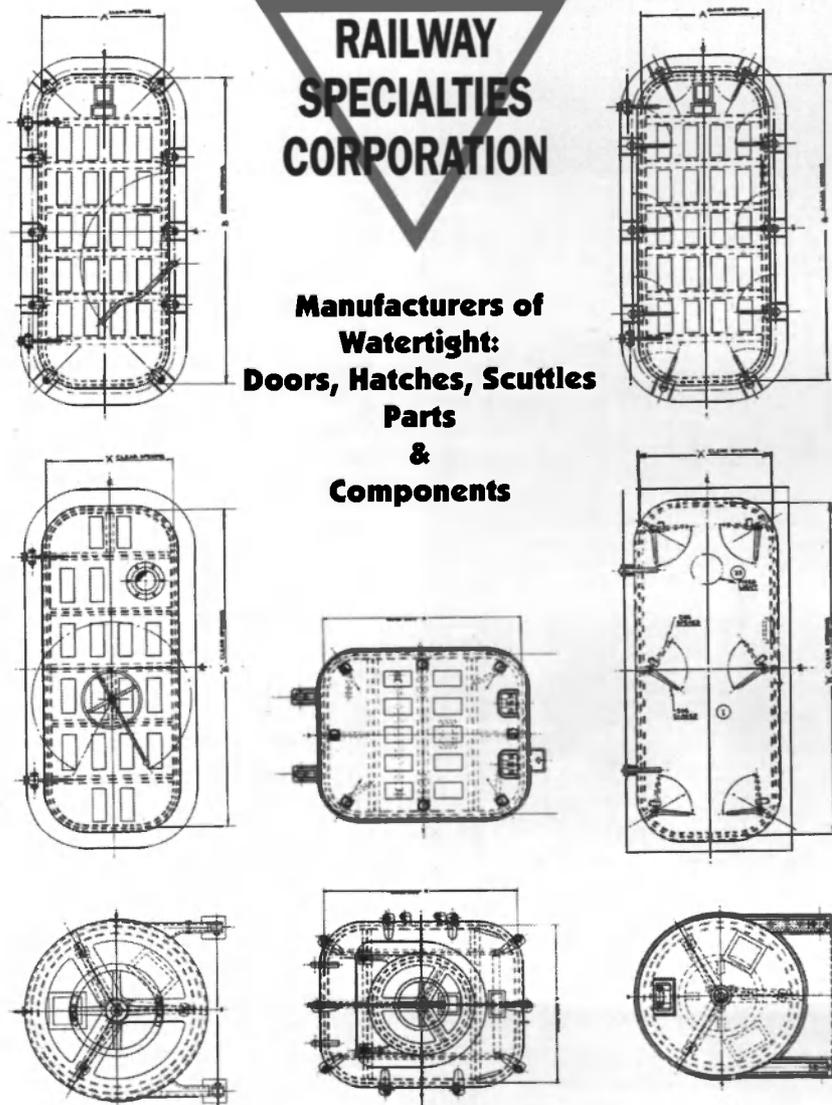
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Circle 276 on Reader Service Card

## GREAT SHIPS OF 1998



Shipbuilder	Kvaerner Masa-Yards
Vessel name	Arcticaborg
Vessel type	Icebreaking supply ship
Owner/operator	Wagenborg Kazakhstan BV

newbuild to entirely encapsulate the innovative double-acting operating principle developed by Kvaerner Masa-Yards, employed for some years to good effect in a pair of modified, Arctic-going products tankers. Central to the arrangements is the adoption of the revolutionary Azipod diesel-electric propulsion system.

Taking Finnish icebreaking technology and Dutch operating know-how into the land-locked Caspian Sea, the support vessel Arcticaborg and sistership Antarcticaborg have ushered-in a new era in ensuring year-round supply lines to Kazakhstan's offshore oil industry.

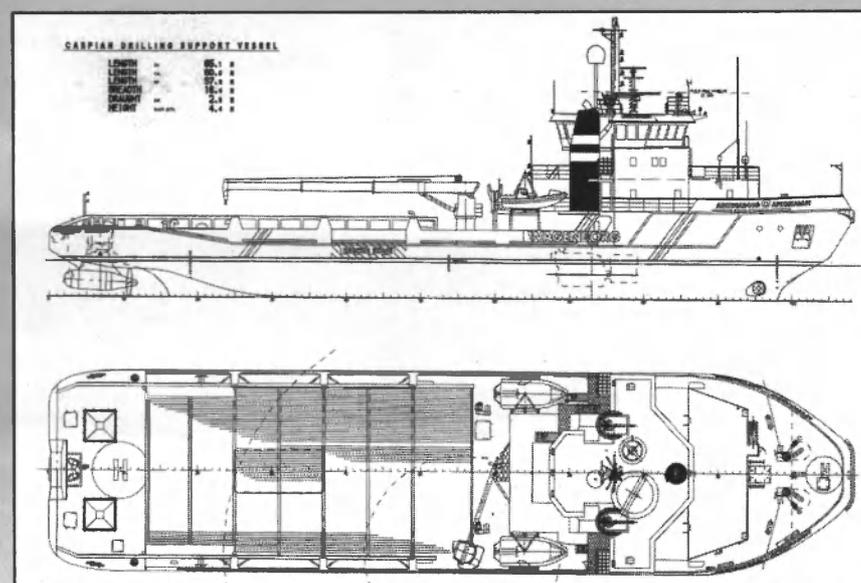
The remarkable new breed of vessel has a draft of only 9.5 ft. (2.9m), as it will tend platforms located in water depths of less than 16.4 ft. (5m), and has exceptional ice-forcing capability as well as maneuverability to ensure dependable service in the difficult conditions that can be encountered in the northern Caspian. Arcticaborg is the first

Constructed at the Helsinki premises of Kvaerner Masa-Yards, and symbolizing the production versatility of a builder currently occupied with luxury cruise ship construction, Arcticaborg and her consort have recently been delivered to Wagenborg Kazakhstan, a new affiliate of the Dutch dry cargo and short-sea trade specialist Wagenborg Shipping.

The project has been underwritten by employment guarantees, in the shape of long-term charter agreements with Offshore Kazakhstan International Operating Company (OKIOC).

Partners in the OKIOC consortium include Shell,

(Continued on page 62)



Shipbuilder Hyundai Heavy Industries  
 Vessel name Front Century  
 Vessel type Crude oil carrier  
 Owner/Operator Frontline Ltd.

The world's largest integrated shipbuilding and engineering complex, the Ulsan works of Hyundai Heavy Industries, where the order backlog at the time of writing stood at around 100 vessels, has put down a new milestone in crude carrier construction with the 311,000-dwt Front Century.

The VLCC is the first of a new generation of crude carriers, dubbed the C-class, designed with the accent on long-term structural integrity, environmental protection and energy-saving performance. Five such vessels have been ordered to the account of Frontline, the previously Swedish-owned company now forming part of the shipping group controlled by Norwegian John Fredriksen.

The 2.1 million barrel-capacity, double-hulled tanker is distinguished by a new hull form, displaying less than usual bluntness in the forepart, and a breadth of 190 ft. (58 m) to achieve a lower sea margin in rough sea conditions. In the structural design phases of the project, particular

attention was paid to reducing hull deflection, and the correspondingly high stresses imposed on secondary structural members, through recourse to detail structural analysis, together with hull vibration and transverse web vibration analysis through the entire ship range. Bow impact and fatigue strength analyses were also carried out.

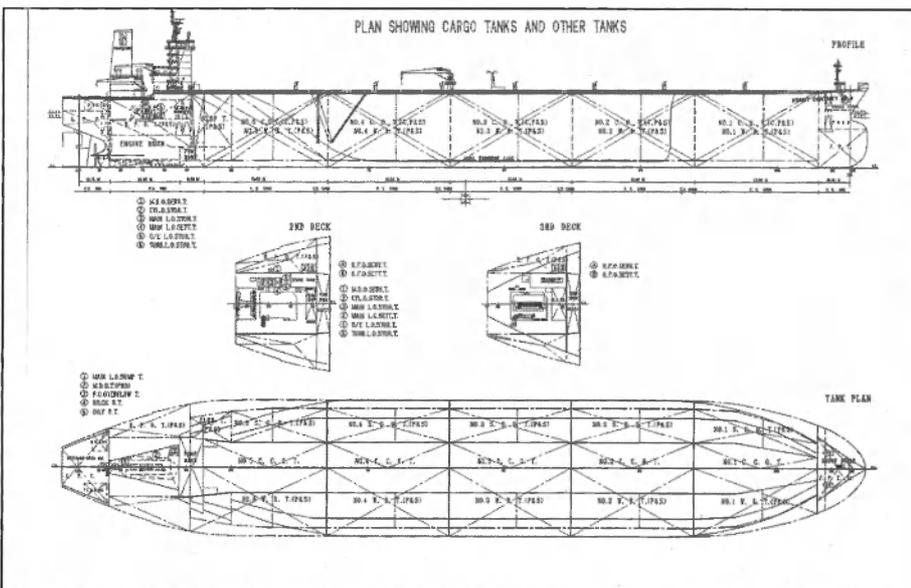
In relation to more standard VLCCs, claims Hyundai, hull deformation in Front Century has been reduced by 10 percent, by strengthening primary members, the deck, double bottom structure and buttress. The connection between the tank and the forepeak bulkhead has been substantially reinforced, and stress on secondary members lessened, through the adoption of cross-ties in the wing tanks.

The more rationalized construction system adopted, in terms of the number of pieces of structure and plate relative to a given area,

(Continued on page 64)



Front Century



Shipbuilder Lindenau Werft  
 Vessel name Hornisse  
 Vessel type Oil and chemical tanker  
 Owner/operator Carl Buttner

Bremen-based Carl Buttner's active support both of German construction and of the innovative Tanker Class 2000 concept devised by the Lindenau yard at Kiel has found new expression in the 13,000-dwt oil and chemical carrier Hornisse. Signifying a further stage in the strengthening of Buttner's modern fleet engaged in the European shortsea and distributive trades, Hornisse represents an advance in home-grown technology as the first in the second-generation series of Tanker Class 2000 tonnage.

Second and third newbuilds have been ordered by the Changjiang National Shipping Corp. of China, while the fourth vessel has also been booked for Buttner's operations. All four ships

are identical in main dimensions and similar in outfit, although the technical specifications differ in accordance with the respective owners' trading needs.

As an entrant into a market scenario characterized by high expectations of service and very demanding operating profiles, Hornisse is distinguished by an especially attractive ratio between economical speed and power, flexibility in the range and degree of segregation of cargoes carried, level of automation, fast rates of loading and discharge, maneuverability characteristics, and tuning to future as well as existing legislation.

The versatility of the ship reflects the mindset of the owner and mirrors the technical stance of the shipyard, which currently offers its Tanker Class 2000 in no less than 147 high-grade variants in around one dozen sizes from 1,500-dwt to 32,500-dwt.

Designed and built under the supervision and approval of Germanischer Lloyd as well as the

Marine Insurance and Safety Association in Hamburg, Hornisse provides for a 14,803-cu. m payload in 10 cargo tanks, subdivision being achieved by a centerline bulkhead and four transverse bulkheads. Embodying an IMO Type II cargo-carrying capability in chemicals as well as oil products, she is equipped for five-grade segregation.

Stiffening has been effected on the exteriors of the tanks, and the cargo section is underlain by a double bottom and bounded by a 3.9 ft. (1.2 m) double shell.

The Frank Mohn outfit of 250-cu. m per hour deepwell pumps, one per tank, makes for expeditious all-up, cargo working rates while meeting the owner's requirement for efficient handling of individual parcels. A hydraulic power pack provides for simultaneous operation of six pumps, and ullage indication is provided by a tank radar system. All cargo pumps, pipes, ladders and fittings in the cargo tanks have been fabricated from stainless steel, while the

(Continued on page 60)

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## GREAT SHIPS OF 1998

Shipbuilder	Daewoo Heavy Industries Ltd.
Vessel name	Canmar Pride
Vessel type	Ice-strengthened containership
Owner/Operator	Canmar Fortune

Canada Maritime Ltd. has again raised the bar in container shipping circles with the acceptance of M/V Canmar Pride from Korea's Daewoo Heavy Industries. The ship, which was delivered from Daewoo's Okpo Shipyard in July, is the first of two 2,808-TEU ice-strengthened containerships ordered in 1997.

In fact, the ship is reported to be the largest ice-strengthened containership operating in ice waters area, and is able to carry 1,378 TEU in its hold, with the remaining 1,430 carried on deck. Electric sockets are arranged for the carriage of 204 40-ft. refrigerated containers (50 FEU in holds, 154 FEU on deck.).

The ship is powered by a B&W 7L80MC main engine, a propulsion unit capable of driving the 804 x 105.6 ft. (245 x 32.2 m) ship to a service speed of 21.3 knots at the 35.4-ft. (10.8-m) design draft at 85 percent MCR with 20 percent sea margin. The ship, however, let "it all hang out" during its maiden voyage from Canada to Europe, averaging an outstanding 22.9 knots and reportedly touching speeds approaching 25 knots. The engine drives a FP propeller, and control is aided by one bowthruster. From a specification standpoint, the design is the result of extensive research with an unusually high degree of involvement from: port authorities, terminal operators, pilots, Canadian Coastguard, Shipping Federation of Canada, classification societies, masters, chief engineers and ship managers. The extensive research ensured that the design meets with the particular requirements of one of the most experienced operators in the St. Lawrence river.

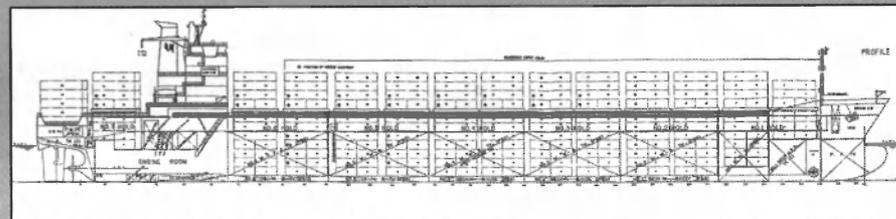
The ship is designed for ice navigation in the winter season, and the hull structure is strengthened to Ice Class 1A and one (1) ice horn of built in type with fabricated steel construction is fitted at the aft body center line. Systems and equipment exposed to the elements is operational at temperatures to minus 40 degrees Celsius.

The ship is built, generally, as a double-skinned containership in the way of cargo holds, of which the vessel features seven. The ship features

(Continued on page 63)



Canmar Pride

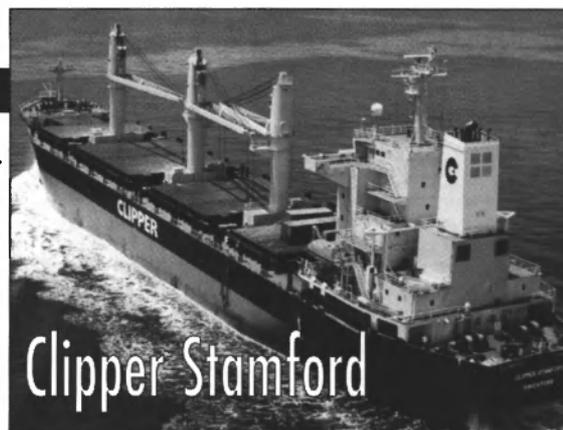


Shipbuilder Hitachi Zosen  
Singapore Ltd.  
Vessel name Clipper Stamford  
Vessel type Multi-purpose  
carrier  
Owner/ operator HSH Maritime

merger of the shiprepair and shipbuilding operations of HZSL and Keppel Corporation into Keppel Hitachi Zosen will give the alliance extra commercial clout.

Commissioned in October as the first of four newbuilds firmly committed from the Singaporean yard,

the American Bureau of Shipping-classed Clipper Stamford has been delivered to locally-based Hai Sun Hup's HSH Maritime. Contractual interests involved in the current series include the Clipper  
*(Continued on page 65)*



The concept of a standard, general purpose cargo carrier designed for economical, volume production has found new expression in a program implemented at Hitachi Zosen Singapore (HZSL).

The 20,370-dwt Clipper Stamford has given first form to a project which provides the market with a true 'maid of all work', maintaining the versatility and competitiveness of an earlier generation of multi-purpose traders, but thoroughly updated in configuration and technology.

Design progression through the range of standard dry cargo vessel types over the past three decades has seen an increasing orientation to hold and hatch moduling for freight in containerized and unitized mode, brought to an impressive new stage in the Stamford class. Its bloodline is thoroughbred, in that the development work undertaken by the Singaporean shipyard included input from consultancy firm Algoship International, closely linked with the Canadian firm G T R Campbell.

Campbell is a master in the art of standard ship design, the company's craft having been reflected in some 300 vessels of the F family, including the Freedom, Fortune and Friendship types, built between the mid 1960s and mid 1980s. Most recently, it has contributed to the development of the 29,000-dwt Fantasy series produced in China by Dalian Shipyard.

In embarking on the latest initiative, HZSL saw particular scope for the Stamford as a potential replacement for F-class vessels, some 200 of which have already seen 15 or more years' service, and as a competitively-priced successor to other types.

Previously best known for its shiprepair activities, the Singaporean yard's confidence in the design and targeting of ship construction as a core business led it to extend its 417 ft. x 131.2 ft. (127 x 40m) slipway to 623 ft. x 131.2 ft. (190 x 40 m). The planned



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## GREAT SHIPS OF 1998

*IHI's P&O Nedlloyd Southampton*  
(Continued from page 41)

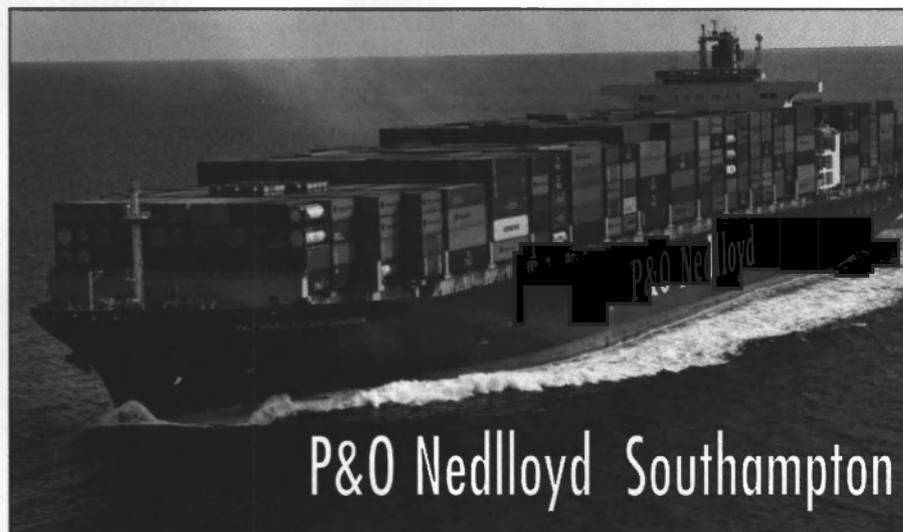
population of RTA84C container-ship engines, but in a bank of cavernous cylinders of 960-mm bore and 2,500-mm stroke.

Reliability was a focus for the RTA96C development project, given the nature of market demand which has sought single-engine solutions to ever-greater power and speed combinations. Each of the engines for the P&O Nedlloyd ships has been manufactured in Japan by Diesel United, a longstanding licensee of Wartsila NSD and its predecessors. Depending on draft and environmental conditions, the plant and underwater hull form enable the ship to make 25 knots if required. It is estimated that an average passage speed of 22.8 knots is

needed so as to maintain the demanding schedule. While this means that a fast, sustainable speed is vitally important, it equally signifies that there must be sufficient power reserve in the installation to enable any lost time to be made up.

Although the Loop One timetable entails a rationalized port itinerary, the knock-on effect of any delays due to terminal or mechanical problems, or especially inclement weather, could be considerable, and P&O Nedlloyd Southampton has accordingly been engineered to minimize the risk and maximize the operating performance.

Scale commensurate to that of the prime mover is reflected in the 94.5-ton Lips propeller, claimed to be the heaviest design ever cast, and in the 3.5-MW shaft generator,



P&O Nedlloyd Southampton

certainly one of the largest units of its kind worldwide, and an imposing part of the electrical power outfit supplied by the U.K. firm Brush Electrical Machines. The ship employs a mighty, 2,600-kW Kawasaki bowthruster, given the

requirement for swinging and maneuvering such a broad hull with substantial windage in restricted waters.

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P&O Nedlloyd Southampton  
Main Particulars

Classification	LR
Order date	May 1996
Delivery date	May 1998
Number of sister ships	Three
Length, o.a.	984 ft. (300 m)
Length, b.p.	936 ft. (285.3 m)
Breadth, molded	140 ft. (42.8 m)
Depth, molded	64 ft. (19.5 m)
Draft, molded	46 ft. (14 m)
GT	80,942
GT, Suez	83,029
DWT, summer	88,669
Complement	32
Speed, service	24.5 knots
Main engine mfr.	Diesel United
Main engine	Sulzer 12 RTA 96C
Propulsive power	89,640 bhp

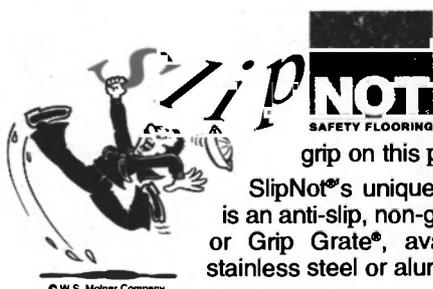
*Lindenau's Mariella Amoretti*  
(Continued from page 39)

entire package enables the vessel to perform quick landing and leaving without tug supply.

The vessel is built with a double hull not only for the cargo tanks, but also for the MDO and HFO tanks in the engine room. The relatively high number of cargo tanks (16) for a tanker this size results in a relatively low tank size, and thus makes the ship much more flexible in the number of cargoes transported. While tank size is smaller, cargo tank volume was optimized by a careful overall cargo tank design. For the purposes of loading and unloading cargo, all cargo tanks are equipped with a frequency converter, electrical deepwell pump, allowing for high flexibility in the discharging of the cargo of different, specific stripping. A stripping system and a newly developed super stripping system is designed to result in bringing residuals down to practically zero. In comparison to the total cargo tank capacity of 19 million liters, the yard and owner consider this to be an outstanding ecological result.

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## GREAT SHIPS OF 1998

*Hanjin's Segero (Continued from page 36)*

in an arc ranging from 80 degrees over stern to 80 degrees inboard up to sea state 5, and provides for launching and recovering a cable plough from either of the two cable lines. One 20 ton swl telescopic crane and one eight ton articulated crane are also fitted aft. The starboard and port cable line consist of a Dowty 4-m diameter, 40-ton pull drum engine and a 4-ton/4-wheel-pair draw-off/hold-back unit each

side.  
Circle 29 on Reader Service Card

Segero Main Particulars	
Flag	Panama
Classification society	KR, Lloyd's Register
Launch date	December 1997
Length, o.a.	378.5 ft. (115.4 m)
Length, b.p.	313.6 ft. (95.6 m)
Breadth, molded	65.5 ft. (20 m)
GT	8,323
DWT, design	3,706.4
DWT, scantling	6,409.5
Draft, design	6.3 (MLD)
Draft, scantling	7.8 (EXT)
Speed, service (alternative engine rating)	16.6 knots at 100% MCR
Water ballast	1,848 cu. m.
Fuel consumption	34.3 ton/day (main engine)

*Samsung's Deepwater Pathfinder (Continued from page 32)*

ularly useful in deep waters or rough currents where it requires a great deal of expense and time to install a marine platform, or when it is required to check for the existence of oil in a short period.

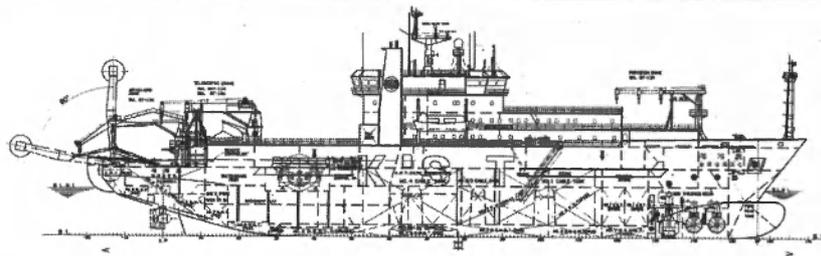
Of all 12 drillships ordered since 1996, Samsung Heavy Industries has received orders for seven vessels.

Circle 45 on Reader Service Card

### Deepwater Pathfinder Main Particulars

Designer	Samsung/RDS
Flag	Panama
Classification	ABS
Number of sister ships	4
Contract date	October 1996
Float out date	March 1998
Delivery date	September 1998
Length, o.a.	726.7 ft. (221.5 m)
Length, b.p.	698.8 ft. (213 m)
Breadth, molded	137.8 ft. (42 m)
GT	60,083 m.t.
Displacement	104,206
Lightweight	30,287
DWT, design	75,919

DWT, scantling	73,919
Draft, design	27.9 ft. (8.5 m)
Draft, scantling	42.6 ft. (13 m)
Speed, service	12 knots
Complement	130
Cargo capacity	15,870
Bunker, fuel oil	4,500 cu. m.
Bunker, diesel oil	750 cu. m.
Water ballast	78,530
% high tensile steel	29%
Main engine	Wartsila 18V 32E, 12V 32E
Total HP	4,860 kW x 3, 7,290 kW x 3
Azimuth thrusters	KaMeWa
Generator	ABB
Emergency generator	MAN-Lindenberg
Motor starters	ABB
Deck machinery	Pusnes
VHF radio	JRC
SSB radio	JRC
Radar	Norcontrol
Compass	Raytheon-Anschutz
GPS	Trimble
Autopilot	SIMRAD
Collision avoidance (ARPA)	Norcontrol
Pumps	Taiko, Shinko
Heat exchangers	Dong Hwa
Air conditioning	Direct Engineering
Liferafts	Norsafe
Liferafts	Viking
Davits	Woo-Il
Fifi System	Unitor
Door	Sung-Mi
Cargo control system	SIMRAD
Ballast control system	SIMRAD
DP system	SIMRAD
Computers on the ship	SIMRAD

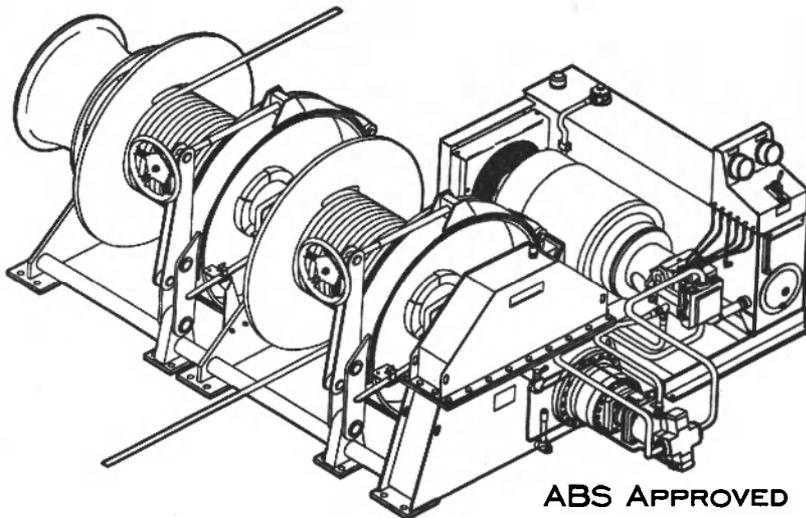


Main engine mfr.	Ssangyong Heavy Industries	DPS	Kongsberg Simrad
Engine types	MAN B&W 8L32/40, MAN B&W 6L32/40, MAN B&W 6L23/30H	Fire detection systems	Samyang Radio
Propellers	Kamewa	Radars	STN Atlas
Bow thrusters	Elliott	GPS, Navigation System	JRC
Stern thrusters	Kamewa (Aquamaster)	DGPS	Racal
		Sewage plant	Jonghap



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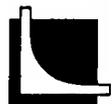
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# The Year In Review

Consolidation — across the full realm of the maritime industry — could reasonably be called the major theme of 1998, and it appears this trend will continue well into the new millennium. While it is impossible to provide a catch-all reason for why vessel builders, vessel owners and marine equipment suppliers are numbering fewer but larger, a strong case can be made for the ever evolving globalization of business. This is not, of course, unique to marine companies, as soda manufacturers, for example, face many of the same operational constraints and market share concerns as makers of bowthrusters.

Simply put, price pressures and politics make it increasingly prohibitive for the "little guy" to profit. A prime example of this trend was seen with the recent announcement that Mitsui O.S.K. Lines Ltd. and Navix Line Ltd. will merge next April, effectively creating one of Japan's biggest shipping firms with revenues comparable to industry leader Nippon Yusen KK. The two companies were reportedly driven to merge in a bid to survive the increasingly competitive global shipping industry. The deals announced or consummated in 1998 are far too numerous to list here, but some recent notable players include General Dynamics, headquartered in Falls Church, Va., which officially added San Diego-based NASSCO to its vast arsenal of shipbuilding and general defense holdings.

But while mega-deals are in vogue, it is worthy to note that size doesn't always matter. Kvaerner ASA, one of the world's largest engineering and construction firms, had a rough year digesting the sum of its previous year's additions.

The company's steady march down the stock market scales eventually led to the ousting of its chairman and CEO. But throughout, it is interesting to note, the company's shipbuilding arm continued making its mark on the global shipbuilding scene by delivering quality, high-value tonnage,

and with the development of advanced shipbuilding facilities, notably in Philadelphia.

Illustrated to the right is a smattering of data and statistics designed to give the broad overview of the year that is almost past. Perhaps most revealing is the correlation (though not exactly) between the curves on the Oil Prices and Rig Utilization charts.

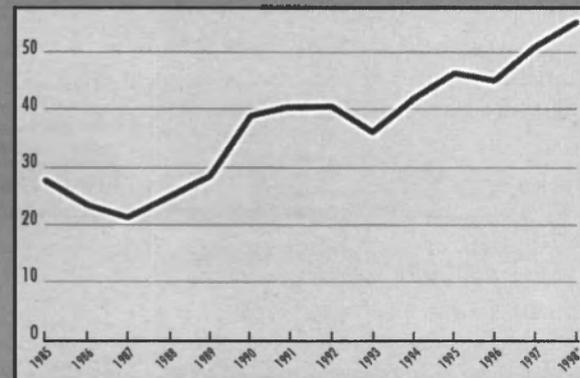
No other theme has dominated the headlines this year more than the stagnation of oil prices at 10 year lows. The offshore oil production business was enjoying a raucous three year run before a host of factors — including the Asian financial crisis — conspired to slow demand and depress prices. Despite the concerted and best efforts of OPEC members and other major oil producing nations to trim output and lessen the glut of product on the market, the price — though temporarily buoyed — has remained mired in the \$13/barrel region.

The inability to prop up the price of oil has a domino effect across the maritime market, and affects a wide spectrum of marine operators, builders and suppliers. It is impossible to accurately predict the future direction of the oil markets, but it is safe to assume that eventually, pricing will rebound.

While a full fledged panic is far away, there have been some signs of late that oil woes will impact marine companies directly in the coming year, most notably as oil majors have uniformly announced plans to trim exploration and production spending. But while cuts will undoubtedly hurt, it is interesting to note that interest and activity in the discovery and recovery of resources in deepwater fields remains economically attractive and a potential area of short term growth. Tax incentives and technology are beckoning oil companies to proceed in increasingly deeper waters, and a true test of the industry's strength should show itself during the next Gulf of Mexico lease sale, which has been tentatively scheduled by the MMS for next March.

## THE ORDERBOOK

The following table — complements of Lloyd's Register — clearly illustrates how the average quarterly millions of gross tonnage for the world orderbook has skyrocketed since 1985 (\*to June 1998).

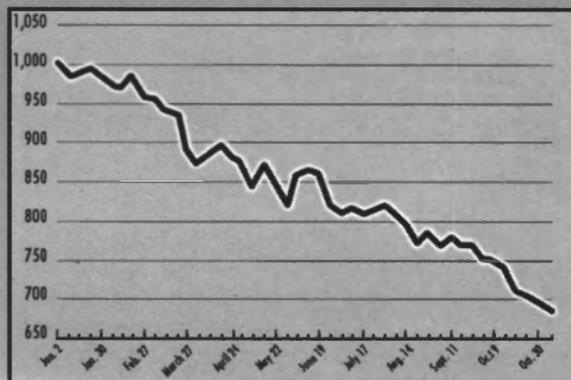
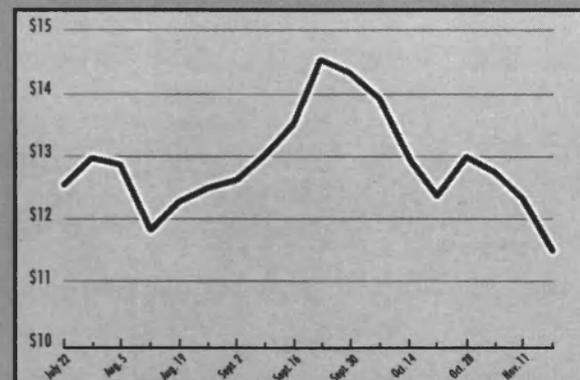


## MW40

The MW40 — complements of MR/EN sister publication Maritime Week — weekly tracks the composite valuation of 40 leading maritime companies. As the chart indicates, 1998 was a relatively rough year for the industry.

## OIL PRICES

Oil prices have remained consistently down for more than a year now, a fact not lost on oil majors in making E&P plans for 1999 and beyond. Oil pricing continues to suffer as a result of the Asian financial crisis, which effectively helped to cut oil products demand.

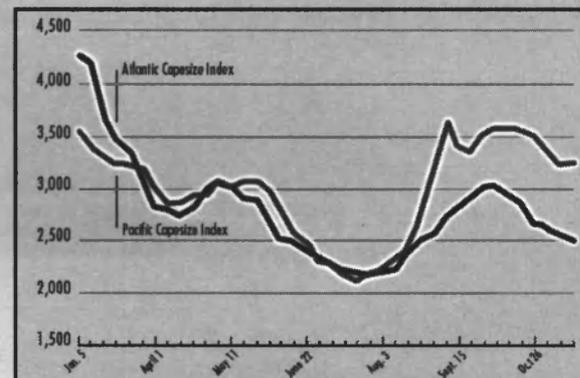


## RIG UTILIZATION

Hand in hand with the above chart, rig utilization around the world has been hard hit by depressed oil prices. However, deepwater project prospects remain strong. source: Baker Hughes

## CAPEX INDICES

Bulk rates embarked on a wild ride for much of 1998, hitting the trough in the late summer. While prospects have peaked of late, sentiment across the bulk market niche is rather bearish. source: SS&Y



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Circle 294 on Reader Service Card

### Top Management Changes at Wärtsilä NSD

As of January 1, 1999 four new Group Vice Presidents (GVP) will be added to Wärtsilä NSD's top management. **Tage Blomberg** has been appointed GVP, head of Business Area Service. Mr.

Blomberg will take over from **Max Wieringa** who has resigned. **Stefan Fant** will take over from **Clas-Eirik Strand** as GVP, head of Business Area Power Plants. Mr. Strand has been appointed to GVP, Key Accounts and Business Development. The present managing director of Wärtsilä NSD

Singapore, **Mikael Makinen**, has been appointed GVP, head of Business Area Marine. In addition, **Raimo Lind** has been appointed a GVP and CFO as of December 1, 1998. All will report to the president and CEO, **Ole Johansson**, and are members of the Board of Management. The head office func-

tions of Wärtsilä NSD Group, presently in Zurich, will be concentrated to Helsinki by mid 1999.

### New Appointments At First Wave Marine

First Wave Marine of Houston, Tex. has announced the following appointments: **Jack Holmes** to Director of Environmental Affairs; **Don Francis** to Director of Marketing; **Randy Tigert** as Director of Safety and Risk Management; and **Suzanne Kean** to Vice President and General Counsel.

### ABS Approves Jastram Steering Cylinders

Jastram Engineering Ltd. has received ABS Type Approved status for its Model S hydraulic steering cylinders. Jastram Model S cylinders are most frequently installed on commercial workboats, mega yachts, large passenger vessels, supply vessels, tankers and icebreakers. The can be used in either new steering system applications or in retrofit and repair programs.

Circle 2 on Reader Service Card

### UMOE Schat-Harding Appoints East Coast Agent

Schat-Harding, Inc., the U.S. company for the international UMOE Schat-Harding life-saving equipment organization, has formed an alliance with Tidewater Naval Architects Inc. in which Tidewater will represent Schat-Harding in the U.S., east of the Mississippi River and north of the Gulf of Mexico. The addition of Tidewater's project management and detail design capabilities will provide a turnkey service to Schat-Harding customers.

Circle 3 on Reader Service Card

### New Naval Architecture Firm Formed

**Kevin M. Kerwin** has recently formed Kerwin Consulting Naval Architects, Inc. The firm will perform naval architecture and marine engineering, project management, and interior design/styling of yachts and commercial vessels. Both new design and refit design work will be undertaken, with U.S. Coast Guard and MSA compliance being a specialty.

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Circle 311 on Reader Service Card

## Inmarsat Appoints Maritime General Manager

Inmarsat has announced the appointment of **Robert Johnson** to the position of general manager of Maritime Services. Mr. Johnson will manage the maritime marketing and safety services teams and continue to build Inmarsat's key maritime business. He joins Inmarsat from Litton Marine Systems BV, where he held the position of director of sales/general manager for Europe, Middle East, CIS, Africa, Australia and New Zealand.

## Spanish Yard Receives ISO 9002 Accreditation

Astilleros de Santander, S.A. (Astander) Quality Management System applicable to ship repairs and conversions has been approved by Lloyd's Register Quality Assurance to the ISO 9002:1994 Standards.

## USCG Grants QSS Recognition To ABS

Quality Standards System (QSS) recognition has been granted by the U.S. Coast Guard (USCG) to the American Bureau of Shipping (ABS) and its affiliated companies. This recognition gives ABS the authority on behalf of the USCG to review and approve various courses and training programs required by the International Maritime Organization's Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). These new authorizations are in addition to other statutory authorizations given to ABS that include various surveys and certifications in accordance with the Load Line, SOLAS and MARPOL international maritime conventions.

Circle 43 on Reader Service Card

## ABS Approved By U.K. To Act As Notified Body

ABS Europe Ltd., a division of the international classification society ABS, has been authorized by the Department of Trade and Industry (DTI) of the U.K. to act on its behalf as a Notified Body for the certification of products under the EU Machinery Directives. According to the directives, manufacturers of specified products must obtain certification from a Notified Body prior to making them available on the European market. Any of the ABS regional offices may carry out the technical review and inspection work subject to confirmatory overview and issuance of the appropriate certificates by the ABS Europe London headquarters.

Circle 44 on Reader Service Card

## CSL Fleet Completes ISM Certification

Canada Steamship Lines (CSL) has achieved ISM certification for its entire fleet after the M/V Atlantic Huron successfully completed its external audit in late October. To smooth the adoption of the ISM Code policies, CSL upgrad-

ed its communications network in order to facilitate the flow of information between ship and shore.

The company also helped to design QMX Maritime, a cutting edge software that automates many time-consuming aspects of the ISM Code.

## Two New Major Appointments At Transas

Transas has appointed two new members to its Board of Directors. **David Campbell** has joined the Transas Group as Finance Director and will be based at the Transas Marine (U.K.)

### STRAINERS, FILTERS TRANSFER VALVES TRANSFER PUMPS

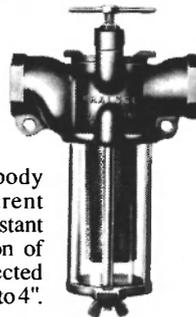
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Simplex-  
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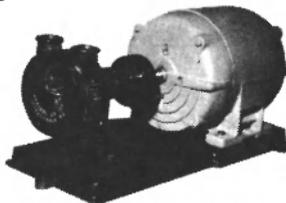


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Circle 259 on Reader Service Card

## PEOPLE & COMPANY NEWS

Ltd. headquarters in Southampton. **Peter Mantel** has been appointed as Director of Marketing and Sales for the Transas Group. Mr. Mantel's immediate responsibilities are to create a well-organized marketing and sales organization with innovative, cost effective solutions for the Transportation Industries.

### Delta Queen To Expand

The Delta Queen Steamboat Co. has announced details of its new small coastal cruise ship line, Delta Queen Coastal Cruises, including preliminary itineraries and a construction timetable. Contracts for the first two vessels will reportedly be awarded this year with construction beginning in 1999. The ships,

costing between \$30 and \$35 million each, will be 300 ft. (90 m), diesel-driven, and able to accommodate 226 passengers.

### Capstans For The New Millennium

Superior-Lidgerwood-Mundy Corp. (SLM) has released a new generation of commercial capstans — the Millennium-2000 Capstans. These newly designed units are being established through a world-wide distributor network and consist of five series of capstans, totalling over one hundred model possibilities. Starting loads are from 1,800 lbs., with speeds of 12 fpm to 100 fpm. Head diameters are 6 in., 9 in., 12in. and 15 in., with motors of .5 to 30 HP available. The Millennium-2000 Capstans are designed to maintain a high efficiency over a wide range of ratios, enabling them to reflect more pull for equal or less horsepower.

Circle 47 on Reader Service Card

### Crewlink.com Announces Advisory Board Member Appointment

Crewlink.com announced the appointment of Capt. **Francis P. McGinty** to its advisory board. Capt. McGinty has more than 19 years experience in the marine transportation industry. CrewLink.com is a leading professional maritime employment e-classified site on the internet, located at <http://www.crewlink.com>.

### Hvide Marine Towing Promotions

Hvide Marine Towing, a unit of Hvide Marine Inc. has announced the promotions of five executives who will report to **James Kimbrell**, president of Hvide Marine Towing and a vice president of Hvide Marine Inc. The newly promoted individuals and their areas of responsibility are: **James C. Brantner**, senior vice president, all harbor and offshore towing operations; **Norman L. Atkins**, vice president, Tampa Bay operations; **J. Edgar Brister**, vice president, Mobile operations; **Richard N. Decker**, vice president, Port Everglades and Port Canaveral operations; and **Jeffrey A. Williams**, vice president, Port Arthur and Lake Charles operations.

### Ship Repair Company Debuts New Name

The companies comprising Southwest Marine Holdings, Inc., including the recently acquired Norfolk Shipbuilding and Drydock Corp. (Norshipco), will operate under the umbrella of a corporation named United States Marine Repair (USMR), to be headquartered in Norfolk, Va. The current president and CEO of Southwest Marine, Inc., **B. Edward Ewing**, will assume the same positions at USMR.

### Venezuelan Shipyard Picks Agent

Dianca Shipyard of Puerto Cabello, Venezuela has nominated **Wes Wheeler**, president of Wheeler Associates, as agent for the U.S. and Canada. The shipyard, founded in 1905 by the Venezuelan navy, is now undergoing privatization.

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## LR Offers New Safety Workshop

Lloyd's Register (LR) will hold a workshop on the new Control of Major Accident Hazards Regulations (COMAH) on Wednesday, February 3, 1999 at the Birchwood Conference Center, Warrington. The one-day workshop is aimed at those in the chemical industry responsible for compliance with the new legislation. Topics will include emergency planning and environmental issues. For more details, contact Dr. Colin Sherrard at tel: +44 1925 830176; fax: +44 1925 830177.

## \$72.6 Slated For Buoy Tenders In 1999

Congressman Jay Johnson has reported that \$72.6 million was included in the FY 99 budget for the acquisition of two WLB Class Buoy Tenders. This is in addition to the two tenders awarded to Marinette Marine in September. Congressman Johnson is a member of the House Transportation Subcommittee of the U. S. Coast Guard. There remain seven additional tenders left to be funded by Congress. Marinette Marine expects the USCG to exercise the option to build these two cutters in January of 1999, with construction to begin in late 1999.

## Nautronix Awarded DP Contract

Nautronix has been awarded a contract from Harland & Wolff to provide Dynamic Positioning Systems for Global Marine Drilling's new generation ultra deepwater drillships.

Circle 38 on Reader Service Card

## Transas "Goes For" Iridium

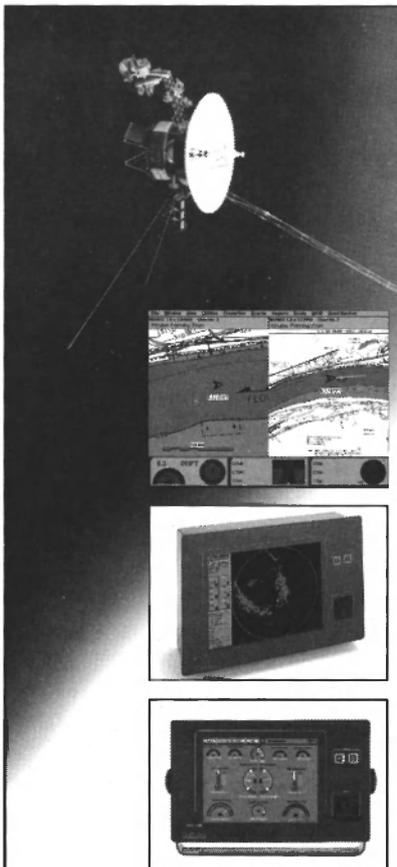
November 1, 1998 is the proposed date for the commercial exploitation of the Iridium project. The new global mobile communication system Iridium has proved to be tailor-made for the conditions onboard ship and extends greatly the possibilities of modern maritime communication.

Transas, as a leader in maritime software and communications markets, has always been active in the most innovative projects and technologies. Transas is planning to offer Iridium-provided services to its numerous marine customers. The long-standing business relationship between Transas and S.P. Radio A/S from Denmark will be

an advantage in fulfillment of these plans. S.P. Radio's parent company, EuroCom Industries A/S (ECI) has as the first company in the world concluded a license and

supplier agreement with Motorola Inc. This means that Transas will distribute the maritime satellite telephones developed and produced by S.P. Radio. There are cur-

rently two versions of S.P. Radio's Iridium equipment: Sailor Iridium Single Channel SC4400, and Sailor Iridium Multi-channel MC4000.



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**Shipbuilder** Fincantieri Cantieri Navali Italiani S.p.A  
**Vessel name** Tor Selandia  
**Vessel Type** RoRo freight ship  
**Owner/operator** Tor Line AB, Sweden

Marking its first newbuild project in two decades, Tor Line's new generation of RoRo freight vessels molds its extensive experience in the tough North Sea trades with an understanding of the changing transportation requirements of industry and commerce.

Tor Selandia heralds faster transits, higher unit capacity, system-shipping efficiency and significantly greater route productivity on the company's AngloBridge operation between Sweden and the U.K. But considerations of year-round service dependability and

freight delivery in pristine condition, and logistical planning matching just-in-time shipping and distribution practices, have complemented the advances in size and speed.

All three Tor Selandia-class vessels, entrusted to Fincantieri's Ancona yard in the Adriatic, are to be phased into AngloBridge, to cut crossing times between Gothenburg and Immingham from 34 to 24 hours, and reduce port turnarounds from around 10-12 hours to six hours.

Ranking among the highest capacity ships deployed on the North Sea, Tor Selandia provides for 2,820 lane meters of rolling freight, equating to approximately 200 trailers. She has been configured and dimensioned for a substantial traffic mix, comprising

rolltrailers and special cassettes, as well as road trailers, containers and trade vehicles. The 640 ft. (195 m) class has been built to the broadest width possible for passage through the lock into Immingham Dock, a prominent U.K. interface for trade on industrial South Humberside.

Industrial shipping provides baseload business for the AngloBridge operation, including inter-plant transfers between Avesta steelmaking facilities in Sweden and the U.K., and a contract of affreightment with Swedish producer Stora covering shipments of newsprint, paper reels and other products.

Turnaround performance benefits from the obstruction-free main garage deck and Kvaerner Ships Equipment-designed cargo access

and internal transfer arrangements, plus the adoption of a new trestle-based lashing system adopted throughout the cargo section. The arrangements involve a structure incorporating a recessed fifth wheel which couples directly to the trailer's kingpin, while the trestle is automatically clamped to the deck using four twistlock connections. Two web lashings are applied at the rear of the trailer to secure the unit against any movement at sea.

Although Tor Selandia has become one of the fastest RoRo freight ships on the North Sea, the operator's concern with sustainable speed performance through the year, given the difficult and extreme conditions often presented by that body of water, matched the requirement for more rapid

*Lindenau's Hornisse  
(Continued from page 49)*

approximate 5,000-cu. m of segregated ballast space is protected by an epoxy coating.

Due account has been taken of future regulations governing minimum stability during cargo loading and discharge in the design of Buttner's new vessel. The main engine was designed and manufactured at the nearby Kiel works of MaK Motoren, a Caterpillar Group business unit focused on the medium-speed marine business.

The nine-cylinder plant employs the highly-regarded M32 design, which turns out 4,200-kW at a crankshaft speed of 600-rpm. Drive through Renk transmission reduces the rotational speed at the Lips controllable pitch propeller to 116-rpm, in a system which has added utility for its incorporation of a pto (power take-off) for a shaft generator running at 1,500-rpm.

Reflecting her operating ambit, with a pronounced need for maneuverability in restricted waters and at tight berths, Hornisse is fitted with a high-efficiency, semi-spade rudder, and an electrically-driven, 550-kW Lips bowthruster.

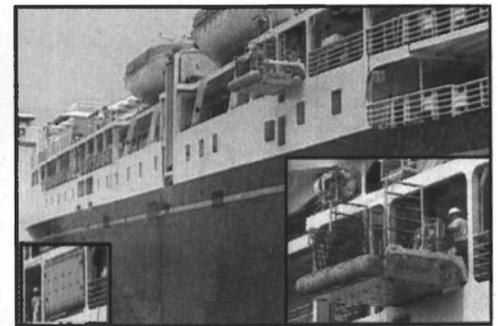
Circle 35 on Reader Service Card

**Hornisse  
Main Particulars**

Classification	Germanischer Lloyd
Length o.a.	477.6 ft. (145.6 m)
Length b.p.	454 ft. (138.5 m)
Breadth	64.3 ft. (19.6 m)
Depth to main deck	35 ft. (10.7 m)
Draft, scantling	27.5 ft. (8.4 m)
DWT	13,000
Gross tonnage	8,080
Cargo capacity	14,803 cu. m.
Main engine	MaK 9M32
Propulsive power	4,200 kW
Trial speed	15.2 knots
Service speed	13.6 knots
Cruising range	8,230 sea miles
Variable pitch propeller	Lips
Gearbox	Renk
Stern-tube seals	Lips, John Crane
Auxiliary engine	Yanmar
Generators	Hyundai Heavy Industries, Siemens
Emergency diesel generator	MAN
Cargo pumps	Frank Mohr
Auxiliary and exhaust gas boiler	Aalborg
Screw pumps	Bornemann
Gear pumps	Steinmetz
Fuel and lube oil purification	Westfolia
Autom. fuel and lube oil filter	Boll & Kirch
Fresh water generator	Sandex
Plate-type heat exchanger	GEA Ahlborn
Other coolers	Prang
Marine centrifugal pumps	IRON
Starting air compressors	Sauer & Sohn (Alup)
CO2 fire extinguishing system	Unitor
Bilge water separator	DVZ
Sewage treatment plant	Hamworthy
Engine room crane	Fuchs Fordertechnik
Central AC plant	Heinen & Hopman
Cooling plants	Heinen & Hopman
Switchboards	Jonsson
Nav/Com	STN
Gyrocompass	Anschutz
Auto pilot	Anschutz
Machinery/data monitoring	Jansson
Marine cable acc. DIN	Siemens
Manifold crane	Acta
Crane for freefold lifeboat and provision	Acta
Steering gear	Ulstein
Anchor-mooring winches	Hatlapa
Freefall life boat and launching system	Hatecka
Rescue boat	Hatecka
Accommodation ladder	Fassmer
Crane for rescue boat	Acta
Marine paints	International
Galley and laundry equipment	Wesco Navy

**First MOR Installed By AB Welin**

The Sweden-based company AB Welin has recently delivered its first MOR, a Means Of Rescue system, that complies with the new SOLAS regulations. The unit was installed on the new Alaskan ferry Kennicott and is approved by the United States Coast Guard.



AB Welin's MOR is based on a floating rigid rescue platform which is suspended by four individual wire falls from a pair of davit arms mounted on a deck above. The four wire falls increase stability and safety and eliminate the risk of platform rotation. The MOR, made of sea water resistant aluminum, is equipped with handrails, protection nets, and two boarding ramps. The ramps and rails can be folded in for small footprint stowage.

The system is ready for immediate use at all times and can be deployed in less than one minute by a single crew member. In a rescue operation, the self-draining platform is lowered to water level where it can be loaded with people from the water, a small boat or from a rescue craft. The loaded platform is then hoisted to deck level where the people are transferred to the vessel.

Circle 1 on Reader Service Card

**OTAL Launches North American Liner Agency**

West Africa shipping and logistics specialist, OT Africa Line (OTAL) has launched OTAL North America, a maritime agency in the U.S. and Canada.

Using a series of inter-line agreements and its own tonnage, the company provides regular weekly sailings linking the

U.S. and Canada with every major West African market between Nouakchott in Mauritania and Lobito in Angola.

The company also manages transportation to and from the interior of West Africa using its own inland transportation network. OTAL (USA) Inc. and OTAL (Canada) Inc. will be headquartered in New York and Toronto, respectively.

transits.

In accordance with contractual requirements, the vessel has been engineered and faired to maintain at least 21.1-knots on the design draft at 85 percent engine output, with 20 percent sea margin. The fact that she achieved more than 23 knots on trials is an indication of her latent power, but the expectation that she will be able to keep to 21 knots even in conditions where existing trailerships of 17-19 knots have to slow down is no less salient to the operation.

Tor Selandia provides the first sea-going reference for the ZA50S engine, a continuation of the Swiss-developed Sulzer medium-speed lineage within the Wartsila NSD portfolio. Remarkably compact in relation to their output, the two nine-cylinder models employed in the Swedish vessel rank among the world's most powerful in-line, four-stroke machinery.

Manufactured in north-east Italy by Grandi Motori Trieste (GMT), a partnership of the vessel's builder

and engine licensor, the prime movers deliver a total 29,340-bhp at 450-rpm, driving twin, highly-skewed Kamewa controllable pitch propellers through a Renk Tacke reduction gearbox. Although it incorporates many of the lauded features of the popular ZA40S engine, a unique feature of the latest design is the adoption of hydraulic actuation for the gas exchange valves, commonly employed in low-speed two-stroke machinery, but hitherto not used in the medium-speed domain. In the ZA50S, it is used in conjunction with pneumatically-controlled, load-dependent timing to provide variable inlet closing (VIC).

One result is a low level of exhaust emissions, an ever-more pressing consideration in the short-sea trades in particular, such that the installation falls well within the IMO year 2000 limits pre-

scribed for nitrogen oxide (NOx) output, while giving a substantial reduction in smoke emissions during part-load engine running. The other major result is improved fuel economy, with a flat fuel consumption profile across the engine's load range.

Circle 36 on Reader Service Card

Tor Selandia	
Main Particulars	
Designer	Fincantieri
Flag	Swedish
Classification	Det Norske Veritas
Number of Sister ships	Two (under construction)
Contract Date	April 1996
Float out Date	April 1998
Delivery Date	December 1998
Length, o.a.	648 ft. (197.5 m)
Length, b.p.	590.5 ft. (180 m)
Breadth, molded	85 ft. (26 m)
Depth, to main deck	31.2 ft. (9.5 m)
Depth, to upper deck	54.5 ft. (16.6 m)
Gross Tonnage	21,700
Displacement	19.2 tons
Lightweight	10.5 tons
Deadweight	10,500
Draft (design)	23 ft. (7 m)
Draft (scantling)	24.6 ft. (7.5 m)
Lane meters	2,820
Speed, service	21.1 knots
Cargo Capacity 200 trailer 14 m, 2.8 lane m with a lane breadth of 2.95	
Bunker	715 tons HFO, 1F 380, 50 tons MDO
Water Ballast	7.1 tons
Fuel Consumption	67 tons/24 hour, with 15.3 kW output
Main Engine Mfr.	Grandi Motori Trieste
Main Engine Type	Sulzer 9ZA 50S
Total HP	21.6 kW (29.4 HP)
Auxiliary Engines	3 x Wartsila NSD 65 220 U
Propellers	2 x Kamewa highspeed CP-propellers
Thrusters	2 x Fincantieri each 1.1 kW
Generator Engines	3 x Wartsila NSD 65 200 U at 900 kW
Generators	STN Atlas 1.400 kW (Shaft Generators)
Emergency Generator	Isotta Fraschini
Anti-Heeling System	Flume
Couplings	SKF
Reduction Gears	Renk
Engine Controls	Lyngsoe
Steering Controls	Ulstein
Deck Machinery	Kocks
Bearings	Cederwall
Coatings	Ameron
UHF Radio	UHF
SSB Radio	Standard Radio
Radar	2 x STN Atlas 9600
Compass	C Plath
GPS	2 x Trimble
Autopilot	STN Atlas
Collision Avoidance	STN Atlas
SATNAV	Loran C
Air Conditioning	AB Flakt
Lifeboats	Greben
Liferafts	Viking
Davits	Greben
Fire Fighting System	CO2, Water Spray
Desalination Equipment	Alfa Laval
Doors/Ramps/Cargo Lifts	Kvaerner
Cargo Control System	Kockumatic

December, 1998

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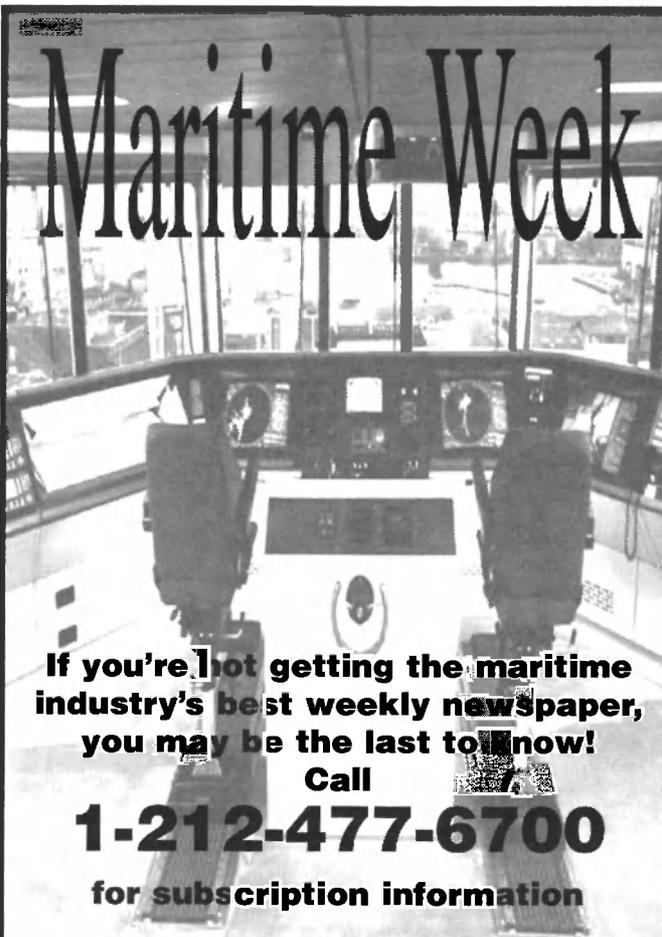
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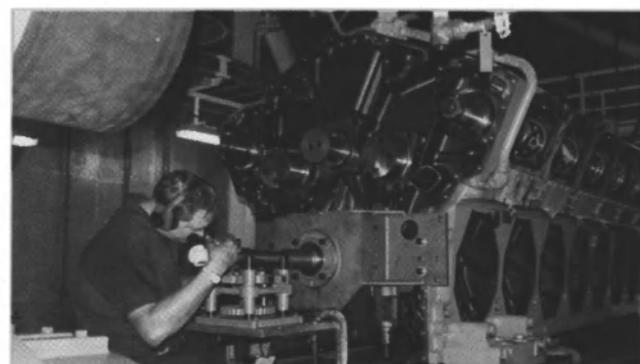
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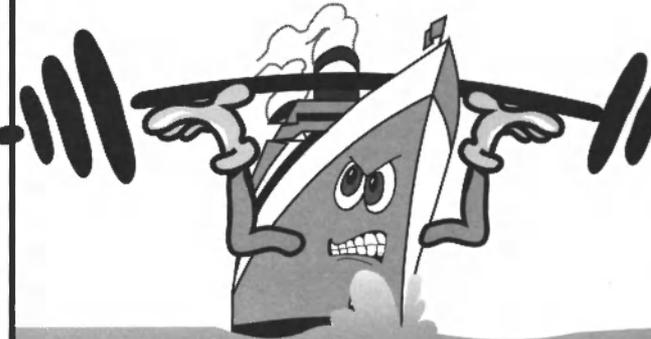
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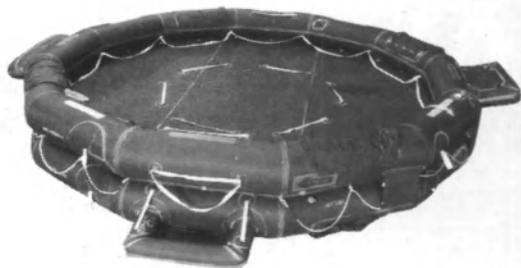
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Circle 269 on Reader Service Card

**GREAT SHIPS OF 1998**

*Kvaerner's Arcticaborg  
(Continued from page 48)*

BP, Statoil, AGIP, Total, Mobil BG and Kazakhstancaspiyshelf. In keeping with the double-acting idea, and given the particular navigating characteristics conferred by podded propulsors, the vessels will run stern-first in heavy ice conditions, and sail in conventional, forward-going mode in light ice or open water. Running astern in thick ice, as demonstrated by model tests at KMY's Arctic Technology Center in Helsinki, and as long proven by large icebreakers in the northern Bothnian Gulf and the Arctic, brings about a substantial reduction in ice resistance.

The design of the Wagenborg vessels has been specially developed to facilitate sternwards operation through level ice of 3.3 ft. (1m) thickness and also ice ridges, as encountered in the northern Caspian. At the same time, it ensures more hydrodynamically-efficient open-water transits than typically obtained with conventional icebreakers.

Arcticaborg is fitted with two electric azimuthing Azipod units, offering very high icebreaking performance relative to the 1,620-kW unit powers involved. The machinery room is located well forward, immediately below the stacks, occupied by two 1,950-kW engines of Wartsila 6L26 type driving 2,250-kVA van Kaick main generators delivering electrical energy into a common bus bar.

The AC propeller motors housed in the steerable pods aft are fed by inverter-type frequency converters.

Anticipated free running speed is in excess of 13 knots, and maneuverability is further enhanced by the adoption of a electrically-driven bow thruster. Built to Bureau Veritas' requirements for class I 3/3 E notation and to Finnish-Swedish rules governing Ice Class 1A certification, Arcticaborg is equipped with special towing gear to enable her to function as an assistance icebreaker, if required. The powering arrangements confer a bollard pull capacity of about 32-tons.

For her mainstream offshore supply role, the compact, 675-dwt vessel has a 350-sq.-m. open deck area aft for transporting gear and equipment, plus silos and tanks under-deck for a range of consumables and materials required on the platforms. Arcticaborg, as with second-of-class Antarcticaborg, has also been installed with firefighting equipment for a standby role, since the vessels are the only supply ships able to maintain operations in the worst conditions experienced in the area. The transit from the Finnish yard of build in the Gulf of Finland to the Caspian Sea, the world's largest inland sea, was made by way of the Volga-Don waterway system.

Circle 32 on Reader Service Card

**Arcticberg  
Main Particulars**

Classification society	Bureau Veritas
Contract Date	December 1997
Length, o.a.	213.5 ft. (65.1 m)
Length, b.p.	198.8 ft. (60.6 m)
Breadth	54 ft. (16.4 m)
Draft, loaded	9.5 ft. (2.9 m)
Depth	14.4 ft. (4.4 m)
DWT	675 tons
Speed, open-water	13 knots
Main engines	Wartsila 6L26
Main engine power	2 x 1,950 kW
Main generator	van Kaick DGS
Harbor genset	Valmet, Stamford

Emergency genset	Valmet, Stamford
Propulsion	ABB Azipod Oy
Icebreaking performance ahead	.2 ft. level ice (0.6 m)
Icebreaking performance astern	.3.3 ft. level ice (1 m)
Ballard pull	.32 tons
Diesel oil capacity	400 tons
Fire pumps, monitors	Kvaerner Eureka
Step up gears	Kumera
Fire extinguishing system	Hi-Fog, Marioff
Main switchboards	ABB Marine
Machinery automation system	ABB Marine
Cabling	Nokia, Helkama
Boiler	Laatukattilat
Fuel oil separator	Alfa-Laval

Incinerator	Uson
Machinery pumps	Iron, IMO
Cement bulk system	Merewida
Cement bulk compressors	Atlas Copco
Oil mud system	Bergen Rührhandel
Oil mud pumps and agitators	Allweiler
Crane	HMB
Hatches	Tebul
WT sliding door	Wintel
Towing winch	Ten Horn
Towing pin	Karmoy
Anchor capstans	Ten Horn
Anchors	SEC
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Paints	Sigma
Autopilot	Anschütz
Radars, radio station	Furuno
Galley equipment	Trimar
AC units, fans	Novenco
Sewage treatment unit	Hamworthy

**Daewoo's Canmar Pride  
(Continued from page 50)**

13 hatches, with triple panel hatches in way of each hold (except No. 1 and No. 2 hatches).

The ship has a continuous upper deck with forecastle, a raked stem with bulbous bow, a transom stern with open water type stern frame, and a semi-balanced rudder. A heeling compensating system using one anti-heeling pump is provided for heel control within two degrees during loading and unloading of containers. Heating coils in wing water ballast tanks, including No. 1 water ballast tanks, are to prevent freezing.

Circle 28 on Reader Service Card

**Canmar Pride  
Main Particulars**

Designer	Daewoo Heavy Industries Ltd.
Country	South Korea
Flag	Bermuda
Classification	Lloyd's Register
Contract date	January 1997
Launch date	April 1998
Delivery date	July 1998
Sister ships	One
Length, o.a.	804 ft. (245 m)
Length, b.p.	761 ft. (232 m)
Breadth, molded	105.6 ft. (32.2 m)
Width of double skin, bottom	6.2 ft. (1.9 m)
Depth, molded to main deck	62.3 ft. (19 m)
Depth, molded to aft mooring deck	54 ft. (16.4 m)
GT	39,174
Displacement	56,526
Lightweight	15,644.5 tons
DWT, design & scantling	40,881
Draft, design & scantling	10.78
Speed, service (design draft)	21.7 knots
Heavy fuel bunkers	2,944.3 cu. m.
Diesel oil bunkers	277.5 cu. m.
Water ballast	15,672.2 cu. m.
Daily fuel consumption	82 tons
% high tensile steel	28.4%
Complement	officers - 16; crew - 12; repair crew - 4; spare - 3
Main engine Mfr.	Hanjin
Main engine	B&W 7L 80 MC
FP Propeller	Hyundai Heavy Industries Co.
Auxiliary engine	Ssang Yong
Alternator	Hyundai Heavy Industries
Boilers	Aalborg Boiler
Crane	Hydralift
Mooring equipment	Ulstein Brattvaag AS
Hatch covers	MacGregor
Container capacity	hold - 1,430 TEU; deck - 1,378 TEU
Pilot door	MacGregor
Cargo control system	Sabroe Control
Ballast control system	Shinko
Bow thrusters	Lips
Bridge control system	Narcontrol
Fire detection system	Salwico
Fifi system	NK Fire Protection Ltd.
Radars	Racal Decca Marine Ltd.
DGPS	Kelvin Hughes
VHF/SSB radio	JRC
Sat/Nav	Nera
DGPS	Lifton
Computer	Sea Wise
Incinerator	Kang Rim Ind. Co. Ltd.
Waste compactor	Electrolux
Sewage plant	Hamworthy Marine
Anti-heeling system	Frank Mohn Fusa AS
Steering controls	Tong Myung
Shafting	Daewoo
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Liferafts	Viking Life Saving

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*Hyundai's Front Century  
(Continued from page 49)*

approach to structural needs, promises long-term gains in maintenance needs and ship integrity.

Front Century and the second VLCC in the series are classed with Lloyd's Register, and the

whole array of notations conferred includes ShipRight procedures as regards structural design assessment (SDA), fatigue design assessment (FDA) and construction monitoring (CM). The ensuing three C-generation ships are being built to Det Norske Veritas' class requirements, including CSA-1 structural

strength and fatigue strength notations.

Subdivision of the revenue-earning section of the hull by longitudinal and transverse bulkheads is such that Front Century offers a loading capacity of 350,060 cu. m. in five center cargo tanks, five pairs of side cargo tanks, plus

two slop tanks, protected by a double side shell and double bottom. The intra-hull spaces, used throughout to provide much of the enormous water ballast capacity required by such a vessel, are dimensioned to Marpol-dictated criteria, giving a width of 11.5 ft. (3.5 m) in the wings and a 9.8 ft. (3 m) height in the double bottom.

A maximum outturn rate of 15,000-cu. m. per hour is offered by three steam turbine-driven vertical, centrifugal cargo pumps, and loading can be achieved at up to approximately 20,500-cu. m. per hour through the central manifold. Three grades of oil can be handled simultaneously with two-valve segregation, and ullaging of the cargo tanks is undertaken using a Saab tank radar level gauge system.

Fixed monitoring equipment detects any hydrocarbon gas released in the pump room and ballast spaces. The strong position of the MAN B&W marque in the Korean shipbuilding two-stroke engine stakes is reflected in the adoption in the Frontline VLCC of the seven-cylinder S80MC diesel, one of the most popular choices for large crude carrier propulsion. Manufactured at HHI's engine works on the shipyard estate, the unit offers a maximum continuous output of 34,650-bhp (25,485-kW) at a slow-turning 79 rpm. The installation provides scope for a service speed of up to 15.7 knots in fine weather.

Electrical power is derived from three gensets based on Wartsila 8L20 diesels rated at 1,414-bhp at 720 rpm, while steam requirements are met by two Mitsubishi marine boilers and a Kang Rim exhaust gas economizer. Indicative of the level of automation incorporated in the new breed of Frontline VLCCs is the adoption of an advanced cargo handling and planning system called Super Cargo, which is supportive of one-man operations, and a machinery predictive diagnosis and maintenance tool known as Super plant. The latter uses sophisticated artificial intelligence (AI) and data acquisition techniques.

**Circle 34 on Reader Service Card**

**Front Century  
Main Particulars**

Designer	Hyundai Heavy Industries Co. Ltd.
Flag	Liberia
Classification	Lloyd's Register
Number of sister ships	4 (on order)
Contract date	February 1997
Delivery date	July 1998
Length, o.a.	1,099 ft. (335 m)
Length, b.p.	1,050 ft. (320 m)
Breadth, molded	190 ft. (58 m)

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Depth, molded	101.7 ft. (31 m)
Gross tonnage	157,976
DWT, design	281,600
DWT, scantling	311,300
Draft, design	68.7 ft. (20.95 m)
Draft, scantling	74.4 ft. (22.7 m)
Speed, service	15.7 knots
Complement	29
Cargo capacity	336,032 cu. m.
Bunker	7,990 cu. m.
Water ballast	100,700 cu. m.
Fuel consumption	92.5 ton/day

% high tensile steel	35%
Main engine mfr.	Hyundai Heavy Industries
Main engine type	B&W 7S80MC
Total HP	34,650 BHP x 79 RPM
Propellers	Hyundai Heavy Industries
Generator engines	Wartsila - NSD
Generators	Hyundai
Emergency generator	Ssang Yong Cummins
Motor starters	Hyundai
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Ballast control system	Samgong - Danfoss
Computers on the ship	Kockumation

*Clipper Stamford*  
(Continued from page 51)

Group of Denmark and Dockendale Shipping of the Bahamas. Incorporating a remarkable degree of trading flexibility and the fully self-sustaining qualities essential to such vessels, the Stamford type employs a four-hold arrangement suited to bulk commodities such as grain and iron ore, packaged lumber, steel coils and pipe, and unitized freight such as woodpulp and other forestry products.

In addition, she has been dimensioned for a full stow of 869-TEU containers, comprising 390-TEU slots in the holds plus 479-TEU on the weatherdeck and hatches. The squared-off, box-like nature of the below-deck spaces is indicated by similarity of the grain and bale volume measurements of 23,880 and 23,795-cu m, respectively.

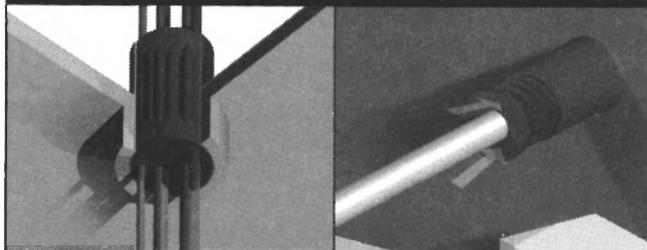
Each of the current newbuild series has been specified with three electro-hydraulic, level-luffing jib cranes mounted on high pedestals along the centerline between the hatchways. The furthest forward unit offers a 36-ton capacity at an outreach of 54 ft. (16.5m), while working within a radial ambit of 13 ft. (4m) to 92 ft. (28m). The other two cranes have a 36-ton rating at 41 ft. (12.5m), with an operating radius of 9.8 ft. (3m) to 78.7 ft. (24m).

The main machinery is an Hitachi-manufactured, six-cylinder engine of MAN B&W's S42MC type. Supplied in its latest, MkVI version, the prime mover has a maximum continuous rating of 6,150-kW at 136-rpm. While cargo intake and turnaround potential are key criteria, the degree of receptivity by the charter market to the Stamford class will also derive from its fuel-burning performance. The designers anticipate a daily consumption rate of 24.2-tons when making 15 knots at the 30 ft. (9.2m) design draft.

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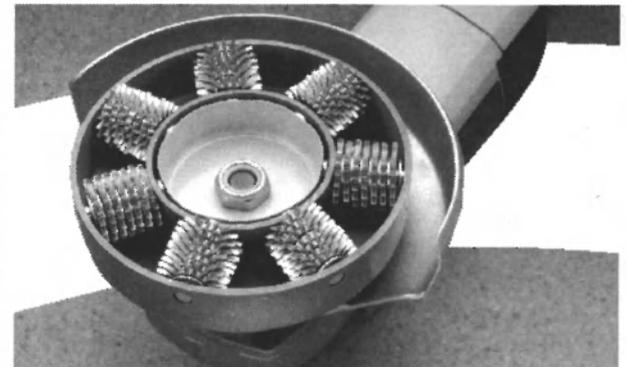


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Circle 304 on Reader Service Card

## Marine Deck Hardware and Equipment

**◆ ANCHORS: ◆**  
50 to 60,000 Lbs. - New and Used  
Stockless - Danforth - L.W.T. - Halls - Snug Stowing

**◆ CHAIN ◆**  
3/4" to 5 1/8" - New and Used  
Stud Link - Cast Steel - Grades 2 and 3 - Oil Rig Quality  
for Moorings, Towing, Barge Handling,  
Ship's Replacement

**◆ WINCHES - WINDLASSES - CAPSTANS ◆**  
Vertical or Horizontal Hand, Electric, Diesel, Hydraulic  
or Repowered to your specs

**◆ HATCHES - WATERTIGHT DOORS  
MANHOLE COVERS - SCUTLES - PORTHOLES ◆**  
All Sizes - New or Reconditioned

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**WATERMAN SUPPLY CO., INC.**

Circle 301 on Reader Service Card

## "An Introduction to Stability Software"

by William A. Price, president of Creative Systems, Inc.  
(with 26 years of experience in ship stability software).  
Look it up on the "web" at  
www.GHSport.com/stabsw.htm or contact Creative  
Systems at the address below for a copy by fax  
or e-mail.  
Find out what ship stability software is, what it  
does and doesn't do, and what to look for in a good  
package - whether it's for naval architecture, salvage  
or on-board use.

# GHS

General HydroStatics

### Stability Software Products

GHS	Full-featured hydrostatics
BHS	Mid-range package
BHS/YACHT	Yacht designer's package
GLM	Shipboard trim and stability
GHS/SALVAGE	Salvage oriented package



**CREATIVE SYSTEMS Inc.**  
CREATORS OF GHS

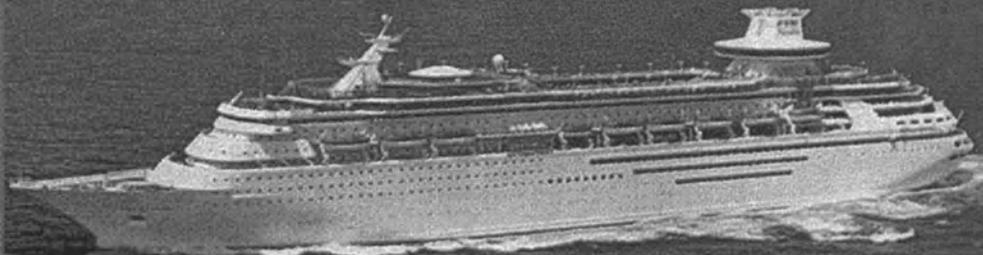
P.O. Box 1910 Port Townsend, WA 98368 USA  
TEL (360) 385-6212 FAX (360) 385-6213  
E-MAIL: sales@GHSport.com • Website: www.GHSport.com  
Developers of advanced hydrostatics software since 1972.

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Marine Systems and Service  
2900 SW 2nd Avenue  
Ft. Lauderdale, FL 33315  
Tel.: (954)763-8600  
Fax: (954)763-4849**

**ABB**

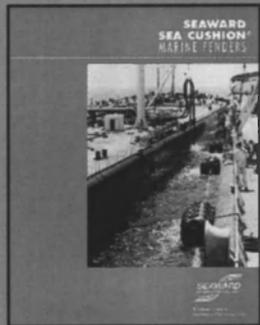
# Marine Literature Review



## Southeastern Connecticut Enterprise Region

Learn about Southeastern Connecticut – the ideal location for marine-related businesses. We offer a great location, a deep-water port, enterprise and foreign trade zones, targeted tax breaks, resourceful incentive programs and a special marine loan fund.

Circle No. 100



## Sea Cushion Manual

Sea Cushion performs in today's most demanding offshore or high seas environments. This offshore marine fender offers increased outer skin thickness, upgraded chain connections, open ring end fittings, upgraded foam density, and aircraft tires -- making it virtually indestructible. Seaward International's Sea Cushion Fender Line, the industry standard providing protection for over 25 years.

Circle No. 101



## Adrick Marine

Adrick Marine, a company specializing in custom air conditioning and refrigeration systems for the marine industry, has the ability to meet specialty marine air conditioning requirements on new and retrofit vessels. Adrick units offer efficient and reliable operation, minimum maintenance and long service life.

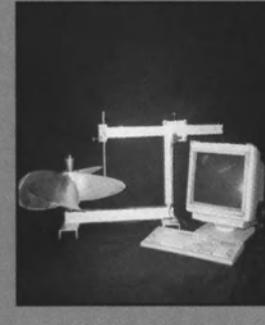
Circle No. 102



## New Blount Catamaran

Blount has invented a totally new composite catamaran that goes faster, costs less, makes a low wake and will be hard to sink. The EXP-299 40' high-speed experimental catamaran is being tested now on Narragansett Bay. For fifty years, Blount has been making catamaran innovations and will continue to patent and introduce improvements.

Circle No. 103



## S&S Propeller

Family owned and operated for over 50 years, S&S Propeller, with locations in Flushing, New York, and Pompano Beach, Florida, offers a lengthy list of products and services, including computerized propeller sizing. Both locations stock propellers, shafting and related hardware to accommodate boat sizes from 15' to 50'.

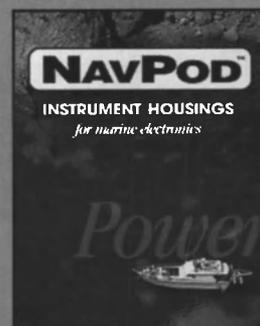
Circle No. 104



## Tire Fill Valve and Pressure Gauges

This six-page brochure provides technical data and specifications on Circle Seal Gauges. The Tire Fill valve gauge allows maintenance to monitor tire pressure and fill the tire with air in one easy step. Circle Seal Controls pressure gauges use a multi-burn Bourdon Coil that will withstand the most severe environments.

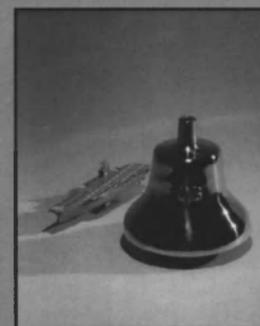
Circle No. 105



## NavPod Instrument Housings

NavPod constructs instrument housings for "big screen" LCD electronics, radar and chartplotters, and sampler instruments for sail and powerboats. Their products, which offer various features like water-resistance, UV protection, rotation, and tamper proofing, are compatible with many popular products.

Circle No. 106



## Ships Bells

Loffler Corporation, a supplier of ships bells to the U.S. Navy for more than 70 years, has a catalog of cast bronze military bells ranging in size from 3 lbs. to 200 lbs., which are made to Mil-B-674, and commercial bells ranging in size from 6 to 24 inches. The catalog also contains information on trip and cylindrical gongs.

Circle No. 107



## Decontaminate Your Fuel Quickly

Fuel Dynamics is the exclusive distributor of Fuel Mag diesel fuel decontamination units in North and South America. Fuel Mag NSA, largely reduces costly maintenance and downtime. It also increases fuel efficiency, extends diesel engine life, and cleans the fuel without the use of hazardous toxic biocides. For further information, call 888-825-4239.

Circle No. 108



## Protecting the Operator and Environment

The portable Hermetic sampler A-1 from Tanksystem SA can be used for connection on 1" Hermetic Compact Valves. It is designed for restricted sampling of liquids that present a fire, health or air pollution hazard. It limits the vapor emission during sampling.

Circle No. 109



#### Marine Products That Work

Headhunter manufactures the Tank Sentry Line of programmable fluid level monitors, known for reliability and accuracy. There are no moving parts to foul or electrical components inside the tank. Unaffected by floating solids or stray current, Tank Sentry is the ideal solution for the toughest of fluid level monitoring assignments.

Circle No. 110



#### Signs For Safety

Maritime Associates Inc. manufactures and supplies a complete range of IMO/SOLAS safety signs and posters as well as LLL pathway systems. The company uses a number of materials in manufacturing, including the internationally certified American Permalight substance used to make the photoluminescent signs.

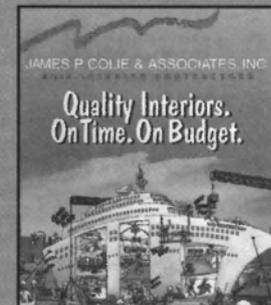
Circle No. 111



#### Prevent and Stop Corrosion

Eureka Chemical Company produces non-solvent base corrosion preventive coatings and lubricants that are applied to steel structure and parts. Commercial ships, military ships, drill-rigs and shipyards (dry-docks) commonly use these products in areas such as topside maintenance, ballast tanks, interior of rudders and wire rope.

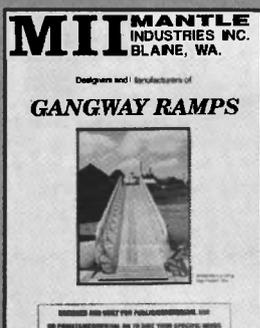
Circle No. 112



#### Turnkey Cruise Ship Renovation

James P. Colie & Associates is a marine general contractor turning the dreams of owners into realities by outfitting interiors to exact owner and designer specifications. They renovate all interior areas including casinos, lounges, gift shops, cabins, and dining rooms, supplying and installing all materials.

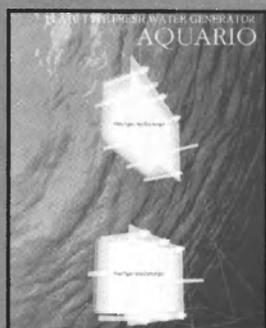
Circle No. 113



#### Mantle Industries, Inc.

Mantle gangway ramps show a level of workmanship and craftsmanship that will showcase your marina or moorage. Besides ensuring strengths and code compliance, Mantle manufactures with all aluminum construction, and provides many options made-to-order.

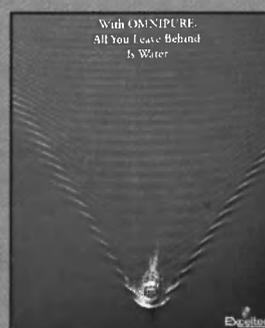
Circle No. 114



#### Sasakura - Aquario

Sasakura, the world's leading manufacturer of marine water makers and industrial use desalination plants, has developed "Aquario," a new generation of plate type fresh water generators. Sasakura combines 50 years' experience in designing and manufacturing of marine water makers with the latest technology.

Circle No. 115



#### All You Leave Behind Is Water

The patented treatment method of Exceltec's OMNIPURE Marine Sewage Treatment System is based on an electrochemical process that uses seawater to produce sodium hypochlorite disinfectant, while achieving a 90-95% oxidation rate and a total bacterial kill within minutes.

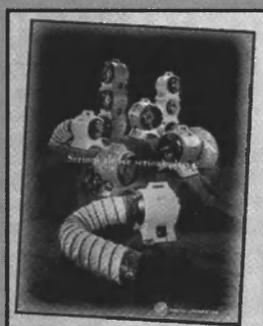
Circle No. 116



#### Marine Fire Protection

Themax non-combustible, non-toxic, marine construction boards are used worldwide for joiner bulkheads, panels, liners, ceilings, door and furniture cores. Themax has all major regulatory body certificates (USCG, Canada, DNV et al) and meets the requirements of IMO/SOLAS resolutions. Themax is sold, distributed, warehoused, laminated and cut to size in North America by PSI.

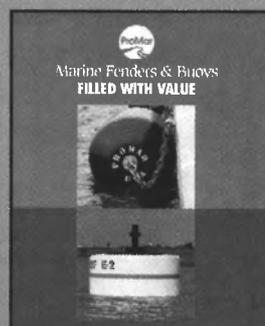
Circle No. 117



#### Portable Ventilators/Dehumidifiers

Dry Air Technology designs, engineers and manufactures custom fans, ventilation equipment and dehumidifiers. We offer a full line of high performance, portable, lightweight ventilators and dehumidifiers. Made of high-density polyethylene, these durable, maintenance free, corrosion-resistant products are perfect for heavy industrial needs.

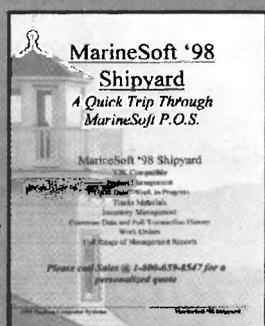
Circle No. 118



#### Fenders and Buoys

ProMar is making quite a splash in the marine fender and buoy market. With engineers and technicians that have decades of worldwide experience, the company is drawing on this knowledge and the latest technology to offer first class products with outstanding value. Their products are used by the military, offshore energy industries, marine companies and government agencies use their products.

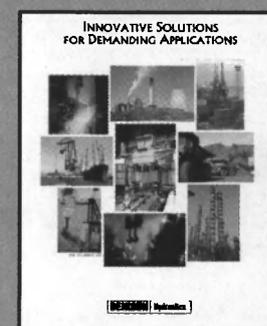
Circle No. 119



#### MarineSoft by PCS

The Marine Industry's most powerful and complete POS and Dealer Management Systems, MarineSoft '98 and MarineSoft '98 for Shipyard can handle most day to day operations without leaving the POS screen. For more information, call Paulson Computer Systems at 1-800-695-8547 or e-mail: sales@paulsonsoft.com.

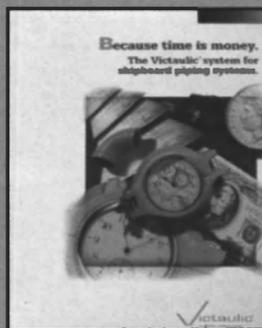
Circle No. 120



#### Denison Hydraulics

Your single source... Since the company was formed in 1931, the Denison name has been associated with many significant achievements in hydraulics technology. Holding over 700 patents, Denison Hydraulics Inc. is one of the world's most innovative developers of high-performance hydraulic products.

Circle No. 121



### Victaulic

Victaulic Company of America has issued a new eight-page brochure on its grooved-end mechanical piping system for marine services. The brochure describes how the system works and its advantages over conventional welded, flanged, and threaded systems, applicable specifications and approvals, worldwide technical support and typical shipyard applications. Website: [www.victaulic.com](http://www.victaulic.com).

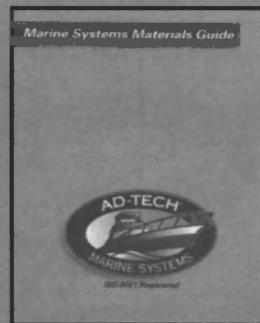
Circle No. 122



### Marine Shaft Packing

GFO fiber packing is a proven long-lasting, high-tech stern tube packing that's virtually maintenance-free and hardly ever drips. It's grease-free, easy to install and runs cool without getting hard or abrasive, so it won't damage shafts. ABS and OMSA approved and used by the U.S. Navy. W.L. Gore Associates, 800-455-2854.

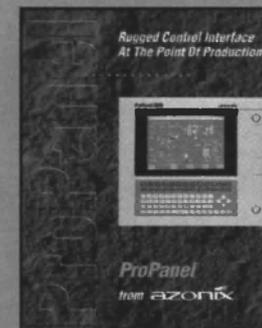
Circle No. 123



### ADTECH

ADTECH Plastic Systems Corp.'s epoxy systems are fast becoming the cornerstone in the marine manufacturing and repair industries. From epoxy laminating systems to blister repair fillers to set-fast adhesives to easy sanding fairing compounds; our history of proven performance in the automotive and aerospace industries has led to our technologically advanced marine systems.

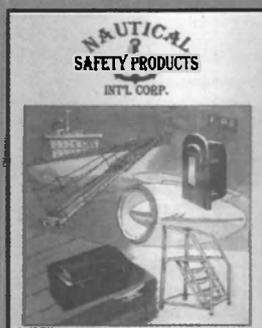
Circle No. 124



### Going Beyond the Industrial PC

Put this robust reliable PC control/data display anywhere. Compare ProPanel's thin profile and compact footprint to bulky monitors and enclosures. Its totally sealed design excludes liquids, particulate, EMI/RFI, shock and vibration. The flat panel display is ideal on the bridge or in the engine room. Find us on the Web at <http://www.azonix.com> or call 800-365-1663.

Circle No. 125



### Nautical Safety Products

The Houston, Texas company makes metal and fiberglass safety products. The metal division specializes in gangways, accommodation ladders, access systems, workstands and ladders. Their Fiberglass division makes products for industrial storage, hydrant enclosures, firehose storage, plus breathing and extinguisher containers. The name associated with durable safety products is Nautical.

Circle No. 126



### Protect Your Vessel

BoatLIFE helps you care for your boat with caulking, sealants, cleaners, primers and special products for teak decks. Waxes, cleans and more for almost any surface. Protect and preserve your vessel with BoatLIFE.

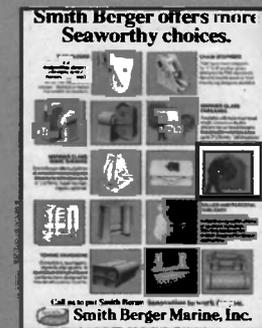
Circle No. 127



### Manly Marine Closures

In business since 1946, Manly Marine Closures has earned a reputation for quality marine closures. Using their own design and construction techniques, Manly custom fabricates marine doors, windows and hatches for shipyards and vessel owners around the world. Manly Marine Closures is a member of the Washington Marine Group.

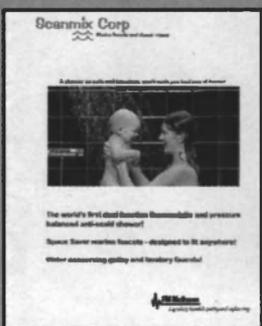
Circle No. 128



### Smith Berger Innovations

Using innovative designs, Seattle's Smith Berger manufactures ship equipment that is unique and sturdy. From Flag Blocks to Chain Stoppers, the company offers many different designs and can even custom manufacture most items.

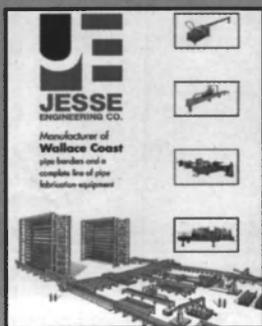
Circle No. 129



### Marine Anti-Scald Shower - "The Safe Shower"

Thermostatic and pressure balanced shower compensates for changes in both temperature and pressure in a ship's water system. Added safety feature of automatic shutdown should the cold or hot water be interrupted. Easy installation, models to fit most any design. Also single lever, ceramic sealing, and water-conserving marine faucets. ABS Type Approved. <http://www.safeshower.com>

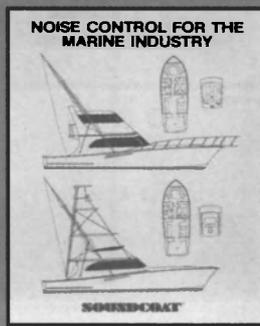
Circle No. 130



### Jesse Engineering Company

Jesse Engineering Company, 5225 7th St. East, Tacoma, WA 98424, manufacturers of Wallace Coast pipe benders, Pipe Shop custom software, pipe fabrication equipment for storage, selection, cutting, flange welding, CNC bending, system integration, conveying, saddle hole, beveling and handling. Custom designers and manufacturers of other industrial machinery. Phone: 253-926-5550 Fax: 253-922-2536.

Circle No. 131



### Noise Control for the Marine Industry

The Soundcoat Company has been involved in noise control for the marine industry for many decades. Working with naval architects, the U.S. Navy, boat yards and marinas, Soundcoat has provided solutions to a wide variety of shipyard noise problems for vessels of all sizes. Contact our headquarters at 800-394-8913 or visit them on the Web at [www.soundcoat.com](http://www.soundcoat.com).

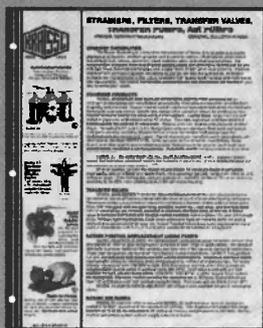
Circle No. 132



### Aiding The Exploration Process

Crowley Marine Services de Venezuela recently converted the barge seen here to a comprehensive support barge for Amoco Venezuela Energy Company. The fully outfitted barge can support an entire drilling operation with bulk materials, casing, water and fuel. The barge is being used as an accommodation, tender, warehouse, and drilling support platform.

Circle No. 133



### Kraissl Company

Kraissl offers you: Model 72 Simplex and Duplex Strainers and Filters to protect pumps and expensive pipeline equipment; Model 72AA series Transfer Valves used to duplex equipment with only one valve in minimum space; Model 60 Fuel Oil Transfer Pumpsets - U.L. listed for fuel oil, both direct drive and V-belt drive versions.

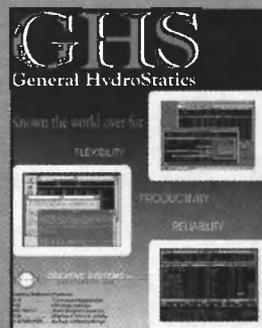
Circle No. 134



### MarineSafety International

"The best safety device on any ship is a well trained crew." Founded in 1974, MarineSafety International (MSI) operates centers for maritime research and training in the U.S. and Europe. Training scenarios include the Full Mission Bridge Simulator, the Bridge Resource Management (BRM) Seminar, and Coastal and River Tug-Barge Training.

Circle No. 135



### Creative Systems

Creative Systems is the originator of GHS, the world-famous PC-based simulator of vessels in fluids and fluids in vessels -- for ships, yachts, docks, drilling platforms, buoys, tanks, etc. -- answering such questions as: How deep and at what attitude will it float? How much will it carry? When will it capsize? Will it survive when damaged?

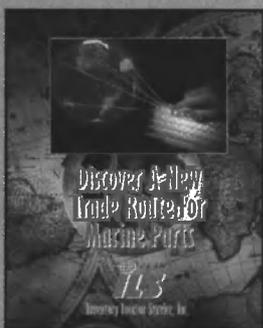
Circle No. 136



### Atlantic Marine, Inc.

Atlantic Marine, Inc. founded in 1964, is a full-service shipyard located on 49 acres on the St. John's River and Intercoastal Waterway in Alabama, only two miles from the Atlantic Ocean. Atlantic Dry Dock Corp., located in Jacksonville, Fla., is its affiliate repair and conversion yard. Both facilities are known throughout the world for high quality workmanship.

Circle No. 137



### A Cheaper Way To Get New Customers

If you locate or sell marine parts, equipment or services, let the Inventory Locator Service work for you. ILS brings you buyers and sellers from their electronic marketplace. You can find new customers, open new markets and increase your visibility without ever adding a single salesperson. Contact them today at: 800-233-3414.

Circle No. 138



### Vancouver Shipyards Company Limited

Vancouver Shipyards is one of the foremost shipbuilding and ship repair operations on the Pacific Coast. Located on the north shore of Vancouver harbor, and employing about 500 tradesmen, the yard's facilities allow for dry-docking and repair work of 15 vessels simultaneously. Vancouver Shipyards is a member of the Washington Marine Group.

Circle No. 139



### Long-lasting Couplings

Renold Hi-Tec Couplings have been world leaders in the design and manufacture of flexible couplings for over 40 years. Their products are comprised of rubber in compression and rubber in shear couplings developed for the complete range of diesel and industrial applications. Renold's products are durable, reliable, and long lasting.

Circle No. 140



### Slip Resistance for All Conditions

Slip-Not products help business owners meet the legal requirements to provide a safe environment, with the optimum in surface traction quality. Its Random Matrix "Stacked Hatch" design ensures that it won't lose its effectiveness with wear.

Circle No. 141



### Jastram Steering Gear

Jastram Model S steering cylinders are specifically designed for commercial marine hydraulic steering service under the ABS-Type Approval Program. They are most frequently installed on commercial workboats, large passenger vessels, supply vessels, tankers and icebreakers, and can be used in either new steering system applications or in retrofit and repair programs.

Circle No. 142



### New England Marine and Industrial

New England Marine and Industrial has three convenient locations in the Northeast: Portsmouth, NH; Brant Rock, MA; and Stonington, ME. Since 1976 they have carried "from anchors to zincs and everything in between," including chain and fittings, Hooven Allison ropes, Stearns safety gear, and a full line of tuna gear.

Circle No. 143



### VISCOSITY MEASUREMENT FUEL OIL

To  
TURBINES-ENGINES-BOILERS  
Automation Products, Inc.  
3030 Maxroy Street  
Houston, Texas 77008-6294 U.S.A.  
Telephone: 713-869-0361  
Fax: 713-869-7332

Circle No. 144



### Albacore Research, Ltd.

ARL produces software that provides cost cutting as well as other efficiency solutions for the ship building industry. ARL's ShipConstructor is the only shipbuilding software suite utilizing AutoCAD and Microsoft Access for creating a complete product model. ARL encompasses Proteus Engineering, HydroComp, Creative Systems, and Spar Associates.

Circle No. 145



### Murphy Instrumentation and Controls

This 12-page catalog gives an overview of Murphy's complete line of instrumentation and controls including new products. The patented Switchgag® control instruments are featured. Murphy products monitor pressure, temperature, level, vibration, time, overspeed, and more.

Circle No. 146



### American VULKAN Corporation

This four-page color catalog introduces the RATO couplings for diesel and electric motor-driven equipment such as marine propulsion, compressors and two-bearing generators. Includes VULKAN Couplings for shock absorbing, alignment correcting and torsional vibration control. Visit their website: [www.vulkanusa.com](http://www.vulkanusa.com).

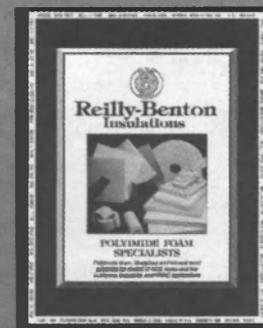
Circle No. 147



### CPV Manufacturing

CPV announces the introduction of G-Series stainless steel valves. The G-Series product line is fully detailed in a 12-page color catalog (Catalog 98). The literature offers easy instructions for determining the right G-Series part number needed to correctly match user needs. Engineering data on pressure drop and flow rate is also included.

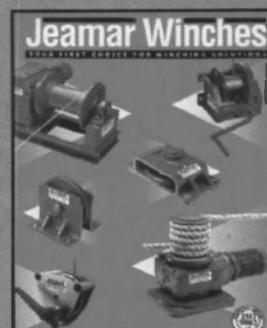
Circle No. 148



### Reilly-Benton Insulations

Reilly-Benton, the Polymide Foam Specialists, manufactures polymide foam, fiberglass and mineral wool products for the control of heat, noise and fire in Marine, Industrial and HVAC applications. This brochure provides specifications for Pelican TA-301 Hullboards, Pelican Fire Boards, Pelican Pipe Insulations, and Pelican Thermal and Acoustic Hullboards.

Circle No. 149



### Jeamar Winches

Jeamar offers its Full Line Product Guide of Heavy Duty Winching Products. All Jeamar products are engineered to international standards. The new catalogue includes new hand winches, power winches, capstan winches, and new sheaves and directional blocks. Visit their website at [www.jeamar.com](http://www.jeamar.com).

Circle No. 150



### 3M Innovative Solutions

The products in this catalog have been selected by the Federal Systems Department to provide innovative solutions for ships and fleet requirements. The products address the needs of information officers, medical officers, combat systems officers, chief engineers, and supply officers.

Circle No. 151



### Ameron Protective Coatings

Ameron offers a complete line of environmentally designed coatings that meet or surpass the most stringent regulations while providing unsurpassed high-performance coating protection. Ameron coatings have been protecting offshore structures throughout the world for over 50 years.

Circle No. 152



### Solon

Solon Relief Valves were used most notably on John Glenn's spacesuit for his historic orbit of the earth in 1962. Solon's competence and reliability continues today in the production of Solon Belleville Springs and Solon Industrial Controls. This brochure details Solon's selection of Belleville Spring Washers and Flange Washers.

Circle No. 153



### Butterworth High-Pressure Water Jetting

High-pressure water jetting provides a powerful, environmentally safe method of solving difficult cleaning and cutting challenges. At supersonic speeds, low-volume, high-pressure water delivers its incredible cleaning energy into most inaccessible areas, blasting away stubborn deposits. Butterworth pioneered the development of these systems in 1961.

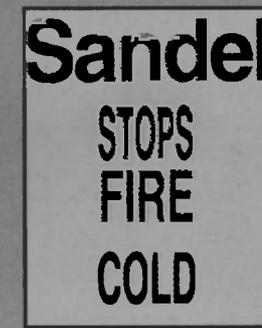
Circle No. 154



### Port Weller

PWDD acts as a single source supplier, bringing together the manpower, facilities and expertise to provide a wide variety of products, from individual components to large modular units. Experienced in the handling of large interdisciplinary projects, PWDD can install and test your project anywhere in North America.

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Sandel is the most cost-effective, technologically advanced fire barrier material available today. The principal ingredient in Sandel is silica or sand -- one of the world's most plentiful and naturally fire-proof materials. Sandel's patented technology, based upon polymeric chemistry, transforms this fabric into a new material with superior flex, drape, dimensional stability and abrasion resistance.

Circle No. 156



### MEBA Calhoon

For over 30 years, the Calhoon MEBA Engineering School has provided the marine officers of MEBA the training necessary to keep American flag vessels safe and competitive. Today, the school proudly offers a curriculum of over twenty-five different courses, all of which meet or exceed STCW requirements.

Circle No. 157

**MARINE COATING INSPECTION** NEW!

**three-day specialty course**

Addresses coatings and coating inspection techniques for:

- Marine environments
- Ship building and repair

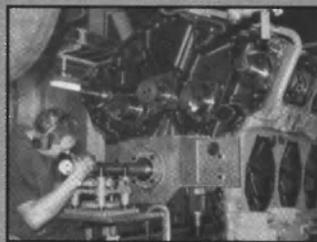
Pre-registration available!

Register today for this specialty course!

**Meet or Exceed the Service Life of Your Coatings Job**

NACE International offers a three-day Marine Coating Inspection course for coating inspectors and marine industry personnel addressing coating and coating inspection issues that are unique to ship building and repair. For a detailed brochure, call NACE International at (281) 228-6285, fax (281) 228-6329, or E-mail:msd@mail.nace.org

**Circle No. 158**



**In-Place Machining**

Crankshaft Grinding of Crankpins and Main Journals while the Crankshaft is in the engine, Optical and Laser measurement of Main Bearing Bores, Line Boring, Metalstitch repair of broken or cracked Cast Iron, machining Water Jackets, all types of on-board machining is accomplished by In-Place Machining Company, phone: 414-562-2000; fax 414-265-1000.

**Circle No. 159**

Optimum steel protection for ships

**TNO Technology**

The life expectancies of coating systems on ships are often not achieved. TNO's Product Testing Division can help to establish the exact cause of premature corrosion and other forms of deterioration. TNO regularly conducts damage inspections for clients in the maritime, inland navigation, and yacht building sectors.

**Circle No. 160**

AROUND THE CLOCK AROUND THE WORLD

**charlestonSHIP**

**Charleston Ship**

Charleston Ship does metal fabrication and repair; diesel engine overhaul and maintenance; fabrication, maintenance and repair of any piping system, valve or pump; troubleshooting, maintenance and repair of air-conditioning and refrigeration systems, hydraulics, pneumatics, and electrical systems.

**Circle No. 161**

**SWIRL-OFF**

THE AMAZING TOOL THAT REMOVES PAINT, RUST, SCALE, AND OTHER HARD COATINGS

APPLICATIONS INCLUDE:

- Ship Maintenance
- Industrial Tanks
- Shipbuilding
- Ship Repair

**The Amazing Swirl-Off Tool**

The new Swirl-Off scarifier, from Desmond-Stephan Mfg., scours surfaces rapidly to remove paint, rust, barnacles, graffiti, and other hard coatings. The rotary tool attaches to portable grinders, sanders, drills, or polishers. Swirl-Off reduces the time and effort needed to clean and refinish almost any floor, wall or other structure.

**Circle No. 162**

**DataStar**

**V-MAC 5500**

For Business Pleasure

**DataStar V-Mac**

The DataStar V-Mac 5500 is an integrated approach to electronic vessel monitoring and control, supervising vessel status and operation and providing alarms as necessary. With appropriate sensors throughout the vessel, the DataStar V-Mac can monitor engine conditions, electrical generation systems, tank levels, and navigational information.

**Circle No. 163**

**AquaMist**

The Next Step In The Evolution Of Fire Protection Technology

**Grinnell**

**Aquamist Fire Protection Technology from Grinnell**

The Grinnell Aquamist Marine System is a low-pressure automatic wet pipe system that can penetrate fires, absorb heat, strip room smoke, cool room gases, etc. Grinnell designs, engineers, manufactures, installs, inspects and services fire alarm detection equipment, sprinklers and special hazards equipment. Visit their website: <http://www.grinnellfire.com>

**Circle No. 164**

**AURAND**

**Aurand**

Aurand introduces "Cetrifi-Clean," a new generation of time, money and work-saving tools that literally "peel" almost any accumulation from any hard surface. Here is the power of sandblasting in a compact, hand-held tool that can be used wherever iron, steel, brick or concrete need to be prepped prior to painting or refinishing.

**Circle No. 165**

**LAKE SHORE**

WORLDWIDE FOR 140 YEARS AND INTO THE NEXT MILLENNIUM

**Lake Shore, Inc.**

Lake Shore, headquartered in Kingsford, Michigan, has expertise in machining, exotic welding, project management, systems engineering analysis, test and integration in mechanical, electrical, electro-mechanical and hydraulic disciplines. The company provides total customer support from design through installation, ILS and worldwide field service.

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# BUYERS DIRECTORY

This directory section is an editorial feature published in every issue for the convenience of the readers of MARITIME REPORTER. A quick-reference readers' guide, it includes the names and addresses of the world's leading manufacturers and suppliers of all types of marine machinery, equipment, supplies and services. A listing is provided, at no cost for one year in all issues, only to companies with continuing advertising programs in this publication, whether an advertisement appears in every issue or not. Because it is an editorial service, unpaid and not part of the advertisers contract, MR assumes no responsibility for errors. If you are interested in having your company listed in this Buyers Directory Section, contact Angela Criscola at (212) 477-6700.

## ADHESIVES

Adtech Marine Systems, 815 W. Shepherd St., Charlotte, MI 48813

## AIR CONDITIONING AND REFRIGERATION -

Repair & Installation, Equipment & Services  
ABB Flakt Marine, Box 1043, S-436 21 ASKIM SWEDEN  
Adrick Marine, 81 Mahan St., West Babylon, N.Y. 11704  
Bailey Refrigeration Co., 2323 Randolph Ave., Avenel, NJ 07001  
Carrier Transicold, P.O. B. 4805, Syracuse, NY 13211  
Refrigeration Resources, 210 Westside Ave., Jersey City, NJ 07305  
RTF Manufacturing, 793 Route 66, Hudson, NY 12534  
Adrick Marine, 81 Mahan St., West Babylon, N.Y. 11704  
Bailey Refrigeration, 2323 Randolph Ave., Avenel, NJ 07001  
RTF Manufacturing, 793 Route 66, Hudson, NY 12534  
Unitor Ship Service Inc., 2375 West Esther Street, Long Beach, CA 90813  
Stork Canada, 47 boul. Marie Victorin, Candiac, Quebec, Canada, J5R 1B6

## ALARMS, FACTORY MUTUAL-APPROVED

Datostar Marine Products Inc., Unit 100 18 Gostick Pl., N. Vancouver, Canada V7M3G3  
SELCO 353 A Asbury Commons Dr., Atlanta, GA 30338

## ALUMINO BOATS

American Eagle Mfg., P.O. Box 597, La Conner WA 98257  
Munson Mfg., P.O. Box 597, La Conner WA 98257

## ANCHORS AND CHAINS

All Alpha Int'l., Inc. P.O. Box 498985, Cincinnati, OH 45249  
Crandall Dry Dock Engineers Inc., P.O. B. 505804, MA 02150  
G.J. Wortelboer Jr. BV, P.O.B. 5003, 3008 AA Rotterdam, Nether  
Marit Chain, 230 Avenue Desandrouins, 59300 Valenciennes  
FRANCE  
Washington Chain Inc., Box 3645, Seattle, WA 98124  
Waterman Supply Co., P.O. Box 596, Wilmington, CA 90748  
Willem Pot, P.O.B. 29102, 3001 GC Rotterdam

## AUCTIONEERS

Plant & Machinery, P.O. Box 19100, Houston, TX 77224  
MACI Auctioneers, 2334 Willis Rd., Richmond, VA 23230

## AUTOMATION SYSTEMS

Electronic Design, 3020 20th St., Metairie, LA 70002-4911

## AUTOPILOT SYSTEMS

Mackay Communications, 2721 Discovery Dr., Raleigh, N.C.  
27616-1851  
ComNav Marine, 1915 Slainsburg Ave., Vancouver, B.C.  
CANADA

## BALLAST

Ballast Technologies, 4620 S. Coach Dr., 85714, Tucson, AZ  
Redland Genstar Inc., Executive Plaza IV, Hunt Valley, MD  
10912-1031

## BASKET STRAINERS

Beard Industries Inc, 601 Benton Kelly St., Shreveport,  
LA 71106-7198

## BATTERY CHARGERS

Newmar, 2911 West Garry Ave., Santa Ana, CA 92663

## BEARING—Rubber, Metallic, Non-Metallic

Blohm & Voss Industrie GmbH, P.O. B. 100720, D-2000  
Hamburg 1, GERMANY  
Simplex-Turmar Inc., P.O. B. 168, Little Neck, NY 11363 0168  
U.S.A. Repts:  
Raikio Ltd., Loudwater, High Wycombe, Bucks  
Hampshire ENGLAND HP109QV  
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241  
Orion Corp., 1111 Cedar Creek Rd., Grafton, WI 53024  
Duramax Marine, 16025 Johnson St., Middlefield, OH 44062  
Thordon Bearings Inc., 3225 Mainway, Burlington, Ont.,  
CANADA L7M 1A6  
NTN Bearing, 1600 E. Bishop Court, Mt. Prospect, IL 60056  
Vesco Plastics, P.O. B. 40647, Cleveland 2022 SOUTH  
AFRICA

## BILGE SYSTEMS

Nelson Div., Exhaust & Filtration Sys., Hwy. 51 West, P.O.  
Box 428, Stoughton, WI 53589

## BLOCKS & RIGGING

Skookum, P.O. Box 280, Hubbard, OR 97032

## BOAT RENTAL

Edison Chouest, P.O. Box 309, Galliano, LA 70354

## BOILERS

B & D Marine & Boilers Inc., P.O. Box 71687, Charleston,  
SC 29415

## BOILER MANAGEMENT

Technical Marine Services, 6040 North Cutter Circle, Portland, OR  
97217

## BOX COOLERS

Ships Machinery Int'l, 8375 N.W. 56 St., Miami, FL 33166

## BRIDGE WIPERS

In-Mar Systems, Yellowstone Street, Kenner, LA 70064

## BROKERS

151 Maritime Services, 34062 El Encanto/B, Dana Pt. CA  
92629  
Captain Astad Company, Inc., P.O. Box 350486, Ft  
Lauderdale, FL 33335  
Jack Faulkner, 2419 Caddy Lane, P.O. Box 371, Flossmoor  
IL 60422  
Mowbray's Tug & Barge Sales Corp., 35 De Hart St.,  
Morristown NJ 07960

## BULKHEAD SEALS/PANELS

CSD North America, 880 Candia Rd., Unit 10, Manchester,  
NH 03109

Blohm & Voss Industrie GmbH, P.O. B. 100720, D-2000  
Hamburg 1, GERMANY

Panel Specialists, Inc./Thermax, 3115 Range Rd., Temple,  
TX 76501

Raikio Ltd., U.S.A. Repts: Simplex-Turmar Inc., P.O.B. 675,  
Tonawanda, NY 14151-0675

Rox Corp., 12402 E. 60th St., Tulsa, OK 74146-6922

## CABLE TRANSIT SYSTEMS

CSD North America, 880 Candia Rd., Unit 10, Manchester,  
NH 03109

O-Z Gedney • Nelson Firestop, P.O. B. 726, Tulsa, OK 74101  
Rox Corp., 12402 E. 60th St., Tulsa, OK 74146-6922

## CAD/CAM SYSTEMS

Albacore Research, 4196 Kashtan Place, Victoria, B.C. Canada  
V8X4L7

All Alpha Int'l., Inc. P.O. B. 498985, Cincinnati, OH 45249

Autoshop Systems Corp., #403, 611 Alexander St.,  
Vancouver, BC, Canada V6A1E

Creative Systems, Inc., P.O. B. 1910, Port Townsend, WA 98368

INSA, 13 Jenkins Court, Suite 200, Durham, NH 03824

Kockums Computer Systems AB, PO Box 50555, S-202 15  
Malmo SWEDEN

Scientific Marine Services, Inc., 101 State Pl., Suite F,  
Escondido, CA 92029

TIMSCO, P.O. B. 91360, Mobile, AL 36691

Ship Motion Associates, 10 Danforth St., Portland, ME 04101-4567

## CARGO MONITORING & CONTROL SYSTEM

Ian-Conrad Bergan, Inc., 3409 Gulf Breeze Parkway,  
Gulf Breeze, FL 32561

Radio-Holland USA, 8943 Gulf Freeway, Houston, TX 77017

## CHAINS

Columbus McKinnon Corp., 140 John James Audobon Pkwy,  
Amherst, NY 14228

New England Marine & Industrial, 200 Spaulding Trunpike,  
Portsmouth, NH 03801

Washington Chain, P.O. Box 3645, Seattle, WA 98124

## CHARGE AIR COOLERS

Crane Heatec, 17 Grandview Ave., W. Orange, NJ 07052

## CHEMICALS

Uniservice Americas, 57174 Hardin Rd., Slidell, LA 70461

Unitor Ship Service Inc., 2375 W. Esther St., Long Beach, CA  
90813

## CLASSIFICATION SOCIETY

American Bureau of Shipping, 2 World Trade Center, 106th Fl,  
New York, NY 10048

Det Norske Veritas, 70 Grand Ave., Riveredge, N.J. 07661

## CLEATS

Washington Chain, P.O. Box 3645, Seattle, WA 98124

## CLUTCHES

Haley Clutch and Coupling Corp., 1820 Hwy. 1 North,  
Greenville, MS 38702

## COATINGS / CORROSION CONTROL / PAINT

Eureka Chemical Co., 234 Lawrence Ave.,  
South San Francisco, CA 94080

Corroseal, Inc., 8114 304th Ave., SE, Preston, WA 98050

Hempel, 6901 Cavalcade St., Houston, TX 77028

Products Research Service, 9229 Hwy 23, Belle Chasse, LA  
70037

GMA Garnet, 6124 114th Ave., N.E. Kirkland, WA 98033

Flexible Decking, 2708 N. Australian Ave. Ste. 9, West Palm Beach,  
FL 33407

Mascoat Products, 3500 E. T.C. Jester, Suite N, Houston, TX  
77018

TMT Services Corp./RUSTECO, P.O.B. 11398, Torrance, CA90510

Nace Int'l, 1440 South Creek Dr., Houston, TX 77084

Enecon Corporation, 125 Baylis Rd., Melville, NY 11747-3800

Esgard, Inc., P.O. Drawer 2698, Lafayette, LA 70502

Ferro Corp., 1301 North Flora St., Plymouth, IN 46563

Jameson Distrib., P.O. Box 348, Jamestown, RI 02835

Graco, Inc., P.O. Box 1441, Minneapolis, MN 55440-1441

Hempel Coatings, 6901 Cavalcade St., Houston, TX 77028

Boatlife Industries, 2081 Bridgeview Dr., N. Charleston,  
SC, 29405

Sigma Coatings, P.O. Box 816, Houston, TX 77029, 330  
Harvey, LA 70059,

Atlantic Systems Supply Co., 1100 Adams St., Hoboken, NJ 07030

TNO Institute of Industrial Technology, P.O.B. 3, 2600 AA  
Delft, Netherlands

Boatlife, 2081 Bridgeview Dr., N. Charleston, SC 29405

Unitor Ship Services Inc., 2375 West Esther Street, Long  
Beach, CA 90813

## COMMERCIAL DIVING COMPANIES

Cruzan Diver's Inc., 300 Strand St., Frederiksted Sterox, Virgin  
Islands 00840

## COMMUNICATION AUTOMATION

International Communications, 813 Diligence Dr. Ste 120,  
Newport News, Va. 23606

## COMMUNICATIONS SERVICE

Hose McCann, 1241 W. Newport Gender, Deerfield Beach,  
FL 33442

ICC Satellite Services, 8400 NW 52nd St., Suite 110,  
Miami, FL 33166

Maritime Telecommunications Networks, Inc., 8400 NW 52nd  
St., Suite 110, Miami, FL 33166

Ascorm Tateco AB, Eppendorfer Weg 234, D-20251 Hamburg,  
GERMANY

AT & T Maritime Services, 412 Mt. Kemble Ave 5170, Morristown,  
NJ 07960

Comsat Maritime Services, 6560 Rock Spring Drive, Bethesda, MD  
20817-1446

Newmar, 2911 West Garry Ave., Santa Ana, CA 92663

Watercom, 458 E. Park Place, Jefferson, IN 47130

## COMPACTORS/FILTER CRUSHERS

Tech Oil Products Inc., 4308 W. Admiral Doyle Dr., New Iberia, LA  
70560

## COMPOSITES PROCESSING

Composite Technology Consultants, Inc.  
12310 Northwinder Row, Bayonet Point, Fla. 34667

## COMPOUNDS

ITW Philadelphia Resins, 130 Commerce Dr.,  
Montgomeryville, PA 18936

## COMPUTER LOFTING

Barataria Lofting Co., Inc., 1616 Barataria Blvd., Ste. 4,  
Manero, LA 70072

## COMPUTER / COMPUTER SOFTWARE

Autoshop Systems Corp., #403, 611 Alexander St., Vancouver,  
BC, CANADA V6A1E

Chand Corporation, 157 Hwy 654, Mathews, LA 70375

Coastal Oceanographics, Inc., 11-G Old Indian Trail,  
Middlefield, CT 06455

Sener, C/Severo Ochoa, 4 Parque Tecnologico de Madrid,  
28760 Tres Cantos - Madrid SPAIN

Intecolor Corp., 2150 Boggs Rd., Deluth GA 30096

Creative Systems, P.O. Box 1910, Port Townsend WA 98368

Lloyd's Register, 100 Leadenhall St., London, England EC3A 3BP

Ship Motion Associates, 10 Danforth St., Portland, ME 04101

Protus Engineering, 301 Pier One Rd., Stevensville, MD 21666

## CONDENSERS/SEPARATORS

Beard Industries Inc., P.O. Box 31115, Shreveport LA 71130

## CONSTRUCTION MATERIALS

Plastic Piling Inc., 1485 South Willow Ave., Rialto, CA 92376

## CONSULTANTS

Homblower Marine, Pier 3 Ferryboat Santa Rosa, San Francisco,  
CA 64111

## CONSOLE - QMDSS

Mackay Communications, 2721 Discovery Dr., Raleigh, N.C.  
27616-1851

## CONTROL SYSTEM - Monitoring/Steering

Engine Monitor, Inc., 179 Hickory Ave. Harahan, LA 70123

GEC ALSTHOM Diesels Inc., 10801 Kempwood Drive, Suite 1  
Houston, TX 77043-1412

Ian-Conrad Bergan, 3409 Gulf Breeze Pkwy, Gulf Breeze, FL  
32561

Gems Sensors Division, One Cowles Rd., Plainville CT 06062

MMC International, 60 Inp Dr, Inwood NY 11096

Robertson Marine Systems, 3000 Kingman St., Suite 207,  
Metairie, LA 70006

Scientific Marine Services, Inc., 101 State Pl., Suite F,  
Escondido, CA 92029

Kobelt Mfg Co., Ltd., 8238-129 St. Suney, B.C. V3W0A6

Stork-Kwant BV, P.O.B. 23, 8600 AA Sneek, Netherlands

Electronic Marine Systems, 800 Farndale Pl., Rahway, N.J. 07065

AutoNav Marine Systems Inc., 55A Clipper St., Coquitlam,  
B.C., Canada V3K 6X2

Kockum Sonics, Inc., 819 Veterans Blvd., Suite 201, Kenner,  
LA 70068

## CONTROL VALVES

Leslie Controls, 12501 Telecom Dr., Tampa, FL 33637

## CONVERSIONS & REPAIRS

Vancouver Shipyards, 50 Pemberton Ave., N. Vancouver, B.C.  
CANADA V7P 2R2

## COOLERS/FREEZERS

Western Engineers, 2112 SE 8th Ave., Portland, OR 97214

## COUPLINGS

Mapeco Products, 91 Willenbrock Rd. Unit B, Oxford,  
CT 06478

Centra Corp., 8185 Cass Ave., Darien, IL 60561

Haley Clutch and Coupling Corp., 1820 Hwy. 1 North,  
Greenville, MS 38702

Fetteroll Corp., P.O. Box 103, Skippack, PA 19474

Lo-Rez Vibration Control, Ltd., 186 West 8th Ave., Vancouver,  
B.C. V5Y 1N2

American Vulcan, P.O. Drawer 673, Winter Haven, FL 33882

MMC Int'l, 60 Inp Drive, Inwood, NY 11096

Renold Hi-Tec, 512 W. Crescentville Rd., Cincinnati, OH 45246

## CRANE-HOIST-DERRICK-WHIRLIES

Lake Shore Inc., P.O. Box 809, Iron Mountain, MI 49801, 1150

Bisso Marine Co. P.O. Box 4113, New Orleans, LA 70178

Holly Hoist Corp., P.O. Box 86, St. Clair Shores, MI 48080-0086

Edgewater Machine & Fabricators, P.O. Box 358, Edgewater, FL  
32132-0358

Marine Travelift, Inc., 49 E. Yew St., Sturgeon Bay, WI 54235

McElroy Machine & Mfg Co., Inc., P.O. Box 4454, Biloxi MS  
39535-4454

New England Trawler Equipment Co., 291 Eastern Avenue,  
Chelsea, MA 02150

Liebherr-Werk Nenzing GMBH, A-6710 Nenzing/Austria,  
Tschalenga 3, P.O. Box 10

Xtek, Inc., 11451 Reading Road, Cincinnati, OH 45241

## CRANKSHAFT DEFLECTION ANALYZER

FCS, Inc., 22 Main St., Centerbrook, CT 06409

## CRANKSHAFT REPAIR

In-Place Machining, 1929 North Buffum St., Milwaukee, WI 53212

## CUSTOM CABLE CONNECTOR

Glennair, Inc., 1211 Airway, Glendale, CA 91201-2497

## CUSTOM CLOSURES

Waltz & Krenzer, 91 Willenbrock Rd., Oxford, CT 06478

## CYLINDER LINERS

Silsan A.S., P.O. Box 127, TR-01210 Adana, Turkey

## CYLINDER LOAD ANALYZER

General Thermodynamics, 210 South Meadow Rd., Plymouth, Ma.  
02360

## DAVIT SYSTEMS

Lake Shore Inc., P.O. Box 809, Iron Mountain, MI 49801, 1150

Holly Hoist Corp., P.O. Box 86, St. Clair Shores, MI 48080-0086

Welin Lambie N.A. Inc., 18 Ridgcrest Drive, Bridgewater Nova  
Scotia, Canada B4V 3 V8

## DECK MACHINERY - Cargo Handling Equipment

Lake Shore Inc., P.O. Box 809, Iron Mountain, MI 49801, 1150

Markey Machinery Co., Inc., P.O. Box 24788, Seattle, WA  
98124-0788

McElroy Machine & Mfg. Co., Inc., P.O. Box 4454, Biloxi, MS  
39535-4454

Skookum, Inc., P.O. Box 280, Hubbard, OR 97032

Leenstra Machine, P.O. Box 9, Drachten, Netherlands, 9200AA

Intercontinental Engineering, P.O. Box 9055, Kansas City,  
MO 64168

Edgewater Machine & Fabricators, P.O. Box 358, Edgewater, FL  
32132-0358

New England Trawler Equipment Co., 291 Eastern Avenue,  
Chelsea, MA 02150

Pusnes, PO Box 102, N-

Superbolt, P.O.B. 683, Carnegie, PA 15106  
**FENDERING SYSTEMS/BUOYS** - Dock & Vessel  
Plastic Piling Inc., 1485 South Willow Ave., Rialto, CA 92376  
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241  
Seaward International, Inc., Clearbrook Industrial Park, P.O.  
Box 98, Clearbrook, VA 22624  
Urethane Products, 17007 South Broadway, Garden, CA  
90248  
Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH  
44062-0067  
Viking Fender Co., 1160 State St., Perth Amboy, NJ 08861  
Ultra Poly, Inc., 2926 South Steele St., Tacoma, WA 98409  
Promar, 115 Industrial Blvd., Kearneysville, W. VA 25430  
Schuyler Rubber Co., 16901 Woodred Rd., Woodinville, WA  
98072

#### FIBERS

Wellington, P.O.B. 244, Madison, GA 30650

#### FILTERS/FILTER SYSTEMS

Boll Filter, 15 International Dr., East Granby, Ct. 06206  
Kraissl Co., 299 Williams Avenue, Hackensack, NJ 07061  
Tech Oil Products Inc., 4308 W. Admiral Doyle Dr., New Iberia, LA  
70560  
Luber-Finer, Inc., 200 South 4th St., Albion, FL 62806-1313

#### FIN STABILIZERS

Blohm & Voss Industrie GmbH, P.O. Box 10 07 20, D-2000  
Hamburg 1, GERMANY;  
Ralko Ltd., U.S.A. Reps: Simplex-Turmar Inc., P.O.B. 675,  
Tonawanda, NY 14151-0675

#### FIRE & SAFETY PRODUCTS

Nautical Safety Products, P.O. Box 590462, Houston, TX 774259  
AGI Shipboard Fire Service Ltd., 561 Wain Rd., Sidney B.C.  
Canada V8L 5N8  
IMSSCO, 2040 Harbor Island Dr., Suite 201A, San Diego, CA  
92101

Nautical Safety Products, P.O. Box 590462, Houston, TX 77259  
Insulations, Inc., Rt. 5, 12360 Leisure Road, Baton Rouge, LA  
70807

Unitor Ship Service Inc., 2375 West Esther Street, Long  
Beach, CA 90813  
Grinnell Fire Protection, 835 Sharon Drive, Westlake, OH  
44145

American Pacific Corp., 3770 Howard Hughes Pkwy, Las  
Vegas, NV 89100

Grinnell, 835 Sharon Drive, Westlake, OH 44145  
Panel Specialists, Inc./Thermax, 3115 Range Rd., Temple,  
TX 76501

Bainbridge, 252 Revere St., Canton, Mass. 02021

#### FLUID HANDLING EQUIPMENT

Graco, Inc., P.O. Box 1441, Minneapolis, MN 55441

#### FRESH WATER GENERATOR

Saskia Engineering, 7-32 Takeshima, 4-chome, Nishiyodogawa,  
KY, Osaka555, Japan

#### FUEL CONSERVATION

Instruments Computer & Controls, Inc., 70 South Bow Rd.,  
Hookset, NH 03106

#### FUEL DECONTAMINATION

Fuel Dynamics, 707 Mullet Dr. #110, Cape Canaveral, FL 32920  
Environmental Solutions Intl, 11002 Raccoon Ridge, Reston, VA  
20191-4911

#### GALLEYS EQUIPMENT

Cospolich Refrigerator Co., 949 Industry Rd., Kenner LA 70062  
Jameson Metal Marine Sales, Inc., 4710 Northwest Second  
Ave, Boca Raton, FL 33431

Lang Manufacturing, P.O. B. 905, Redmond, WA 98073  
Marine Accommodations, Inc., 3830 Williamsburg Park Blvd.,  
Building 7, Jacksonville FL 32257

#### GANGWAYS, LADDERS

Nautical Safety Products, P.O. Box 590462, Houston, TX  
77259-0462

SlipNot Safety Flooring, 2545 Beaufait St., Detroit, MI 48207  
Wooster Products Inc., 1000 Spruce St., P.O. Box 896,  
Wooster, OH 44691

#### GEARS & GEAR REPAIR

Haley Marine Gears International, Inc., 2600 N. Concord Belle  
Chasse, LA 70037

Nico Marine Specialties, 39 Louisiana St., West Wago, LA 70094  
The Falk Corp., PO Box 492, Milwaukee, WI 53201-0492

Marine Gears, P.O. Box 689, Greenville, MI 38702  
Centofanti Marine Systems, Inc., P.O. Box 660, West Elizabeth,  
PA 15088-0660

Cincinnati Gear Co., 5657 Wooster Pike, Cincinnati,  
OH 45227

#### GENERATOR

Alaska Diesel, 4420 14th Ave., NW, Seattle, WA 98107  
Baylor Co., 500 Industrial Blvd., Sugarland, TX 77478

#### GNSS

International Communications, 813 Diligence Dr. Ste 120,  
Newport News, Va. 23606

Furuno USA, Inc., 271 Harbor Way, S. San Francisco, CA  
94080

Radio-Holland USA, 8943 Gulf Freeway, Houston, TX 77017  
Sea, Inc., 7030 220th S.W. Mt. Lake Terrace, WA 98043

#### HEAT EXCHANGERS

Alfa-Laval Separation Inc., 955 Meams Rd., Warminster, PA  
18974

Beaird Industries Inc., P.O. Box 31115, Shreveport, LA 71130  
Computube - A Division of Britannia Heat Transfer, Ltd., 15-20  
Coleshill Industrial Estate, Station Road, Coleshill,  
Birmingham B46 1JP UK

Crane Heatex, 17 Grandview Ave., West Orange, NJ 07052

#### HEAT TRANSFER FLUID

Parathem Corp., 1050 Colwell Rd., Conshohecken, PA 19428

#### HIGH TEMPERATURE ELASTOMER

Greene, Tweed & Co., 2075 Detwiler Rd., Kulpville,  
PA 19443-0305

#### HOISTS

Holly Hoist Corp., P.O. Box 86, St. Clair Shores, MI 48080-0086

#### HORNS/WHISTLES

Kahlenberg Bros Co., P.O. Box 358, Two Rivers, WI 54241  
Kockum Sonics, Inc., 933 Industry Rd., Ste105, Kenner, LA 70062

#### HOSE & FITTINGS

Hydrasearch Co., Chesapeake Bay Business Park, 100 Log Canoe  
Circle, Stevensville MD 21666

#### HYDRAULICS

Cunningham Marine Hydraulics Co., 201 Harrison St.,  
Hoboken, NJ 07030

Engine Monitor, Inc., 179 Hickory Ave. Harahan, LA 70123  
Hamilton Jet, P.O. Box 709, Christchurch, NEW ZEALAND

Offshore Inland, Inc. 3521 Brookdale Drive, Mobile, AL 36618  
Ultra Hydraulics Limited, Cheltenham Road East, Gloucester,  
GL2 9QN, ENGLAND

Demaree Infatables Boats, 410 Oak St., Friendsville, MD 21531  
Ocean Technical Services Inc., 1140 Peters Rd., Harvey, LA  
70058-1705

#### HYDRAULIC SYSTEM FLUSHING

Consolidated Fluid Power, 155 Wright Ave., Dartmouth, N.S.  
Canada B4C 3M1

#### HYDRAULIC TRAINING

Consolidated Fluid Power, 155 Wright Ave., Dartmouth, N.S.  
Canada B4C 3M1

#### INFLATABLES

Ocean Technical Services Inc., 1140 Peters Rd., Harvey, LA  
70058-1705

#### INSULATION

Blohm & Voss Light Insulation, Bartels & Laders GmbH,  
Norderebstrasse 1S, 20457 Hamburg GERMANY

Panel Specialists, Inc./Thermax, 3115 Range Rd., Temple,  
TX 76501

Insulations, Inc., 1101 Edwards Ave., Harahan, LA 70123  
Mascoat Products, 3500 E. T.C. Jester, Suite N, Houston, TX  
77018

Pacor, Inc., P.O. Box 107, Westville, NJ 08093x  
Superior Ropes Inc., P.O. Drawer 386, Groves TX 77619

#### INTEGRATED MONITORING SYSTEMS

Datatar, Unit 100, 18 Gostick Place, N. Vancouver, BC  
Canada

#### INTERIORS

Custom Ship Interiors, Inc., P.O. Box 882, Solomons, MD 20688  
Hopeman Brothers, P.O. Box 820, 435 Essex Ave.,  
Waynesboro, VA 22980

Insulations, Inc., Rt. 5, 12360 Leisure Rd, Baton Rouge, LA  
70807

Jamestown Metal Marine Sales, Inc., 4710 NW Second  
Ave, Boca Raton, FL 33431

Marine Accommodations, Inc., 3830 Williamsburg Park Blvd.,  
Building 7, Jacksonville FL 32257

Maritime Services Corp., 3457 Guignard Drive, Hood River, OR  
97031

Directions In Design, 1848 Craig Rd., St., Louis, MO 63146  
James P. Colie & Associates, 2116 Sherman St., Hollywood,  
FL 33020

#### ISOLATORS

Lo-Rez Vibration Control, Ltd., 186 West 8th Ave., Vancouver,  
B.C. V5Y 1N2

#### JET BOWTHRUSTERS

Thrustmaster of Texas, P.O. Box 840189, Houston,  
TX 77084-0189

#### JOINER—Watertight Door—Paneling—Ceiling System—Decking

All Alpha Intl., Inc. P.O. Box 498985, Cincinnati, OH 45249  
Branton Ind., 1101 Edwards Ave., Jefferson, LA 70181

CustomShip Interiors, Inc. P.O. Box 882, Solomons MD 20688  
Hopeman Brothers, Inc., P.O. Box 820, Waynesboro, VA  
22980

Insulations, Inc., 1101 Edwards Ave., Harahan, LA 70123  
Marine Accommodations, Inc., 3830 Williamsburg Park Blvd.,  
Building 7, Jacksonville FL 32257

Maritime Services Corp., 3457 Guignard Drive, Hood River, OR  
97031

Panel Specialists, Inc./Thermax, 3115 Range Rd., Temple,  
TX 76501

Waiz & Krenzer, 91 Willenbrock Rd., Unit B4, Oxford CT 06478

#### KEEL COOLERS

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49858

Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241  
Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH  
44062-0067

The Walter Machine Co., Inc., 84-98 Cambridge Avenue,  
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Avon Marine, 11215 Young River Ave., Fountain Valley, CA 92708  
DBC Marine Safety Systems, 12351 Bridgeport Rd., Richmond,  
B.C. CANADA V6V1J4

Norsafe AS, P.O. Box 115, N-4818 Faervik, Norway  
Edgewater Machine & Fabricators, P.O. Box 358, Edgewater, FL  
32132-0358

Viking Life Saving Equipment, 1625 N. Miami Ave., Miami, FL  
33136

Willard Marine Co., Inc., 1250 N. Grove St., Anaheim, CA  
92806

Zodiac of North America, P.O. Box 400, Stevensville, MD 21666

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Stearns Manufacturing, P.O. Box 1498, St. Cloud, MN 56302

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ACR Electronics, Inc., 5757 Ravenswood Rd., Ft. Lauderdale,  
FL 33310-5247

Archway Marine, 4501 Swan Ave., St. Louis, MO 63110  
Golten Marine, 160 Van Brunt St., Brooklyn, NY 11231

Kockum Sonics, Inc., 933 Industry Rd., Ste105, Kenner, LA 70062  
Pauluhn Electric Mfg. Co., Inc. P.O. Box 53, Pearlard, TX 77588

Francis Searchlights/Stam Supply Co., 4415 6th N.W.,  
Seattle, WA 98107

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King Engineering Corp., P.O. Box 1228, Ann Arbor, MI 48106

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Mackay Communications, 2721 Discovery Dr., Raleigh, N.C.  
27604-1851

Maritime Power 200 Henderson St., Jersey City, NJ 07302

Hornblower Marine, Pier 3 Ferryboat Santa Rosa, San Francisco, CA  
94111

PCS Marine, 174 Colonnade Road S., Nepean, Ontario K2E715

Marine Accommodations, Inc., 3830 Williamsburg Park Blvd.,  
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King Wholesale Supply, Co., Inc., P.O. Box 4002, New Orleans,  
LA 70178-4002

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70807

Panel Specialists, Inc., 3115 Range Rd., Temple, TX 76501

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Resolution Management, 11 Eves Drive Suite 140, Marlton, NJ  
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94111

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36691

Kvaerner Masa Marine, 201 Defense Hwy., Annapolis, MD 21401

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Selby, P.O.Box 1600, Sapulpa, OK 74067

Flexible Decking, 2708 N. Australian Ave. Ste. 9, West Palm  
Beach, FL 33407

SlipNot Safety Flooring, 2545 Beaufait St., Detroit, MI 48207

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CA 90209-4098

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Frank L. Beier Radio, 2001 Ridgelake Dr., Metairie, LA 70001  
Atronica USA, 234 Industrial Pkwy, Northvale, NJ 07647

Kockum Sonics, Inc., 933 Industry Rd., Ste105, Kenner, LA 70062  
Saab Marine Electronics AB, Box 13045, 402 51 Goteborg,  
SWEDEN

Advanced Marine Technology, 2003 Western Ave., Suite 725,  
Seattle, WA 98121

Marine Electric & Process Control, 3931 Leary Way NW, Seattle,  
WA 98107

ACR Electronics, Inc., 5757 Ravenswood Rd., P.O. Box 5247,  
Ft. Lauderdale, FL 33310-5247

Scandinavian Micro Systems, P.O. Box 155, N-1411,  
Kolboton, NORWAY

Interstate Electronics, 1001 E. Ball Rd., Anaheim, CA 92803  
Scientific Marine Services, Inc., 101 State Pl., Suite F,  
Escondido, CA 92029

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Maritime Power Corp., 200 Henderson Str., Jersey City, NJ 07302  
Northeast Tech., P.O. Box 38189, Olmstead Falls, Ohio, 44138

Bonnet & Associates, 1150 Rule Rochelle, Sidell, VA 70458  
Scardana Americas Bkg., 502 Empire St., Montreal,  
Greenfield Park, J4V1V7, Canada

MacGregor, 20 Chapin Road, Unit 1012, NJ 07058  
McElroy Machine, P.O. Box 4454, Biloxi, MS 39535-4454

Debis Financial Services, 201 Merrit 7, Suite 70, Norwalk, CT 06856  
Bank Corp., 3 Riverway Ste, 1900 Houston, TX 77056

Safeco Credit Co. Inc. 4909 156th Ave. NE, Redmond, WA  
98052

Sarba Art Studio, 6 Ridge Drive, Old Saybrook, Ct 06475

Stidd Systems Inc., P.O. Box 87, 220 Carpenter Drive,  
Greenport, NY 11944

Western Branch Metals, Inc., 2401 Wesley St., Portsmouth,  
VA 23707

Kahlenberg Bros. P.O. Box 358, Two Rivers, WI 54241

Defense Reutilization & Marketing Service, 2163 Airways  
Bld., Memphis, TN 38114

Applied High Technology, 4 Place Dee Commerce  
Brossard, Suite 201 Quebec Canada J4W-3B3

Calhoun MEBA Engineering School, 27050 St. Michaels Road,  
Easton, MD 21601

GSI Marine, 4016 Strawberry Road, Suite B, Pasadena, TX  
77504-3050

Marine Safety Intl., Marine Terminal Laguardia Airport, NY  
11371

USMMA - Continuing Education, 300 Steamboat Rd., Kings Point,  
NY 11024

Calhoun MEBA Engineering School, 27050 St. Michaels  
Road, Easton, MD 21601

John Crane Marine, USA, 1536 Barclay Blvd, Buffalo Grove,  
IL 60089

Selco USA, 2508 Lakebrook Ct., Atlanta, GA 30360

Intercolor Corp., 2150 Boggs Rd., Deluth GA 30096

Mackay Communications, 2721 Discovery Dr., Raleigh, N.C.  
27616-1851

Datastar Marine Products, Inc., Unit 100 18 Gostick Pl.,  
N.Vancouver, Canada V7M3G3

Phillystran, Inc., 151 Commerce Drive, Montgomeryville, PA  
18936-9628

Marine Safe Electronics, 37 Staffen Dr., Concord, Ontario  
L4K CANADA

Nautical Gold Creations, 23731 Madison St., Torrance, CA  
90505

Band, Lavis, & Associates, 900 Ritchie Hwy, Suite 203, Severna  
Park, MD 21146

Northeast Technical, P.O. Box 38189, Olmstead Falls, Ohio,  
44138

Advanced Marine Enterprises, Inc., 1725 Jefferson Davis  
Hwy., Arlington, VA 22202

Bay Engineering, 253 N. First Ave., Sturgeon Bay, WI 54235  
Donald L. Blount, 2550 Eilsmere Ave., Ste. K, Norfolk, VA  
23513

C. Baxter & Associates, P.O. Box 9006, Mobile, AL 36609  
CDI Marine Co., 8550 Regency Square Blvd. Ste. 400,  
Jacksonville, FL 32225

Childs Engineering Corp., Box 333, Medfield, MA 02052  
Crandal Dry Dock Engrs., Inc., P.O. Box 505804, Chelsea,  
MA 02150

Crane Consultants, 15301 First Ave S., Seattle WA 98148  
C.R. Cushing, 18 Vesey St., New York, NY 10007

CT Marine, 56 Crooked Trail, Rowleyton, CT 06853  
Cunningham & Walker, 1762 Providence Hollow Lane,  
Jacksonville, FL 32223

Arthur D. Darden, 3200 Ridgelake Dr., Suite 403, Metairie LA  
70002

DaJong & Lebet, Inc., 1734 Emerson Street, Jacksonville, FL  
32207

Design Associates Inc., 14360 Chef Menteur Highway, New  
Orleans, LA 70129

Designers & Planners, 2120 Washington Blvd. Ste.200,  
Arlington, VA 22204

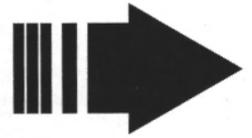
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ABB Drives Inc., P.O. Box 372, Milwaukee, WI 53201-0372  
ABB Industry Oy, P.O. Box 185, 00381 Helsinki, FINLAND  
ABB TURBOCHARGER, INC., 1460 Livingston Avenue, N. Brunswick, NJ 08902  
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Kamewa America Inc., 106 Park Place, Suite 200, Covington, LA 70433, USA  
Kamewa AB, Box 1010, S-68129, Kristinehamn, Sweden  
Kamewa Finland Oh, "Aquamaster", Box 220, FIN-26101 Rauma, Finland  
Avtron Manufacturing, 7900 E. Pleasant Valley, Independence, OH 44131  
Brunvoll A/S, P.O. Box 370, N-6401, Molde, Norway  
ZF Marine 3131 SW 42nd St., Ft. Lauderdale, FL 33312  
Caterpillar, 100 NE Adams Street, Peoria, IL 61629-2320  
Centa Corp., 8185 Cass Ave., Darien, IL 60541  
Cincinnati Gear Co., 5657 Wooster Pike, Cincinnati, OH 45227  
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The Falk Corp., PO Box 492, Milwaukee, WI 53201-0492  
Fincantieri, Diesel Engines Div—GMT, Bagnoli della Rosandra 334, Trieste, ITALY  
GE Naval & Drive Turbine Systems, 166 Boulder Dr., Fitchburg MA 01420  
GEC ALSTHOM Diesels Inc., 10801 Kempwood Dr. Ste 1, Houston, TX 77043-1412  
Goltens Worldwide, 160 VanBrunt St., Brooklyn, NY 11231  
Harbormaster Marine Inc., 31777 Industrial Rd., Livonia, MI 48150  
Harrington Metal, 6720 124th Ave. Lennville, MI 49408  
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241  
Knupp Mak, 7555 Danbro Crescent, Mississauga, Ontario, CANADA L5N 6P9  
LIPS B.V., P.O. Box 6, 5150 BB Drunen, The Netherlands  
Lohmann & Stolterfoht, P.O. Box 1860, D-58408 Witten, Germany  
Lo-Rez Vibration Control, 186 West 8th Ave., Vancouver, BC CANADA, V5Y 1N2  
Mapeco, Inc., 91 Willenbrook Rd., Unit B4, Oxford CT 06478  
Markisches Werk, P.O. Box 1442, D-5884 Halver GERMANY  
MAN B&W Diesel, 17 State St., New York, NY 10004  
MAN B&W Diesel A/S, Ostervej 2, DK-4960 Holeyb, DENMARK  
MAN B&W Diesel A/S, Alpha Diesel, Niels Juels Vej 15, DK-9900 Frederikshavn, DENMARK  
MAN B&W Diesel GmbH, Stadtbachstrasse 1, D-86153 Augsburg 1 GERMANY  
Ornithruster, Inc., 743 N. Main St., Orange, CA 92868  
Orion Corp., 1111 Cedar Creek Rd., Grafton, WI 53024  
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S&S Propellers, 26-15 123rd St., Flushing, N.Y. 11354  
Schottel (Baylor), 500 Industrial Blvd., Sugarland, TX 77478  
Karl Senner Inc., 25 W Third, Kenner LA 70062  
Schottel-Werft, Manizer Strasse 99, D-56322 Spay/Rhein, GERMANY  
Schottel North America, Inc., 1505 Corbin Ave., Hammond, LA 70403  
Siemens Electric Ltd., 1180 Courtneypark Rd., Mississauga, ONTARIO  
Stewart & Stevenson, 1400 Destrehan, P.O. Box 8, Harvey LA 70059-0008  
Thrustmaster of Texas, P.O. Box 840189-12227 IFM 529, Houston, TX 77284-0189  
Ulstein Bergen Diesel A/S, P.O. Box 924, N-5002, Bergen, NORWAY  
Ultra Hydraulics Limited, Cheltenham Road East, Gloucester, GL2 9QN, ENGLAND  
Vorth Hydro Marine Technology, P.O.B. 1125, D89509, Heidenheim, GERMANY  
Marine Propulsion Inc., 1505 Corbin Ave., Hammond, LA 70403  
The Cincinnati Gear Company, 5657 Wooster Pike, Cincinnati, OH 45227  
Propulsion Systems, 609 N.W. St., Seattle, WA 98107  
Renold Hi-Tec, 512 W. Crescentville Rd., Cincinnati, OH 45246  
Bird Johnson, 110 Norfolk St., Walpole, Mass., 02081  
U.S. Rep: Voth Schneider America Inc., 121 Susquehanna Ave., Great Neck, NY 11021  
**PUMP—Repair—Drives**  
Scardana Americas Bkg., 502 Empire St., Greefield Park, J4V1V7 Canada  
Gilkes, Inc., PO Box 628, Seabrook, TX 77586  
Hamworthy Marine, Inc., 1129 Hospital Dr. Ste 3C, Stockbridge, GA 30281  
Marine Electric & Process Control, 3931 Leary Way NW, Seattle, WA 98107  
Kraissl Co., 299 Williams Avenue, Hackensack, NJ 07061  
Vita Motivator, 566 Parker St., Newark, NJ 07104  
Alfa Tec Inc., 4027 21st Ave. West, Seattle WA 98199  
Ampco Pumps, 4000 West Burnham St., Milwaukee, WI 53215  
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Furuno USA, Inc., 271 Harbor Way, S. San Francisco, CA 94080  
Radio-Holland USA, 8943 Gulf Freeway, Houston, TX 77017  
**REMOTE VALVE OPERATORS**  
American United Marine Corp., 5 Broadway, Rt 1, Saugus, MA 01906  
Elliott Manufacturing, P.O. Box 773, Binghamton, NY 13902  
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Goltens, 160 Van Brunt St., Brooklyn, NY 11231  
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Willard Marine, Inc. 1250 N. Grove St., Anaheim, CA 92806  
Zodiac of N. America Thompson Creek, P.O. Box 400, Stevensville, MD 21666  
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Bayer AG, D-41538, Dormagen, GERMANY  
Phillystran, Inc., 151 Commerce Drive, Montgomeryville, PA 18936-9628  
Puget Sound Rope, 1012 Second St., Anacortes, WA 98221  
Pelican Rope Works, 4001 Carriage Dr., Santa Ana, Ca 92704  
Rasmussen Equipment Co., P.O. Box 81206, Seattle, WA 98108  
Wellington, P.O.B. 244, Madison, GA 30650  
**RUDDER BEARINGS & BUSHES**  
Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH 44062-0067

Thordon Bearings, Inc., 3225 Mainway, Burlington, Ontario Canada L7M 1A6  
Vesco Plastics, P.O. Box 40647, Cleveland 2022, South Africa

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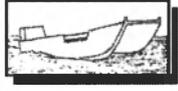
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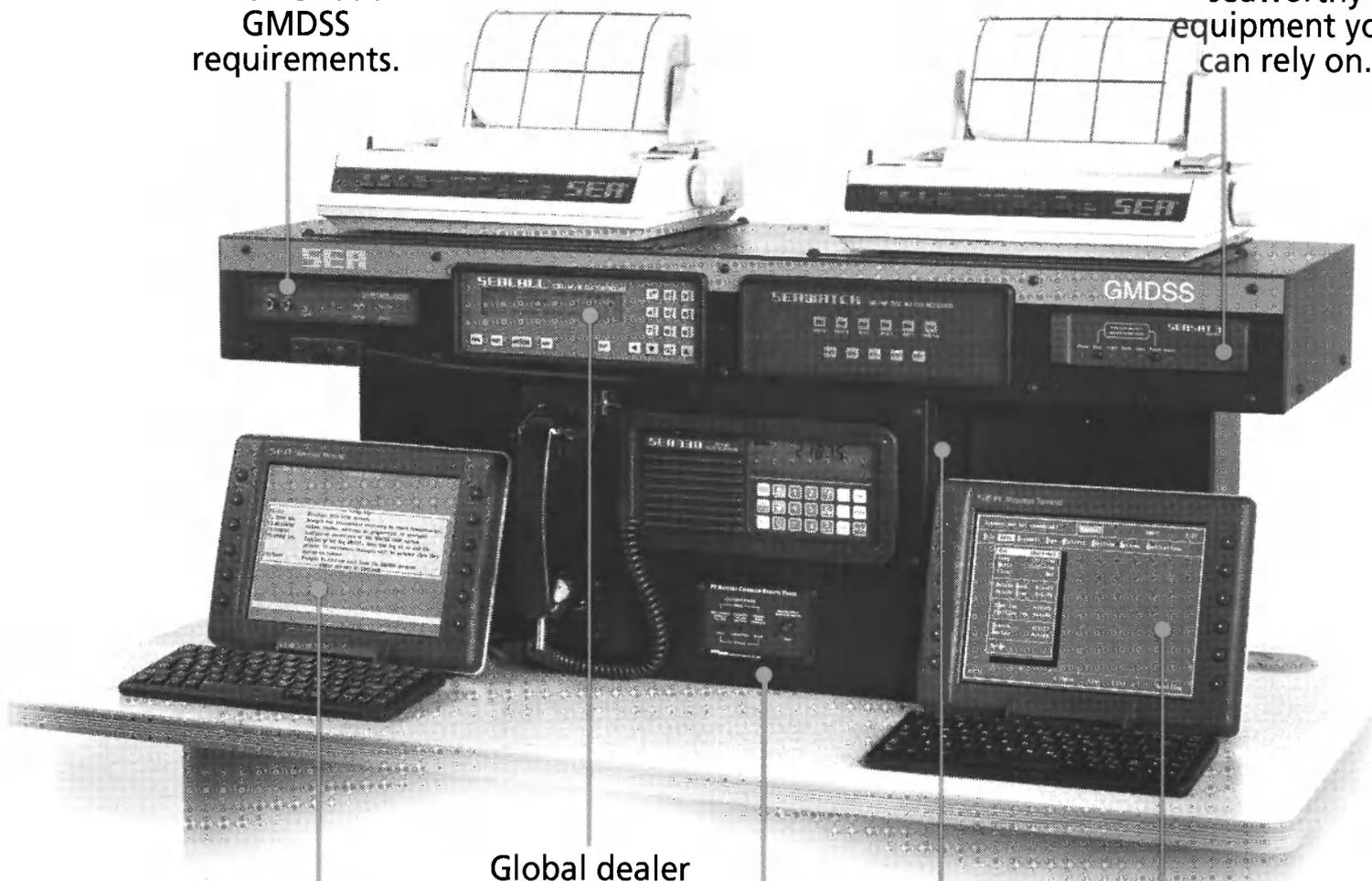
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