

December 1999

MARITIME REPORTER AND ENGINEERING NEWS

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Great Ships of 1999

Ship & Boatbuilding Technology
Containership design matters top GL agenda



The world's largest cruise ship ever built, Voyager of the Seas, recently entered service

Clear Sailing
The Panama Canal handover is imminent ... What's next?

Breaking Out
Marine electronic and software advances are on the fast-track

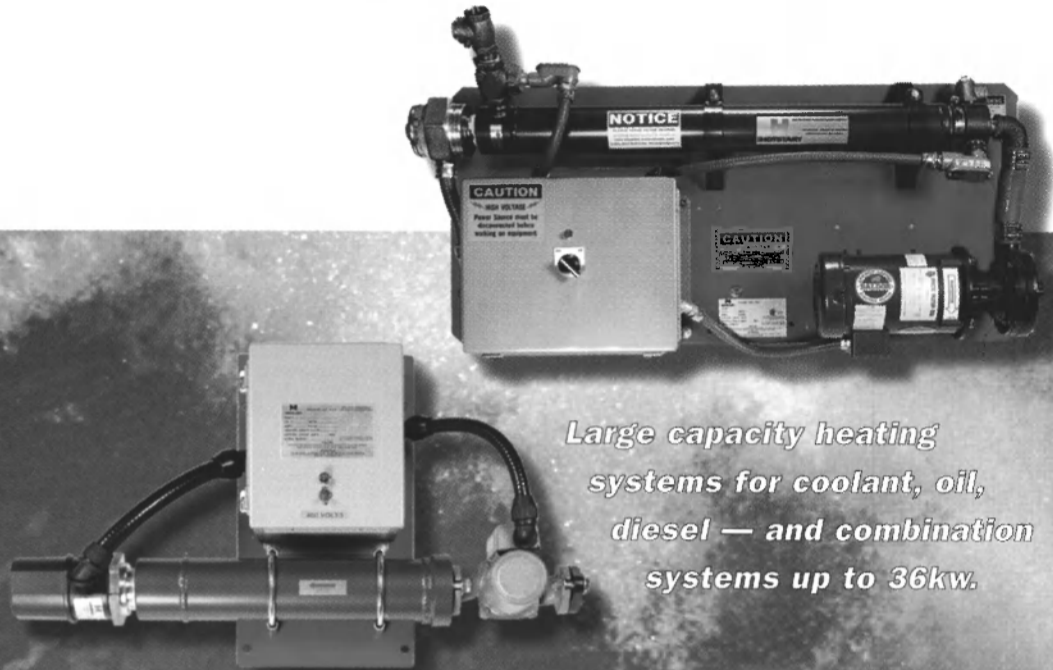
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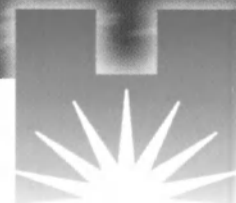
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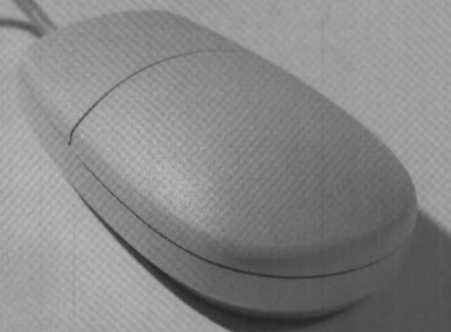
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Otweg 18
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Netherlands
Telephone: +31 (0) 172 230707
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e-mail: maritime@tqdesign.nl
<http://www.wirehub.nl/~tqdesign/maritime.htm>

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On the Cover: Voyager of the Seas, the world's largest cruise ship, made its debut last month. It is included as a GREAT SHIP of 1999. Technical Editor David Tinsley reports on the engineering wonders found aboard Voyager, starting on page 30.

30 GREAT SHIPS of 1999

Maritime Reporter & Engineering News' annual salute to the companies which design, build and outfit outstanding ships. This year's "class" includes the largest cruise ship ever built, a parcel tanker which can simultaneously carry fruit juice and propylene oxide, the world's largest drill-ship, and the largest LNG carrier of the GTT Mark-II membrane type.



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Editorial & Executive Offices
118 E. 25th St., NY, NY 10010
Tel: (212) 477-6700; Fax: (212) 254-6271
e-mail: mren@marinelink.com

PUBLISHERS

Charles P. O'Malley
John E. O'Malley
John C. O'Malley

Vice President/Editorial Director
Gregory R. Trauthwein

EDITORIAL

Assistant Editor
Regina P. Ciardiello
Technical Editor
David Tinsley
Editorial Consultant
James R. McCaul, president,
International Maritime Associates

Manager of Information Systems
Susan Cosme

MARKETING

Marketing Manager
Mark Manzano

PRODUCTION

Production Manager
Adam Hellman
Asst. Production Manager
Luis Mendes

CIRCULATION

Circulation Manager
Dale L. Barnett

ADVERTISING SALES

Director of Sales
Lucia Annunziata
Regional Sales Manager
Angela Criscola
Regional Sales Manager
Andrew Sweeney
Tel: (561) 368-2196
Regional Sales Manager
Robert C. Howard
Tel: (561) 368-4233

Classified Sales Representatives

Carrie Rivera
Patti Hawthorn
(561) 368-3306
WEST COAST
Amy Stewart
1126 Ninth Street
Manhattan Beach, Ca., 90266
Tel: (310) 374-1085; Fax: (310) 374-1436
stewart@marinelink.com

U.S. GULF COAST

James N. McClintock
Simpson Corporate Park, Indigo House, Suite A, 206
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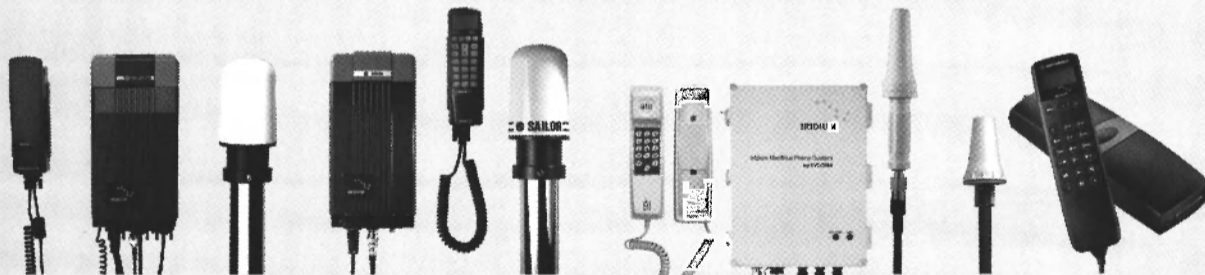
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EDITOR'S NOTE

The changeover to 2000 means many things to many people, on both a personal and professional level, as the end of the millennium serves as a handy measuring stick against which achievements can be measured. But, potential Y2K problems aside, for the maritime industry the strike of midnight on December 31, 1999 will mean nothing more and nothing less than any other measure of time.

The manner in which boats and ships are designed, built, outfitted and operated has changed rather dramatically during the past decade. Everything from the advent of powerful computing hardware and software — both maritime specific and general business — to sweeping consolidation on the vessel building, vessel owning and marine equipment manufacture side has drastically altered the traditional maritime landscape. Advancing technology and consolidation have been recurring themes in the pages of *Maritime Reporter & Engineering News* for many years, but it was perhaps the recent Europort exhibition in Amsterdam that truly drove both points directly home. The proliferation of truly revolutionary marine products and systems — such as the industry's first type approved ECDIS systems from both Transas and Kelvin Hughes — is astounding. Similarly amazing is the sheer size of some of the industry's leading companies, as well-known manufacturers as Litton and Wärtsila NSD now incorporate products and systems acquired through often aggressive acquisitions.

Yet through the constant turmoil, the maritime industry remains hauntingly the same. This is not a swipe at the industry's traditionally held conservative nature, rather a tribute to an industry, which is virtually incapable of becoming obsolete. While the economics, logistics and technology of the maritime business will continue to change, sometimes dramatically, it is a safe bet that in this generation there will be no manner in which products will be moved more efficiently from point A to point B than via ships and boats. This is not to say that radical changes will not be incorporated. The rapid progression toward the building of the new gas turbine powered FastShips — as well as a surge of orders for fleets of newer, larger, faster passenger vessels — are signs that the "need for speed" will continue to grow, driving development in all industries, including maritime.

While the trend is toward consolidation in all sectors, and while deep corporate pockets and capabilities are particularly welcome when the time comes to set and spend the R&D budget, medium and small-sized players maintain an enviable position, in part because smaller companies are sometimes more flexible and adept at providing immediate, customer-mandated solutions for the business opportunities du jour. One of the keys to success for any maritime company of any size in 2000 and beyond is gaining more market sector knowledge and savvy, while carefully monitoring the effects of expansion as compared to a company's overall goals.



Gregory R. Franthum

Coming in MR/EN

January
Passenger Vessel Annual • Great Boats of 1999 • **Monitoring & Control: Next-Generation Products & Systems** • Marine Propulsion Directory & Services Guide • **Vessel Focus: MegaYachts**

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Cruise Shipping Annual • Cruise Ship Marine Products Catalog • **Navigation &**

Communications Electronics Selection Guide
 • Vessel Focus: Cruise Ships • **Country Focus: Finland**

March
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International Representatives

INTERNATIONAL OPERATIONS

CHARLES E. KEIL, Vice President
 4400 N. Federal Highway, Ste. 121, Boca Raton, FL 33431
 Telephone: +561-368-1021; Fax: +561-368-1161
 24-hr Tel/Fax: +561-998-0313; Mobile Tel: +561-716-0338

Australia/New Zealand

ANNE MURRAY
 World Media Network
 Suite 106, 82 Alexander Street
 Crows Nest NSW 2065
 Australia
 Tel: +61 2 9966 4388; Fax: +61 2 9966 4311

Argentina

R. LESLIE RAMSAY
 Calle Pellegrini 173
 Primer Piso, Departamento C
 1009 Buenos Aires, Argentina
 Tel: +54 1 394 8821; Fax: +54 1 326 4377

Benelux

PAULA TACQ
 Maritime Media ML
 Olweg 18 2771 VX Boskoop, Netherlands
 Te: +31 172 230707; Fax: +31 172 230708

Brazil

JOSE DUARTE DOS SANTOS
 Multipla Agencial Maritima, Ltda.
 Rua Carolina Rodrigues 28
 Cuarto Andar, CEP-11055-070
 Santos, Sao Paulo, Brazil
 Tel/Fax: +55 1 32 32 74 74

Central America

EDUARDO F. LOPEZ/ISELA BAZAN
 Transmarine Media Services, P.O. Box 8579,
 Balboa Ave., Panama 5, Panama
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China

WANG ZE/XU XIAO FENG
 Liaoning Foreign Trade Advertising Corp.
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 Tel: +86 411 2801924; Fax: +86 411 2644606

Eastern Europe

IVAN BERENYI/DILGA IVANOVA
 Pannonia Media Agency, 8630 Balatonbogar
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Egypt

CAPTAIN TARIQ M. OSMAN
 Osman Marine Media Co.
 Algamhoria St., P.O. Box 1248, Alkleej Bldg., Port
 Said, Egypt
 Tel: +20 66 340988; Fax: +20 66 325706

France

DANIEL SOLNICA
 Ediconsult Internazionale, 25 rue Saulnier 75009
 Paris, France
 Tel: +33 1 4246 9571; Fax: +33 1 4246 8508

Germany/Switzerland

HANSJORG BRANS
 Maritime Media
 Freiherr v. Stein Str. 24, D-63303
 Dreieich, Germany
 Tel: +49 6103 697745; Fax: +49 6103 697743

Hong Kong/Taiwan

DENNIS LO/JIMME KWAN
 Phantom International, Ltd.
 Room 208, Seaview Centre
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 Kowloon East, Hong Kong
 Tel: +852 9179 9872; Fax: +852 2304 1232

Italy/Malta

VITTORIO NEGRONE
 Ediconsult Internazionale
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 Tel: +390 10 583684; Fax: +390 10 566578

Japan

AKIO ISHII
 Ace Media Service Inc.
 12-6, 4-chome, Nishiike
 Adachi-ku, Tokyo 121, Japan
 Tel: +81 3 5691 3335; Fax: +81 3 5691 3336

Korea

JO, YOUNG SANG
 Business Communications, Inc.
 Kwangwhamun P.O. Box 1916, Seoul, Korea
 Tel: +82 2 739 7840; Fax: +82 2 732 3662

Portugal/Gibraltar

PAULO BREHM
 AZ Publicidade Lda., Rua Almirante Barroso, 52-1 D,
 P-1000 Lisbon, Portugal
 Tel: +351 1 3142256; Fax: +351 1 3525157

Scandinavia

STEPHAN R.G. ORN/LEON SCHULZ
 AB Stephan R.G. Orn, Box 184
 S-271 24 Ystad, Sweden
 Tel: +46 411-184 00; Fax: +46 411 105 31

Singapore

CATHERINE WONG
 The Euro-Asia Link, 20 Maxwell Road 07-18A Maxwell
 House, Singapore 069113
 Tel: +65 3231025
 Fax: +65 3237026, +65 4564610,

South Africa

FINN KVAMSDAHL
 Finn's Enterprises, Media Marketing Division
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 Blinkpan, Republic of South Africa
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South America/ Caribbean Basin

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Spain

JOSE LUIS SEVA
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 C/ Viriato, 69 SC
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 Tel: +34 91 448 76 22; Fax: +34 91 446 0214

Turkey

NIHAT BOYTUZUN
 Kamera Corp., Cumhurlyet Cad. 257/3,
 Harbiye 80230, Istanbul, Turkey
 Tel: +90 212 248 48 64;
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United Kingdom

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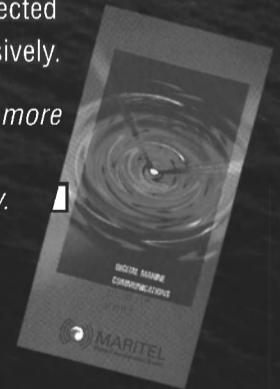


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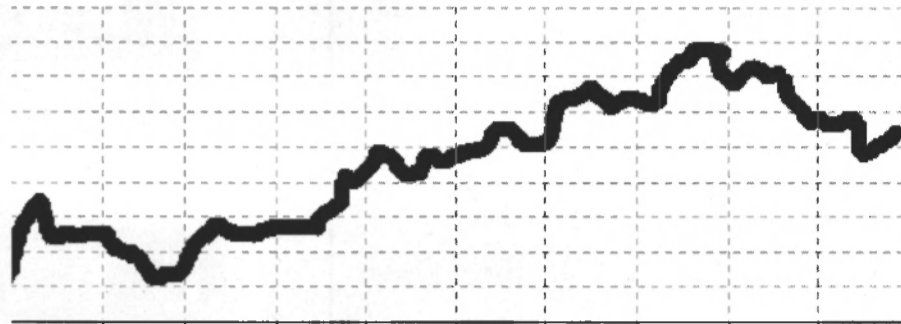
Shipping outperforming offshore on OSE

Higher oil prices have helped the Oslo Stock Exchange's shipping index, which features maritime and offshore shares, to rise by 33.7 percent so far this year - outperforming the exchange's other indexes. Share prices of offshore shares have decreased for two months now, resisting the influence of continued buoyant oil prices. The value of shares on the Main List dropped 5.6 percent in September and 13.6 percent in October. The 19.6 percent price fall recorded by the seismic company Petroleum Geo-Services (PGS), the biggest offshore company on the Exchange, was the main contributor.

The SMB-listed offshore company Ocean Rig (OCR) tops the losers list for the second month running, having sliced almost 30 percent off its share price in October. Big players such as Fred. Olsen Energy (FOE), ProSafe (PRS), Stolt Comex Seaway (SCS), Det Søndenfjeldske (SFJ) and TGS Nopec (TGS) all fell between 10 percent and 20

percent during the month.

Only three offshore companies increased their value: Polar Holding (POL) rose almost 11 percent following merger talks with District Offshore (DOF), topping the winners list. Uglan Nordic Shipping (UNS) and Nortrans Offshore (NOL) also experienced gains in October. The cruise company Royal Caribbean Cruises (RCCL) rose 17.7 percent in October holding the fall in the shipping index to 2.2 percent. Actinor Shipping (ACS) rose 23.3 percent, while the Swedish shipping company Atlantic Container Line (ACL) moved up 9.5 percent. NCL Holding (NCL) moved the opposite direction to its competitor RCCL with a share price drop of 11.6 percent in October, continuing the negative trend from the previous month. Among the shipping companies Benor Tankers (BET) performed the worst with a fall of 16 percent, while Belships (BEL) dropped 10.9 percent.



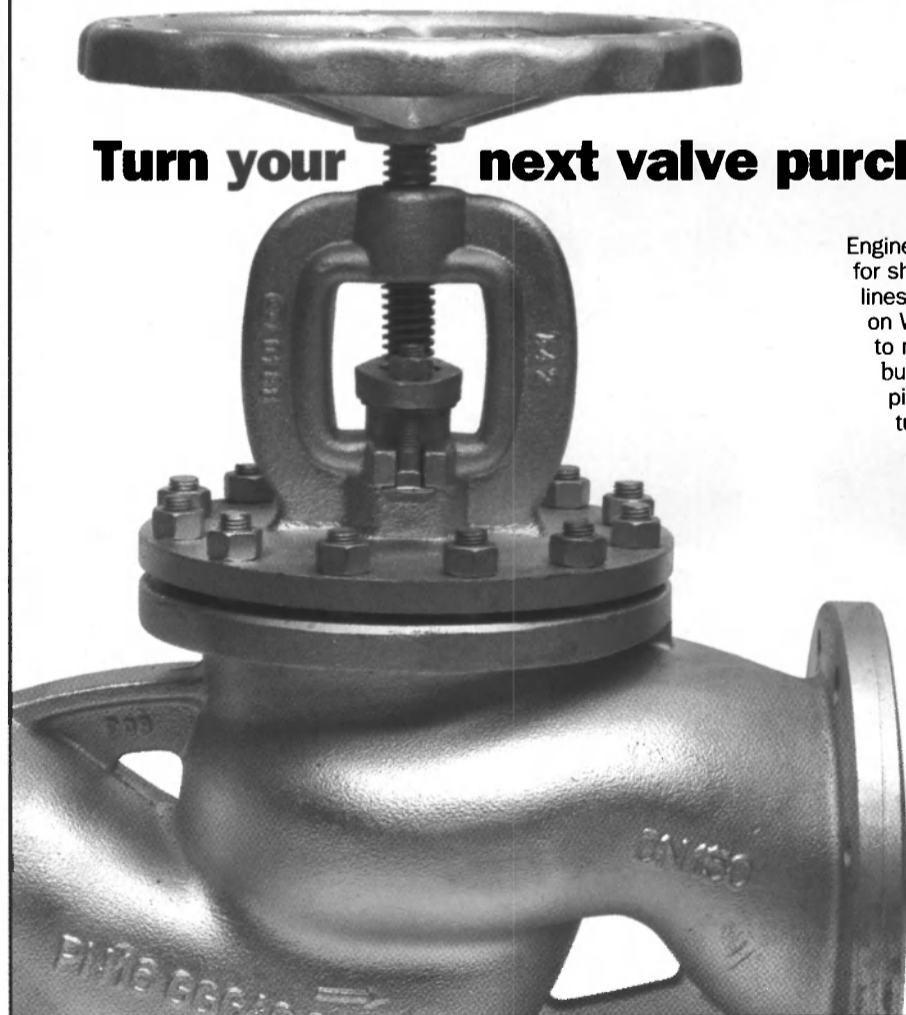
Winners in October

Shipping	List	Change
Actinor Shipping	Main	+ 23.3%
Royal Caribbean Cruises	Main	+ 17.7%
First Olsen Tankers	Main	+ 10.0%
Atlantic Container Line	Main	+ 9.5%
Wilh. Wilhelmsen B	Main	+ 8.1%
Offshore	List	Change
Polar Holding	SMB	+ 10.8%
Uglan Nordic Sh.	Main	+ 9.2%
Nortrans Offshore	SMB	+ 8.7%
Stolt Comex Seaway	Main	- 1.1%
Brevig Offshore	SMB	- 2.0%

Losers in October

Shipping	List	Change
Benor Tankers	Main	- 16.0%
NCL Holding	Main	- 11.6%
Belships Co.	Main	- 10.9%
Nomadic Shipping	Main	- 9.4%
Odfjell A	Main	- 9.1%
Offshore	List	Change
Ocean Rig	SMB	- 29.6%
Havila Supply	SMB	- 22.9%
Fred. Olsen Energy	Main	- 20.5%
Petroleum Geo-Serv.	Main	- 19.6%
ProSafe	Main	- 12.7%

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Inland Report

Bollinger's Barge Business Is Booming

Well-known in the vessel building industry as a quality builder of various vessels and as a specialist in ship and barge repair, conversions and barge flaring, Lockport, La.-based Bollinger Shipyards has made a name for itself as a major builder of barges used on inland waterways and ocean-going uses. Stemming from the shipyard's growth are five contracts for 17 specialized large barges ranging in sizes from 240 to 365 ft. (73.1 x 111.2 m) Some were recently delivered, while others will be sent off before year-end 2000.

According to **Lynn Falgout**, vice president and general manager of Bollinger Marine Fabricators, "Until April 1997, we had had a limited barge program in eight shipyards. We upgraded our capacity that year when we acquired the former McDermott shipyard in Amelia, La., which is a 67-acre dedicated barge building facility with large, covered construction buildings. It is now known as Bollinger Marine Fabricators, LLC. It, along with \$2 million capital improvement program, has given us the capacity to launch as many as three hopper barges per week as demonstrated with our recently completed MEMCO contract."

"At the time of purchase," Falgout added, "McDermott had a contract for, but had not yet begun construction of 250, 200 x 35 x 13 ft. (60 x 10.6 x 3.9 m) and 14 box and rake hopper barges for MEMCO located in St. Louis, Mo. We began building those barges in April 1996, and completed that contract ahead of schedule in March 1999."

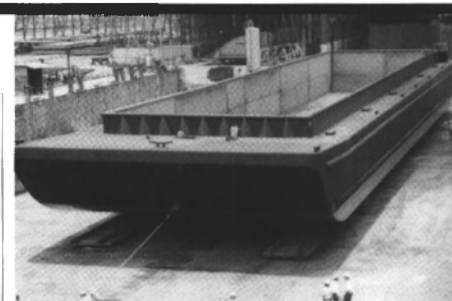
The largest of the contracts amounts to six barges designed by Shearer & Associates, Metairie, La. Measuring 260 x 60 x 14 ft. (79.2 x 18.2 x 42.6 m), the vessels were built for the PCS Phosphate Company located in Raleigh, N.C. Two of the barges will be covered hopper barges built to carry phosphate rock or fertilizer between PCS Phosphate's Aurora, N.C. mine and plant and the port at Morehead City, N.C. Each will be equipped to transport 3,000 metric tons of products and will house fiberglass, telescoping rolling covers.

Designed to carry sulfuric or phosphoric acid, two are 12,000 BBL double skin tank barges with two integral stainless steel cargo tanks equipped with two electric-driven deepwell turbine pumps. Cargo systems valves will be flanged gate valves specifically designed and manufactured for acid service, while all cargo tanks will have a remote read-out level sensor, and sight glass and fittings

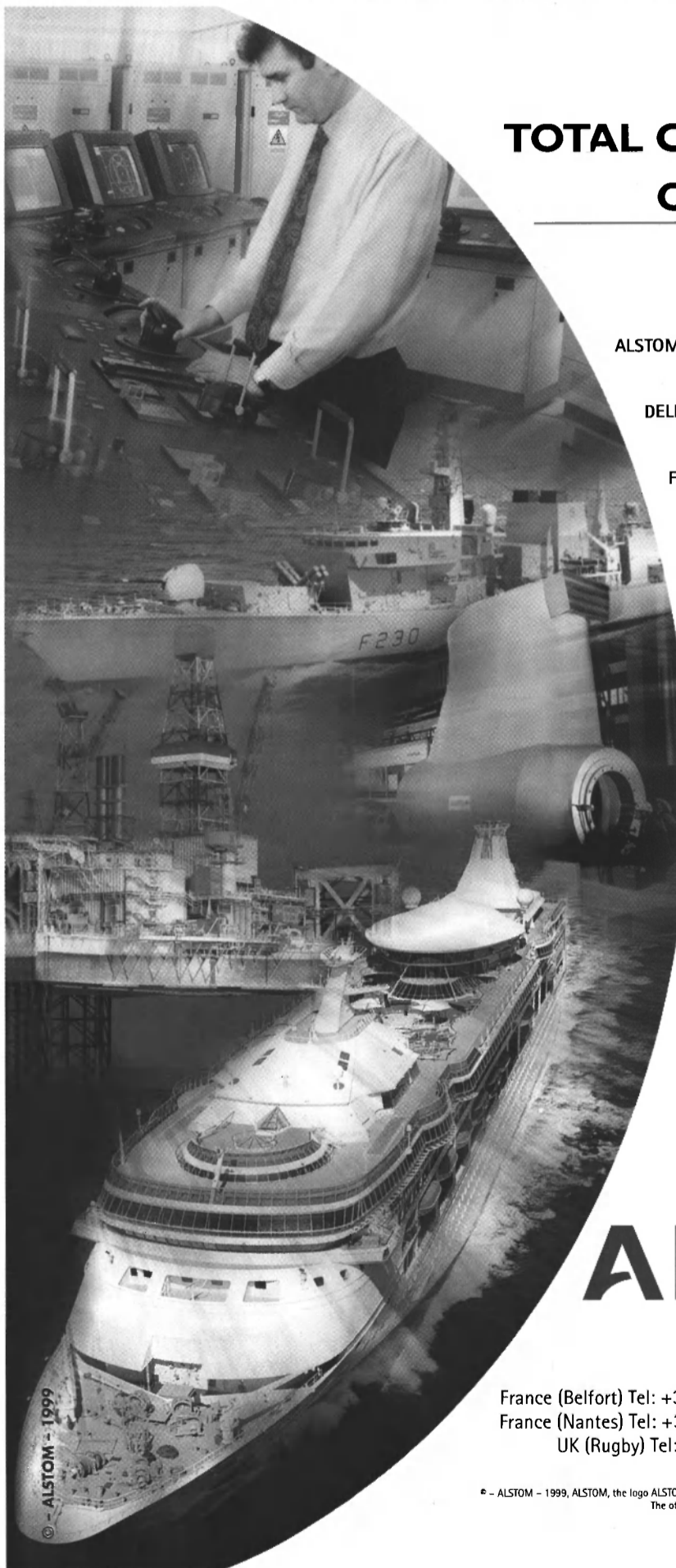
for future installation of a vapor control system.

The final two of the six-part barge contract calls for double skin barges

built to carry molten sulfur. The same size as the bulk cargo and sulfuric acid barges, this pair will have two integral mild steel cargo tanks of 12,000 BBL



Bollinger Marine Fabricators tank barge awaits delivery following completion at the Morgan City, La. barge building facility.



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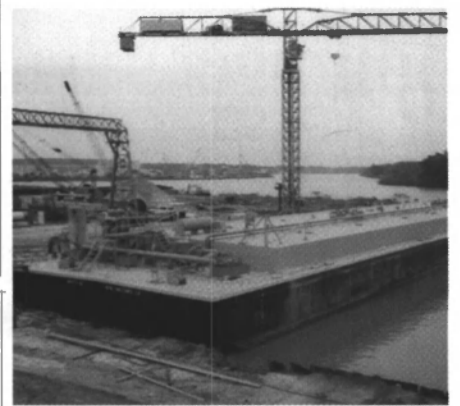
Inland Report

total capacity. Most equipment present on the other four barges will be duplicated on this pair as well including two electric-driven deepwell turbine pumps and remote read-out level sensors.

Similar to their sulfuric acid sister-barges — they too will comply with U.S. Coast Guard regulations for Hull

Type II. Cargo will be heated with hot oil circulating through four sets of coils in each cargo tank, coiled and arranged that the loss of one set of coils will not detract from the overall heating ability of the system. Hot oil will heat the cargo pumps, fill lines, vents and drip pan drains, while above deck cargo piping

and the drip pans will be heated with steam supplied from external sources. A heat exchanger will transfer heat from the shore-supplied steam to hot oil. The cargo heating system, which was designed by Shearer and PCS, provides a quality heating system with due consideration for the type of cargo and the



250 x 52 x 14 ft. (76.2 x 15.8 x 4.2 m) double hull jumbo hopper for Tide Leasing LLC, Birmingham, Ala. preparing for launching on Bollinger's submersible drydock.

environment where the barges will work.

A self-contained fiberglass house complete with lights, and air conditioning and heating will function as a shelter for crewmembers during the barges' transfer operations.

All six barges will be fitted with 40-ton manual winches and will have identical semi-integrated hull configurations from the main deck down — all will have coatings specially designed for operation in salt water. External hull scantlings based on two PCS barges constructed in 1992 will be present on the six vessels as well. All external and internal welding will be double continuous to strengthen the structural integrity of the hull scantlings and to provide better coating surfaces.

Falgout reports that contracts completed this year at Bollinger Marine Fabricators include two 240 x 60 x 16 ft. (73.1 x 18.2 x 4.8 m) deck barges for Connolly-Pacific Company, Long Beach, Calif.; and four 250 x 52 x 14 ft. (76.2 x 15.8 x 4.2 m) double hull, jumbo hopper barges for Tide Leasing LLC, Birmingham, Ala. The barges built for Connolly-Pacific have 2,900 lbs. per sq. ft. deck loading and were delivered ahead of schedule on September 8. The Tide Leasing hoppers were constructed with .75-in. steel at the bottom and .625-in. steel at the sides. In separate tandem tows, all arrived at their South American destination of Santa Maria, Colombia during September and October.

Bollinger's additional projects currently in the works include: two double skin 356 x 54 x 13 ft. (108.5 x 16.4 x 3.9 m) asphalt tank barges for American General Transportation, Mobile, Ala.; one 295 x 52.5 x 14 ft. (89.9 x 16 x 4.26 m) cement barge for Indianapolis-based Lone Star Industries measuring 295 x 52.5 x 14 ft. (89.9 x 16 x 4.2 m); and two 240 x 54 x 22 ft. (73.1 x 16.4 x 6.7 m) 4,000 cubic yard split hull dump scows for DonJon Marine Company in Hillside, N.J.

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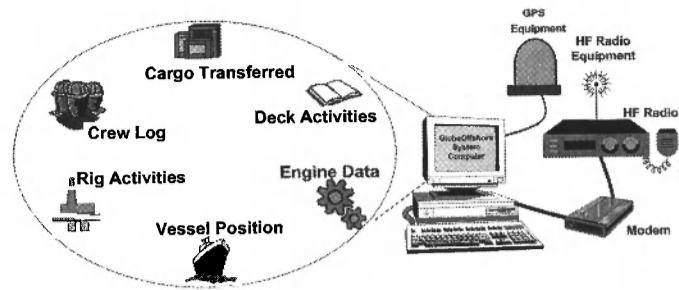
A system touted as the first fully integrated workboat management system — dubbed GlobeOffshore — was recently unveiled by Globe Wireless at the International Workboat Show in New Orleans. GlobeOffshore is designed to act as a decision support tool helping to improve vessel utilization, streamline operational and strategic decisions and maximize vessel efficiency. Onboard, the GlobeOffshore log captures all types of information — cargo, operational, crew & passenger, as well as position. The data is then made available to the boat owner or charterer on the Internet.

The system is set-up to allow managers, both operational and strategic, to track fleet and produce timely reports on vessel activities, cargo transfers, engine maintenance, crew schedules and charge allocation. The new offering from Globe Wireless is meant to complement the organization's burgeoning number of communication solutions, and is one of the many offered with the Globe Communications Center. The company offers messaging and data file transfer services via satellite and via the digital Maritime

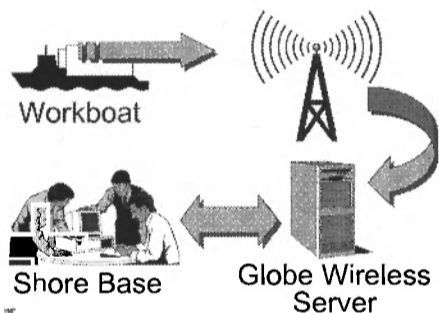
Data Network to the maritime industry. Vessels at sea can send and receive e-mail, fax, telex, as well as transfer data files. The Globe Communications Center runs on a PC, and is compatible with most existing satellite equipment and HF radios.

Circle 29 on Reader Service Card

GlobeOffshore The Shipboard System



GlobeOffshore The Overall Data Flow



A.F. Theriault Begins Longliner Construction

A.F. Theriault & Son Ltd. of Metahgan River, Nova Scotia has commenced construction on a 99 x 26 ft. (30 x 7.9 m) steel-hulled longliner for Wesley Heneberry. The vessel will be powered by a Cummins KTA38 M1 rated for 1,000-hp at 1,800 rpm driving through a ZF BW361 marine gear with a 6.16:1 ratio. Auxiliary power for the electrical system will be a pair of six cylinder Cummins B-series engines each turning 70 kW Onan gensets.

The longliner's hull measures 13 ft. (3.9 m) molded depth and will include a four-man cabin aft of the engine room. An insulated and refrigerated 7,000 cu. foothold will stow approximately 250,000 lbs. of iced fish in front of the engine room.

Scheduled for delivery in the fall of 2000, the vessel's design work was completed by Maritime Marine Consultants in St. Johns, New Brunswick.

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Circle 252 on Reader Service Card

Inland Report

Bollinger Provides Speedy Rig Modification



Bollinger Shipyards in Fourchon, La. accommodated the Glomar Adriatic IX and Adriatic X for leg modifications and repair work following the two rigs' return to the U.S.

Bollinger Fourchon, LLC, a subsidiary of Bollinger Shipyards, recently completed a project for R&B Falcon Drilling, which included the replacement of jet piping and the fabrication and erection of an interior bulkhead on the Cliffs 150 rig in just eight days.

The Lockport, La.-based shipyard also performed work on two Marathon Le Tourneau 116-C jack-up drilling rigs - Glomar Adriatic IX and Glomar Adriatic X - owned by Global Marine International Drilling Corporation. On each rig, Bollinger, in conjunction with Marathon Le Tourneau, lengthened three legs from 410 to 477 ft. (124.9 to 145.3 m). The company also added a wind wall around the drill floor, installed BOP (blow out preventor) trolley beams and a shale shaker trough, and extended the jet piping lines.

Cory Upgrades Bristol Tug Fleet



Cory Towage's tractor tug, Stackgarth, has been transferred to the company's Bristol fleet.

Throughout the past few months, Cory Towage has invested more than \$800,000 in upgrading its Bristol tug fleet for the extension of operational

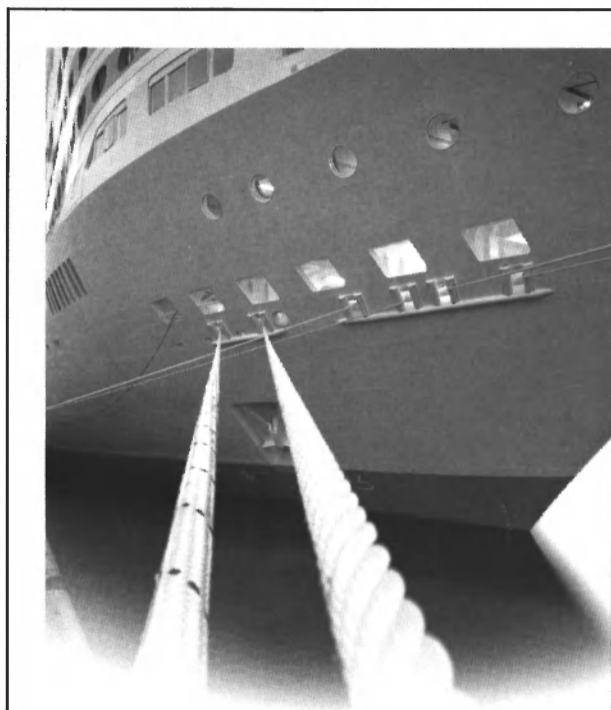
flexibility.

The 43-ton bollard pull tug Stackgarth has been transferred from Swansea, replacing the 50-ton bollard pull tug Edengarth. Despite being less powerful than its predecessor, Stackgarth is a highly maneuverable tractor tug fitted with azimuthing propellers, while Eden-

garth is a conventional single screw vessel. Prior to being incorporated into the Bristol fleet, Stackgarth underwent refurbishment at the Dunston shiprepairyard in Hull, which included a major overhaul of all machinery onboard. New slipping clutches have been installed to improve the tug's per-

formance at low engine revolutions and the skeg has been modified to reduce roll.

An additional Bristol vessel, "combi" tug Point Gilbert also underwent refurbishment - the rebuilding of the main engine and Caterpillar unit driving the front Aquamaster unit.



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Inland Report

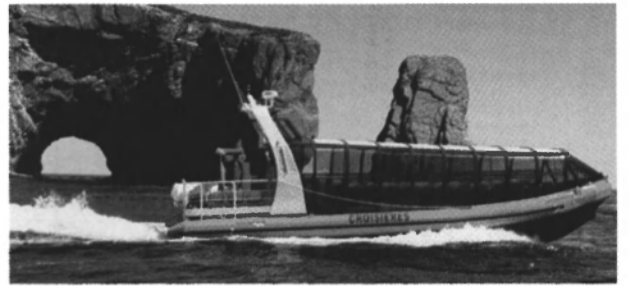
Swedish Company Acquires High-Tech Vessel

Stromma Kanalbolaget Turism & Sjöfart AB, a Swedish-based tourism organization, has purchased a new 48-passenger Explorathor high performance vessel from Recherches Et Travaux

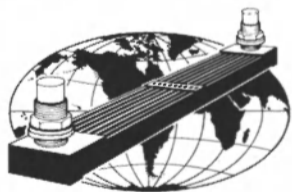
Maritimes Construction (RTMC) in Quebec, Canada.

Measuring 45 ft. (13.7 m) with a 12.6 ft. (3.8 m) beam, the vessel is powered with twin TAM74C, 450-hp (331 kW) Volvo Penta diesel engines driving two Alpha Power jets, which incorporate elements of aircraft technology to pro-

duce a higher propulsion efficiency than other conventional designs. The jets can be adapted to provide either high thrust or high velocity characteristics, depending on the intended load and



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type of application. In addition to its ultra-modern appearance, the vessel features the Fabrilite system of fabrication, which allows for a new generation of lightweight, robust aluminum hulls up to 130 ft. (40 m) that can move up to 35 knots. Explorathor is 20 percent lighter than any comparable vessel in its class or size, resulting in a savings of up to 25 percent in fuel consumption.

Cummins Powers

Taiwanese Navy Tugs

The first of an eight-part tug series powered by 1,200-hp Cummins KTA38M2 engines for the Taiwanese Navy has been delivered to its owners. The second member of this tug series is currently undergoing sea trials in preparation for its upcoming delivery. Harbor trials for the third vessel are underway.

The sale of main and auxiliary engines for this series of Z-drive tugs was handled through Cummins' Singapore office. Measuring 94 ft. (28.8 m) with a beam of 26 ft. (8 m) and a molded depth of 12 ft. (3.8 m), the vessel was built by Ching Fu Shipbuilding Co. in Kaoshiung, Taiwan. The tugs' engines drive a pair of Ulstein 650H steerable propeller systems for a design speed of 10 knots. This model drive is rated for up to 800 kW with its 62-in. prop; input to the prop is 1,800 rpm. A PTO in the Z-drives' upper gear box powers the hydraulic steering pump and clutch. Bollard pull for the 2,400-hp tugs is approximately 23 tons.

Circle 32 on Reader Service Card

Global Industries To Open Offshore Construction HQ

Global Industries will significantly expand its capacity to meet operators' deepwater and reel pipelay needs in the Gulf of Mexico this December with the opening of its 625-acre offshore construction headquarters in Carlyss, La. Chosen because of its location along the 40 ft. (12.1 m) deep Calcasieu Ship Channel - the site is capable of supporting Global's deepwater fleet - and includes a pipe assembly rack that measure more than half a mile long.

As a result of this new facility, Global closed both its Houma and Lafayette, La. facilities in late October to consolidate its offshore operations in Carlyss.

Contracts

Royal Caribbean Injects \$800M Into Germany

Royal Caribbean Cruises Ltd. (RCCL) has signed a letter of intent with Papenburg-based Meyer Weft shipyard to construct the third and fourth Vantage-class vessels for RCCL at an approximate price of \$800 million for both ships.

The first two 88,000-ton vessels in this class are currently under construction at the yard — Radiance of the Seas and Brilliance of the Seas. These vessels are scheduled for delivery in June 2001 and April 2002, respectively. This new order, as well as options could set up RCCL for up to six 2,100-passenger ships in the class by 2006.

Featuring gas turbine engines for power generation and Azipod propulsion systems for steering, the Vantage-class vessels are powered by GE gas turbines — significantly lowering airborne emissions — and lowering noise and vibration levels.

Fincantieri Signs \$210M Contract

Fincantieri has signed contracts with Minoan Lines for two new high-speed ferries to be delivered in fall 2001 and spring 2002 for a price of about \$105 million each. With a gross tonnage of approximately 36,000 tons and overall length of 702 ft. (214 m), the vessels will travel in fully loaded conditions at a speed of 29.5 knots. Passenger capacity is 2,000 with garage space for 110 cars and 120 trailers.

These are the third and fourth vessels that Minoan will have on order at Fincantieri. The first two vessels, which will be named Knossos Palace and Festos Palace, will be delivered in 2000 and 2001.

Circle 3 on Reader Service Card

Aker Marine, Vryhof Sign Letter Of Intent

Aker Marine Contractors, (AMC) a subsidiary of Aker Maritime, and Vryhof Anchors have signed a Letter of Intent to extend their cooperation agreement through their U.S.-based joint venture company - TACP/Aker LLC.

Per this new agreement, AMC will sell to Vryhof the substantial assets and rights of Sea Talon Anchors, which was attained by AMC in 1988. Within their core business, Vryhof will continue to focus on the design and manufacturing of high holding power drag embedment anchors and the supply of mooring components through other alliances. AMC will concentrate on the marine contracting market, focusing on the design and installation of cost effective mooring

systems for floating drilling, production and construction operations.

Circle 4 on Reader Service Card

FirstWave/Newpark Awarded Repair Contract

FirstWave/Newpark Shipbuilding was granted a contract by Pride Offshore of

Houma, La. for repair and maintenance of the jack-up drilling rig Pride Colorado. The rig, which arrived at the company's East Pelican Island facility in Galveston during mid-October, will be drydocked on a heavylift barge for inspection and repair, if required. Newpark has completed three successful dockings on lift barges in the past.

Bath Iron Works To Launch AEGIS Destroyer

Bath Iron Works launched its 10th Arleigh Burke Class AEGIS guided missile destroyer, Howard on November 20 at the West Gate.

The vessel bears the name of Marine Corps Sgt. Jimmie E. Howard, a Medal



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Contracts

of Honor recipient who was honored for his leadership of a platoon against attacks by a Viet Cong force.

Bath will launch two more destroyers on its traditional building ways before utilizing the modern land-level transfer facility for ship construction.

Vickers Ulstein Wins Design And Equipment Packages

Vickers Ulstein Marine Systems' specialist offshore design company, Ulstein Ship Technology, has signed three separate contracts to supply designs and equipment packages for offshore support vessels. Two UT755s are currently on order for different owners at Brevik Construction in Norway, and a UT722 on order at Orskov Christensen's Staalkibsvaerft in Denmark. Total value of the contract trio to Vickers amounts to \$18.5 million. Ulstein Ship Technology's most

recent contract is a \$2.9 million deal with Brevik Construction for the provision of the design and equipment package for a standard UT755 platform supply vessel to be constructed for Nordenfjeldske Dampskibsselskap.

Utah DOT Grants Construction Contract

The Utah DOT has awarded a contract to Mark Steel Corp. of Salt Lake City for a new Lake Powell ferry-boat at Hall's Crossing. Known as the builder of John Atlantic Burr - the lake's exclusive ferry since 1985, Mark Steel is scheduled to launch the 150 ft. (45.7 m) vessel in September 2000. Designed by M.D.A. Marine Design Associates of Victoria, B.C., Canada, the ferry's name-sake honors **Charles A. Hall**, the pioneer who operated the first ferry-boat across the Colorado River.

Gunderson Signs Barge Contracts

Gunderson, Inc., a subsidiary of The Greenbrier Companies has received two new barge orders to be built at the company's Portland, Ore. facility for a 2000 delivery. The larger of the two hulls, a

giant ocean-going barge is being constructed for Alaska Railbelt Marine, a subsidiary of Lynden Inc. The largest vessel to be built by Gunderson in two decades, it will combine a railcar and deck cargo barge measuring 400 x 100 x 24 ft. (121.9 x 30.4 x 7.3 m) with a deck load capacity of 3,350 lbs. per sq. ft.

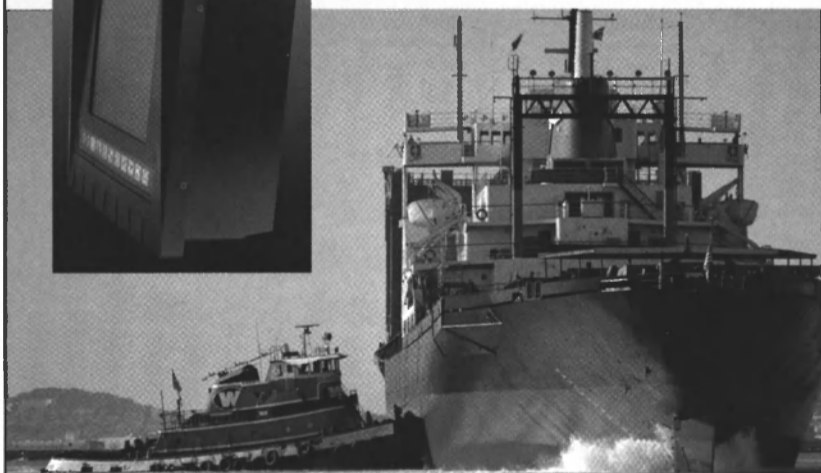
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Transition In History: A Look At The Panama Canal

Dubbed "The Greatest Engineering Wonder of the World," the Panama Canal has experienced a whirlwind run since President Woodrow Wilson flicked a switch of the first gushes of water to flow through the 51-mile body of water that is arguably the most important shipping channel in world.

— by Regina P. Ciardiello

It was 1914 and it was as though Central America and Europe — situated at opposite sides of the Atlantic — were worlds apart. For it was in the Central American country of Panama where workers from many nations joined forces to build the massive Panama Canal, while hostilities in Europe were quickly leading to WWI.

Together, these workers, who came from all walks of life and all different backgrounds - all shared one dream - to be part of a piece of history that to this day, is considered to be one of the world's greatest engineering feats.

The canal will soon be handed back to its homeland from the U.S., per a treaty signed on September 7, 1977. But it was not a member of U.S. or Panamanian government who initiated the idea for the canal, rather a King from Spain named Charles who reigned in the early 1500's. It was King Charles, who, in 1534, explored the possibilities of constructing a canal in the region. His revelation never came to pass, as he scratched his plans when the Spanish governor expressed his thoughts of disbelief regarding the King's idea.

For centuries continuing, various proposals were drawn posing the same question: How do we find an effective route through the continental divide? Enter Ferdinand de Lesseps' French company, which had successfully completed the Suez Canal in 1869. Although de Lesseps had not encountered many roadblocks throughout the Suez's construction, he would find out that the construction of the Panama Canal was different. It was not long after building commenced in 1882 that yellow fever took its toll on many of the canal's workers. It is estimated that by the time the century ended, more than 22,000 workers had succumbed to the disease, which had been spread by infected mosquitoes. This, along with poor sanitation and disorganized management forced the French company into bankruptcy - ceasing all construction on the unfinished waterway.

Three years and \$40 million later, in 1903, the U.S. purchased what was left of de Lesseps' failed company, with full support from President Theodore Roosevelt in allowing Panama's request to become a republic. Following the signing of a treaty between the two countries, the U.S. took over the task of building the waterway on May 4, 1904, and completed the job nine years later for an estimated

The Cut - Looking north from Contractors' Hill - December 28, 1907



Note: All photos are courtesy of the Panama Canal Commission.

\$380 million.

The lock-style canal, which, according to the Panama Canal Commission's Office of Executive Planning, took in 1,058 transits and 4,88,400 long tons of cargo during its first full year of operation in 1915, allows vessels to enter from either the Atlantic or Pacific side. Entrance from the Atlantic side brings a ship to a sea level sail the seven-mile distance from Cristobal Harbor to Gatun Locks. The vessel is then brought up 85 ft. to Gatun Lake where it passes through three step-like lockages. After departing Gatun, the vessel moves 85 ft. above sea level to complete the 31-mile distance to Pedro Miguel Locks. Just one lock at Pedro Miguel lowers the ship 31 ft. to Milaflores Lake - setting up for the entrance to Milaflores Locks. It is here where the vessel will, in just two lockages, be lowered 54 ft. to the Pacific Ocean level. Before completing its canal journey, it must then sail four miles of the waterway - bringing it to Balboa Port before entering the outer harbor.

Measuring 110 x 1,000 ft. (33.5 x 305 m), the locks' chambers are able to handle vessels limited to a beam of 106 ft. (32.3 m) with a length of 950 ft. (289.5 m) and a draft of 39.6 ft. (12 m) tropical freshwater.

But perhaps the most renowned portion of the canal is the Galliard Cut, which is the waterway's narrowest portion. Plagued by a variety of landslides - the worst during 1987-did not prompt the closing of the canal, but prompted the Panama Canal Commission's Board of Directors to approve a widening plan in July 1991. Because of its narrow width, vessels are only permitted through the cut on a one-way basis - Northbound during early morning hours - Southbound by afternoon, with a flow switching between both directions during the rest of the day.

Originally constructed at 500 ft., the Commission plans to widen the cut to at least 630 ft. along straight stretches and 730 ft. at curved areas. Scheduled for a 2014 completion, the approximate cost of the project, whose dry excavation is 91 percent finished will cost approximately \$17 million to fund post year 2000. The cut's wet excavation is halfway complete, while overall drilling and blasting are about 70 percent done.

Throughout its existence, the Canal has accommodated vessels of all shapes and sizes — the first being SS Ancon on August 15, 1914.

According to the Panama Canal Commission, the tanker Arco Texas holds the top spot of most cargo carried through the canal. The vessel, which passed through the canal on December 15, 1981, held 65,229 long tons of oil. The Commission also cites that U.S. Navy hydrofoil, Pegasus, in June 1979, performed that quickest transit - from Miraflores through Gatun Locks in two hours and 41 minutes. An incredible feat as the average transit time (from port to port) for this type of ship normally stands between eight and 10 hours.



Craneboat A. La Valley leaving Miraflores lower locks. The first steam vessel to pass from ocean to ocean through the Panama Canal, January 7, 1914.

Century Hope makes it way through the canal's locks.





The Signing of the Panama Canal Treaty (Torrijos-Carter Treaty) by General **Omar Torrijos** and President **Jimmy Carter** occurred on September 7, 1977.

A change in course

September 7, 1977 was an instrumental day for both the Panamanian and U.S. Governments as it marks the first the signing of the Panama Canal Treaty, first step taken by both nations in Panama's quest to take back control of the Canal.

Known as the Torrijos-Carter Treaty, the document stated that on December 31, 1999, the Republic of Panama would be permitted to take control of the canal — disbanding all U.S. opera-

tions. Set into force on October 1, 1979, the treaty provided the Republic of Panama with a 20-year transition period — allowing the nation to prepare itself for its role.

The treaty also called for the establishment of a new agency of the U.S. Government - the Panama Canal Commission - abolishing the former Panama Canal Company. The purpose of this organization was to take action in the improvement, upgrading and maintenance of the canal until the transition date. In addition, the treaty also set forth a toll rate increase of 29.3 percent in order to provide Panama with canal revenues. A slew of improvements, in addition to the Galliard Cut widening encompass new locks towing locomotives, locks machinery and equipment upgrade, as well as enhanced vessel traffic management system. According to the Commission, the first two units of the new locks are currently in place, having already performed successful factory tests. Eighteen production units are expected by February 2002. Regard-

ing the vessel traffic management system (VTS), the enhanced version went into effect this past July. More than 50 electronic boxes have already been implemented and are up and running in the Commission's floating equipment and shore sites.

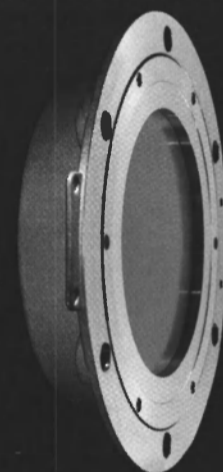
Tolls, which were last increased on January 1, 1998, will remain the same after the handing-over. Vessel rates continue at \$2.57 per PC. Net Ton, Laden; and \$2.04 per PC. Net Ton, Ballast. Measured by the Panama Canal Universal Management System (PC/UMS), which was put into effect by the Commission on October 1, 1994; total long tons of cargo that passed through, based on 12,924 transits stood at 192,091,107, garnering a toll rev-

enue of \$543,036,483.

According to Panama's President **Mireya Moscoso**, the Panama Canal will be operated as a non-political state entity once it is handed over from the U.S. President Moscoso also reassured that Panamanian politics will not interfere with the Canal and that the Republic is ready to gain control on the 31st.

There have been some recent, publicized concerns that China will try to gain command of the canal based on a

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contract that Panama awarded to Hutchinson Whampoa Ltd. - one of the world's largest shipping and port companies located in China. The contract calls for the organization to operate the two facilities situated at the canal's Atlantic and Pacific entrances. Some have even speculated that the company, which is based in Hong Kong, is linked to the Chinese military. President Moscoso disagrees however, assuring that the

"canal will never be in Chinese hands and that there is no Chinese threat to the ports."

Despite any discord or speculation, the canal will still be handed back to the Republic whose soil it is built on. At 12 Noon on the eve of the new millennium, a historical event will occur - an event that seemed years away on that day in 1977 that changed the fate of the canal forever.

Canal Transition Milestones

1970s

September 7, 1977 - Signing of the Panama Canal Treaty (Torrijos-Carter Treaty) between the Republic of Panama and the U.S. This agreement establishes a regime of neutrality guaranteeing that the Canal remains open, safe, neutral and accessible to vessels from all over the world.

September 30, 1979 - The canal's final day of operation under the Panama Canal Company and the Canal Zone Government, as per the treaty signed two years earlier.

October 1, 1979 - The Panama Canal Treaty is entered into force, granting Panama jurisdiction over the former Canal Zone. The Panama Canal Commission, a new agency of the U.S. Government, is now responsible for managing, operating and maintaining the Canal through December 31, 1999.

1980s

June 11, 1980 - Established under the Treaty, the Coordinating Committee holds its first binational meeting in Panama City

March 31, 1982 - Marked the end of the 30-month transition period. The Panama Canal Commission's transitory police force and magistrate's court, in addition to the U.S. District Court disbanded on this day.

September 30, 1989 - A long-term project to revamp 50,000 ft. of towing locomotive track at the locks - including water and landslide rails, rack selections and conductor slots is finished.

1990s

December 25, 1993 - The Panama Legislative Assembly approves the first legislature of the Constitutional Title on the Canal.

December 1994 - Adding nine additional articles guaranteeing that the Canal authority would have both administrative and financial autonomy, the Legislative Committee approves the second legislature of the Constitutional Title.

February 1996 - President Clinton signs Public Law 104-106 - The Defense Authorization Act for fiscal year 1996, which converted the Panama Canal Commission to a wholly owned U.S. government operation.

August 18, 1996 - Alberto Aleman Zubieta is sworn in as the second Panamanian Administrator of the Panama Canal Commission.

October 9, 1996 - The proposed bill regulating the Panama Canal Authority - the agency that will operate the canal upon its transfer - is presented to Panama President Ernesto Perez Balladares.

July 17, 1998 - The first Board of Directors meeting between the Panama Canal Commission and the Panama Canal Authority occurs.

September 3, 1998 - Administrator Zubieta is sworn in as the first Administrator of the Panama Canal Authority - serving in both positions until the December 31 transition.

March 24, 1999 - The Cabinet Council of Panama approves the Panama Canal Authority (PCA) toll rates, which in essence, remain the same.

December 31, 1999 - The U.S. hands over The Canal to Panama at 12 Noon per the Torrijos-Carter Treaty.

Source: Panama Canal Commission

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Marine Electronics Update

Electronic Matters Rule The Day In Amsterdam

The maritime industry gathered in Amsterdam last month at the semi-annual Europort Exhibition to display the latest technological advances in marine products and systems. While the show maintains a large local contingency — a good deal of the exhibitors are local agents rather than the manufacturing company principles — it is well regarded as one of the industry's premier events for showcasing new products and services to an international shipowning community.

Of particular note — and not just in Amsterdam — are the tremendous strides which are continually made on the marine electronics products and systems front. Competition in this segment is very keen, and the category is dominated by very large, usually diverse industrial conglomerates that have made consolidation of systems and capabilities a quasi-sport in recent years. The need by shipowners to meet increasingly strict rules and regulations with advanced electronic products and systems and the economies of scale of being a "one stop shop" for bottom-line minded shipyards have been primary drivers in the urge to merge. In addition, the task of continually delivering advanced products and systems which are increasingly easy to use requires that

companies dedicate tremendous amounts of capital into the R&D side, another rationale for the trend towards bigger.

Europort was used as the launching pad for two of the world's first type-approved



Kelvin Hughes' ECDIS Certificate.

ECDIS systems, from Transas and Kelvin Hughes. Transas was the world's first company to receive type-approval, as was reported on in the November edition of *Maritime Reporter & Engineering News*, while the Kelvin Hughes announcement was a mild surprise to competitors and customers alike. BSH, the Federal Maritime and Hydrographic Agency, has provided the type-approval for Kelvin Hughes' Nucleus2 "dual-fuel" 5000 and 6000 Electronics Chart Display and Information System (ECDIS) in accordance with the IMO resolutions and IEC specification. While a string of new ECDIS approvals are anticipated in the coming months and years, currently Kelvin Hughes is the only company to offer an IBS solution with a type-approved ECDIS.

ECDIS is much more than a simplistic replacement for paper charts, and is rather an integrated, complete solution to the navigator. The Nucleus2 ECDIS works in harmony with other bridge

equipment such as the radar, GPS and autopilots, taking real-time information to continuously update the on-screen display.

While the developments in ECDIS



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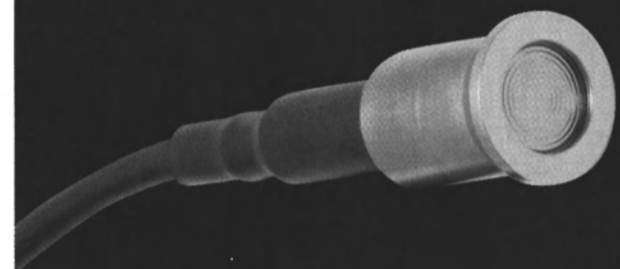
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will surely sweep many maritime circles in 2000, and remains a leading edge technology, Transas' **Andrey Vorobiev**, chief design engineer, Marine Navigation Systems, points out that ECDIS is simply the cusp of development, and that the next step will involve integration of all shipboard systems.

Echoing that thought was **Patrick T. Enright**, Litton Marine System's (LMS) new director, Strategic Business Unit Machinery Automation, who recently

joined LMS to lead the development of a complete ship control and monitoring system. LMS is a particularly strong example of a company that has steadily built through acquisition, as it has integrated a host of widely recognized marine industry manufacturers in recent years, including Decca and C. Plath. Litton has traditionally exuded a strong market confidence — confidence backed by a significant backlog of orders on both the commercial and naval

fronts. Today is no different, as Litton touts its position aboard the largest cruise ship ever built — Royal Caribbean's *Voyager of the Seas* built by Kvaerner Masa-Yards. "The IBS for *Voyager of the Seas* is actually two separate systems," said Dr. **Clark Graham**, president of Litton Marine Systems. "The system has been designed so that there is a complete duplication and redundancy for all critical components."

Litton's major announcement at Euro-

port centered on the introduction of a new virtual reality design tool for bridge layout. Design Vision 1.0 is a conceptual design tool for creating and evaluating integrated bridge system designs. It is a CAD program, which allows the designer to build a 3-D model of the bridge layout and evaluate various configurations. The software was developed jointly by Litton Marine Systems and the University of Strathclyde.

STN Atlas Marine Electronics is another organization which has been transformed significantly of late, as the company was recently integrated into new parent company, Düsseldorf-based Rheinmetall Group, made a major announcement in Amsterdam. STN Atlas presented a new navigational product, the Radarpilot 1000, with various versions of high-resolution 12 and 16-in. color graphic displays. New features include a new "clean sweep" function which is designed to significantly eliminate clutter, and an enhanced zoom function to offer an enlarged display for tracked targets.

For more information on:

Transas' type-approved ECDIS
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Kelvin Hughes' type-approved ECDIS
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Litton Marine System's Design Vision 1.0
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Raytheon Presents Its New Raychart 420

Raytheon, supplier to the worldwide recreational marine electronics market, introduces its new, fully waterproof Raychart 420 chartplotter. The new device uses intuitive software to simplify sophisticated functions such as viewing electronic charts, navigating, and creating and editing waypoints. The chart's Find Ship button instantly centers the screen on your current chart position - no matter which area of the chart you are viewing.



Measuring six-in., the compact LCD Raychart 420 is economically packaged with the Raystar 112LP GPS. For advanced accuracy, Raytheon offers the Raychart 420D, which is equipped with the Raystar 114 combined GPS/Differential beacon receiver, providing repeatability greater than 39 ft.

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A New View In Bridge Design

Introduced for the first time at the Ft. Lauderdale Boat Show and exhibited for the first time at Europort, Kelvin Hughes' new MANTA Integrated Bridge System offers vessel owners a unique new look in bridge design. Developed in consultation with one of the world's premier SuperYacht designers, **Jon Banenberg**, the system uses flat screen technology with a space saving and ergonomic design. The system's "At Sea" mode entails the units five displays operating as multi-functional, interchangeable Radar, ECDIS, Conning Display, Collision Assessment and Avoidance System and a

Alarm Monitoring and Control/Communications system.

In "Harbor" mode, the displays can be used for general ship's monitoring and control functions, such as power management, bilge, fuel and water tank control, fierce detection and air-conditioning.

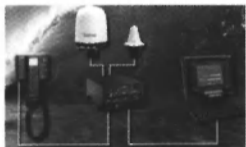
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Kelvin Hughes' MANTA bridge.

Thrane & Thrane Expands Communications Capabilities

Thrane & Thrane has developed a Global Marine Executive Office suite, combining mandatory Inmarsat GMDSS with a fully-fledged executive office communication suite including Internet, e-mail and fax.



Based upon a software interface formulated by Thrane & Thrane engineers, the new product offers users with a variety of different information technology and communications backgrounds for any type of information exchange — at any time from any place.

Extending beyond the Captain's quarters, linking every workstation to the Inmarsat global communication network, the system also enables the connection of a DECT base station to serve cordless handsets on deck, or on quay-side when in port.

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Hvide Marine Continues With Malin 2000

Hvide Marine has purchased the Malin 2000 analyzer — a new low cost portable precision diesel engine analyzer — for vessel Ambrose Channel.

Malin 2000 also increases the speed, accuracy and reliability of determining the health of the main and generator diesel engines. Information can be rapidly gathered and downloaded to a desktop PC, while a Windows-based software program, known as the MK-5 generates a drawcard, indicator and derivative. The program also offers an immediate check on the fuel injection system, power output of each cylinder, fuel injection timing and engine balance trends.

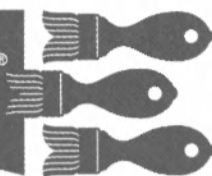
Laurin Maritime (America) is providing MV Sunny Blossom with Malin 3000 MK-5 — a portable diesel engine analyzer with angular velocity sensor.

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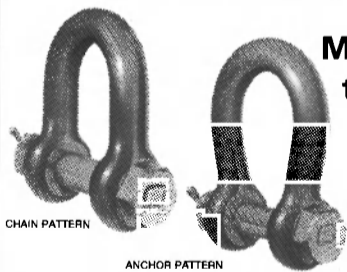
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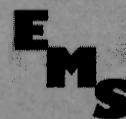
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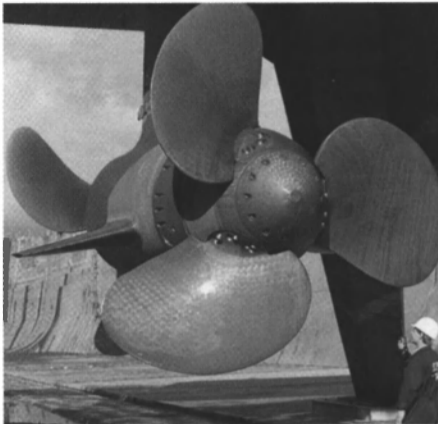
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SSP Pod Approved For Service



After more than two years of development and successful performance trials at Howaldswerke-Deutsche Werft AG in Kiel, the Siemens-Schottel Propulsor (SSP) consortium was granted approval for the new SSP marine propulsion system. Classification society Det Norske Veritas was responsible for technical acceptance of the propulsion system for worldwide service.

The SSP is the result of a successful cooperation between two German marine industry stalwarts, Siemens Marine Engineering Subdivision and Messrs Schottel of Spay. Work began in 1997 on the development of a marine propulsion "pod" system that would be

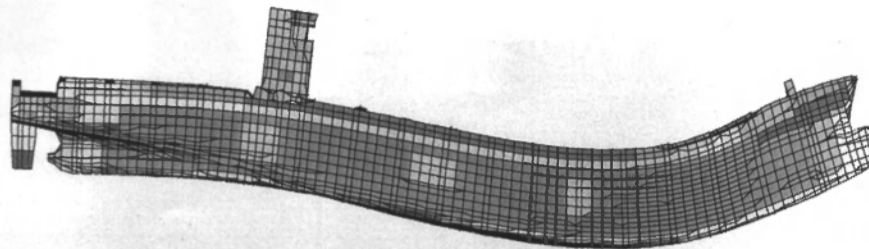
offering not only economic advantages, but superior technological performance. The pod-type propulsion system features an electric motor housed in a pod or nacelle suspended beneath the hull of a vessel, and providing direct drive to a propeller or propellers. The fact that the pod can be rotated about its vertical axis too, so that it points in any required direction, means that the system also performs a steering function.

The power output of the unit tested at the shipyard amounts to 7MW, which corresponds to 9,510 hp.

Similar type pod systems have already been adopted for technically advanced uses, and have been specified and operational aboard such high value vessels such as cruise ships. The system is particularly interesting for the cruise ship market because its twin screws produce low noise and vibration levels to ensure passenger comfort.

Siemens, one of the world's foremost suppliers of electric marine propulsion systems, provided a permanent-magnet motor, which has permanent magnets attached to the rotating rotor. The design of the permanent-magnet motor has been undergoing development and testing for the past 12 years and is now ready for general use, including by the Germany Navy. The Propulsor employs the patented "Twin Propeller System" developed by Schottel GmbH. The prin-

(Continued on page 27)



Containership Safety: Averting Disaster Through Research & Design

Containership design development has grown as rapidly as its gain in popularity as the vessel of choice in many product shipping niches. Germanischer Lloyd's Dr. Hans Payer, who has been on the forefront of containership safety and design issues, examines the strength requirements for large, fast containerships.

The structural safety of modern large container carriers, with their high demands on the hull, could, and still can only be guaranteed by modern methods of analysis. These demands include an extreme deck opening ratio, resulting in considerable deformations due to wave and deck load on hatch covers. Hence, the development of the container vessels was accompanied by continual advancement of computational methods.

Today's Panamax vessel offers up to

4,800 stowage positions, whereby the percentage of deck containers has risen to more than 50 percent. Optimization focuses on minimizing the steel weight and maximizing tonnage, as well as maximizing the stowage positions. Low consumption diesel propulsion engines also contribute towards greater operating economy, with the energy needed per container being only about half that of the third generation container vessels running on steam turbines.

After these optimized containerships were introduced, an increased incidence of forebody damage has been observed, as reported also in a study by the Salvage Association. Typical features include local and global buckling of brackets, wing bulkheads and decks, which considerably reduces the ultimate strength margin of the structure. According to this study, high speeds during bad weather, because of the pressure of time schedules as well as a lack of "seaman's intuition" for extreme loads due to the vessel size, are generally taken as the primary cause of extreme loads higher than previously assumed. Very often, the damage is only noticed in the port of destination, and usually the crew can no longer ascertain the cause.

Ships with a widely flared forebody system have, as was already the case for container carriers of the second generation, a good seakeeping behavior without green water on deck. So from the viewpoint of the shipmaster, there is no reason to reduce speed in a seaway. Only if the danger is recognized, can the risk of foreship damage be reduced

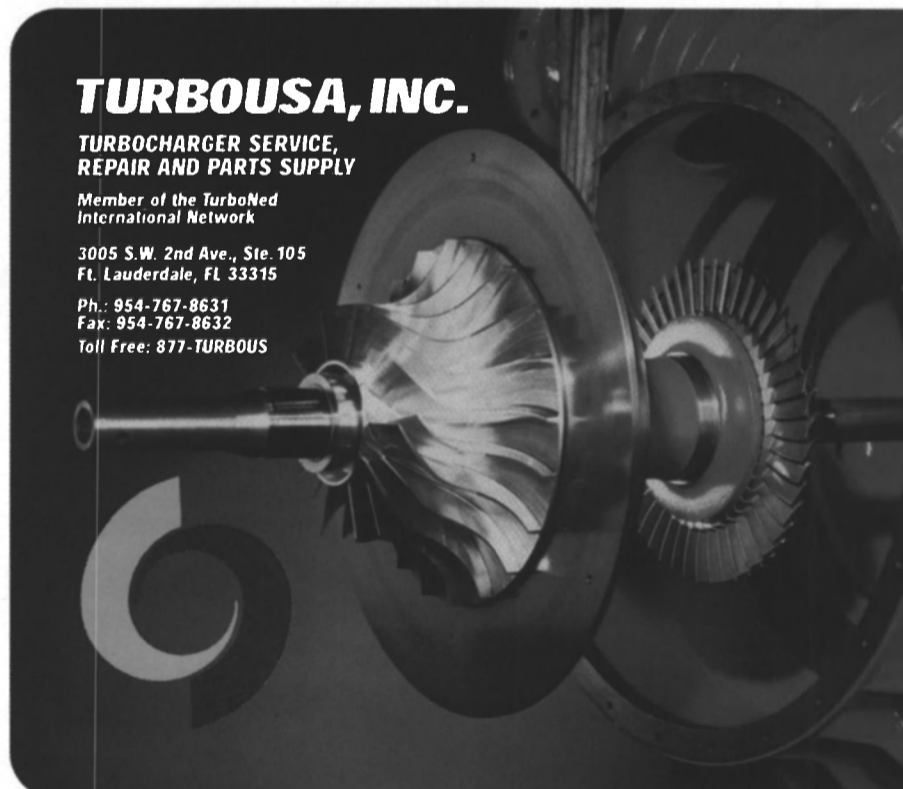
(Continued on page 26)

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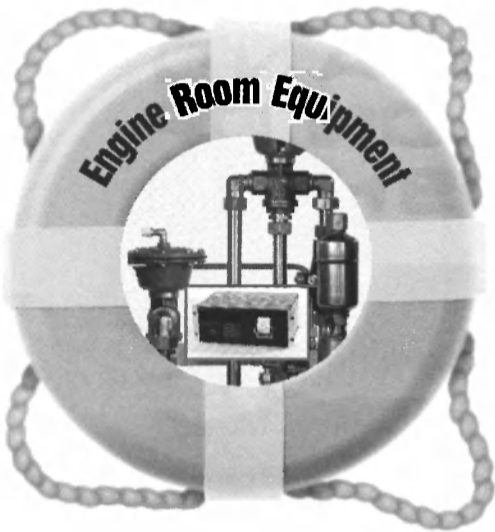
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Marine Engineering

(Continued from page 24)

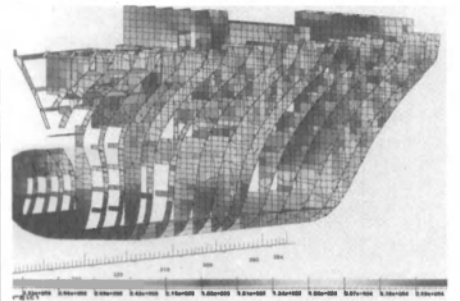
appreciably through changes in speed and course.

It is noticeable that in the North Atlantic, mainly smaller vessels of about 591 ft. (180 m) in length are affected, whereas in the North Pacific it is more so the larger ships. This obser-

vation by the Salvage Association is confirmed by the results of a research project conducted by Germanischer Lloyd, in which inter alia the wave-induced loads and bending moments on various container carriers were measured. Similar problems have also occurred on modern cruise liners, where

a projecting bow is intended to give the ship the looks of an elegant yacht.

A significant advantage for passenger ships is, however, that the bridge is situated far forward, and the master is thus much closer to the bow action than in a jumbo containership. Nonetheless, there is also in the passenger/ferry ship



segment a strong trend towards fast ships: at present, four jumbo ferries and two fast cruise liners are under construction to GL class, all with service speeds of around 28 knots. GL immediately took appropriate action as a result of these findings, and initiated a research project in which, amongst other factors, extreme loads on the forebodies of large and fast ships are being investigated. The development of fast RoRo passenger ferries is the reason why a conventional but very fast (28 knots) RoRo passenger ferry was chosen as the reference ship for the new EU research project DEXTREMEL. In this project, the extreme loads on the ships are being investigated in depth, with the loads on the forebody representing one of the main aspects. Another work package involves determining the structural reserve strength for the elements of a damaged structure and, associated with this, an investigation of the possibilities for enlarging this residual structural strength without increasing the steel weight appreciably. In these studies, peak pressures caused by slamming are being calculated for a variety of bow shapes using modern methods such as computational fluid dynamics. Naturally, the results obtained from the example of a fast RoRo passenger ferry can be transferred fully to other ship types including the container carriers mentioned.

The initial results have already been incorporated into the new edition of the Construction Rules for Hull Structures (Edition 1998). The new regulations include increased design pressures for the forebody structure, including the forecastle, together with structural requirements and guidelines on increasing the ultimate strength under extreme loads. The consideration of stresses caused by hydrodynamic impact forces on the forebody, as part of the global analyses of the large containerships, is the current state-of-the-art ship structural analysis at Germanischer Lloyd.

Just how urgent these amendment to the Rules are with a view to improving the operational safety of modern containerships can be seen from the fact that responsible-minded shipowners - after having been informed by GL - have already, before official publication, made them a contractual requirement for their order of Panamax as well as post-Panamax vessels.

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Circle 256 on Reader Service Card

(Continued from page 24)

principle of the design is to share the propulsive power between two screws so that it is possible to employ propellers with a lower specific loading and very high efficiency which, as well as producing less noise and vibration, also allow significant savings in energy consumption to be made. The SSP comes in sizes from 5,000 to 30,000 kW.

Circle 59 on Reader Service Card

Rochem Snags \$2 Million Celebrity Order

As the cruise market comes under continued scrutiny for its environmental practices, companies — such as Rochem Environmental, Inc. — that manufacture advanced environmental solutions should flourish.

Royal Caribbean Cruises Ltd.-owned Celebrity Cruises recently awarded Rochem Environmental a \$2 million contract to install a Rochem FM-Module gray water membrane system on two of its ships, Galaxy and Mercury. The contract has an option for three additional units.

Gray water, almost 90 percent of which is coming from a cruise ship's sinks and staterooms, can be legally discharged in most places. By using the Rochem system, Celebrity expects to significantly purify gray water that is released.

The membrane system rejects bacteria, suspended solids and organic matter, making the equipment suited for gray water treatment. "We believe this is another important step forward in our Above and Beyond Compliance (ABC) environmental management system," said Nancy Wheatley, vice president of Safety and Environment for Royal Caribbean Cruises.

Circle 62 on Reader Service Card

Boatrac Presents ChartView At Workboat

Boatrac, a business unit of Advanced Remote Communication Solutions (ARCOMS) has formed a strategic alliance with Nobeltec Corp., a developer of charting and navigation software. Together, they will spotlight ChartView Celestial Mariner, Boatrac's and Nobeltec's nautical charting navigation and communications software, which was presented at the 1999 Fish Expo in Seattle during November.

The product was shown again at the International Workboat Show in New Orleans in December.

ChartView is a complete electronic charting and navigation solution for the marine navigator.

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need, while offering auto-pilot controls, an integrated captain's log and the GPS Data Manager.

The package also includes the industry standard "Tides and Currents Pro," which is designed to provide accurate tide and current predictions through the year 2100 for the entire North American continent.


Circle 54 on Reader Service Card

Pennzoil Launches New Synthetic Line

Pennzoil Marine has expanded its line of marine lubricants to include three 100 percent synthetic products: Pennzoil Marine 100 percent synthetic Outboard two-cycle oil TC-W3; Pennzoil Marine 100 percent synthetic Lower Unit Gear Lube SAE 75W-90; and Pennzoil

Marine 100 percent synthetic White Marine Grease. The Synthetic Outboard oil is a biodegradable product, recommended for use in all makes and models of water-cooled, two-cycle engines using either variable ratio oil injection systems or a pre-mix of oil and gasoline. It can also be used for air-cooled two-cycle engines that require ashless oils.

Circle 61 on Reader Service Card



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SHIP'S HEADING: 351°
SHIP'S SPEED: 22.6 knots

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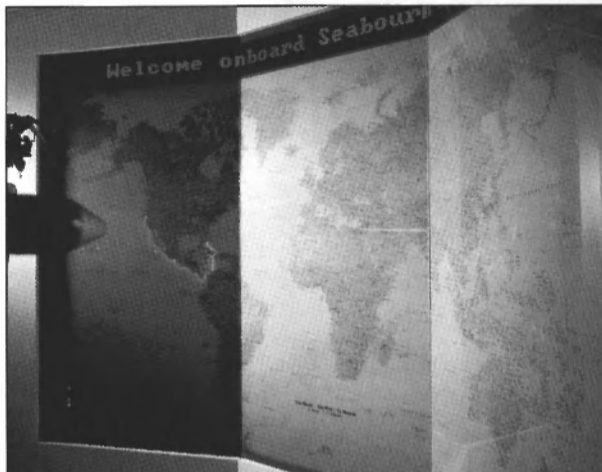
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Northrop Grumman Readies New Gas Turbine For Market

As the use of gas turbines as main ship's propulsion power continues to grow in popularity, particularly in the niche vessel segments of cruise shipping and rapid transport, Northrop Grumman recently announced that its WR-21 Intercooled Recuperated (ICR) advanced-cycle gas turbine ship propulsion engine has begun final development tests for the market which has most widely used the product in ship propulsion applications — naval.

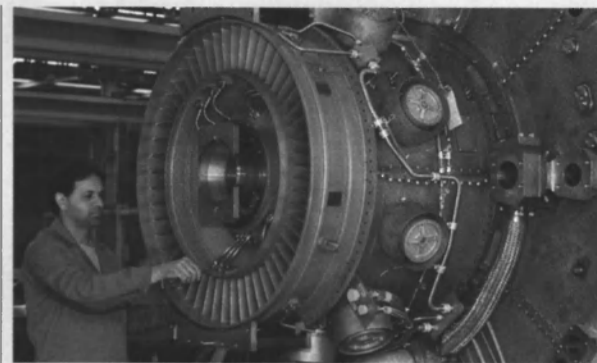
The engine, which is being developed for naval warship applications through a team led by Northrop Grumman, is being put through its final paces at a naval facility in Philadelphia. England's Rolls-Royce is designing and developing the gas generator and power turbines, while AlliedSignal's Aerospace Systems & Equipment Group in Los Angeles is providing the Intercooler and Recuperator Heat-Exchanger

Cores.

The WR-21 is touted particularly for its fuel efficiency, as it will reportedly reduce both operation and support costs significantly while keeping the naval ships it serves battle ready. To date, it is a candidate for the U.S. Navy's DD-21 program and for European advanced combatants.

"In initial tests, the WR-21 has already demonstrated a 25 percent annual propulsion fuel savings, compared to the existing gas turbine engines on a typical Navy destroyer," said **Jim Hupton**, vice president, Northrop Grumman Marine Systems. "The WR-21 is now predicted to deliver a 27 percent propulsion fuel savings in its initial mechanical drive production configuration.

An additional benefit from the newly developed gas turbine is a lower exhaust temperature, which can help to reduce the infrared signature of the vessel. Also, the



system is designed to reduce airborne noise by 70 percent over current marine gas turbine models. The WR-21 is designed with ease of maintenance in mind, as well, and individual modules of the unit can be removed and replaced aboard the ship.

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Great Ships of 1999

Builder Kvaerner-Masa Yards
Vessel name Voyager of the Seas
Vessel type Cruise Ship
Owner Royal Caribbean
By David Tinsley

Slipping out through the Finnish archipelago on a Sunday morning at the end of October, Voyager of the Seas cut a figure of unprecedented scale in the passenger ship sector, symbolizing both the surging growth in the cruise market and the fertility of the Finnish maritime technology cluster.

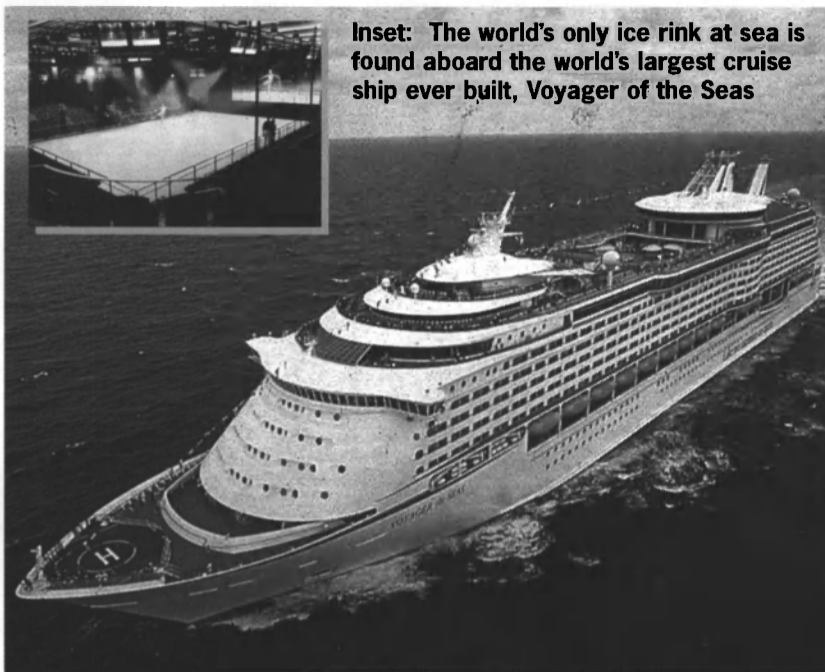
The 137,200-gt cruise ship, whose towering superstructure and an air draft of 208-ft. (63.5-m) belies a relatively tender draft of just over 28-ft. (8.8-m), marks a new high-point in the industry's unerring endeavors to foster long-term sustainable business development in the seagoing leisure sector.

Although the shipbuilding price from

Kvaerner Masa-Yards was around \$500 million, about seven times the current cost of a VLCC, Royal Caribbean estimates that its overall project expenditure in bringing Voyager of the Seas to the market has been closer to \$700 million. The group's overall fleet expansion program is no less astounding than its record-breaking new cruise liner, with \$3.6 billion being ploughed into new-build investments spanning deliveries up to the summer of 2002.

At a time when European shipbuilding is facing intensified competition from the Orient in fields of construction it has hitherto dominated, as demonstrated by Japanese and Korean successes in the cruise ship and RoRo passenger (RoPax) ferry segments, Voyager of the Seas is a powerful reminder of Nordic maritime industrial capabilities.

Quality and contractual performance have long been the watchwords of Kvaerner



Inset: The world's only ice rink at sea is found aboard the world's largest cruise ship ever built, Voyager of the Seas

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Maritime Reporter/Engineering News

Masa-Yards (KMY) and its forebears. The shipbuilder's track record in meeting delivery undertakings has been reinforced by its delivery of the latest, seminal vessel on schedule. The accomplishment has been all the greater for the production setbacks it suffered during the early part of the year when the ship sustained a fire and mainly smoke-incurred damage while alongside at Turku.

"Like no vacation on earth" is emblazoned along the sides of the hull of a vessel in which the design focus has been not only on combining the biggest-ever cruise passenger volume with very high standards of comfort and service, but also on melding passenger scale with considerable variety in shipboard activity and facilities. While acutely aware of customers' rising expectations and perceptions of 'value-for-money,' the shipowner has sought to bolster overall revenue generation through higher quality and imaginative new activity options.

The size of the shipboard community at any time during the course of its seven-day voyages in the Western Caribbean is startling, whether judged by the lower-bed passenger capacity measure of 3,138 or maximum of 3,840, together with up to 1,180 crew.

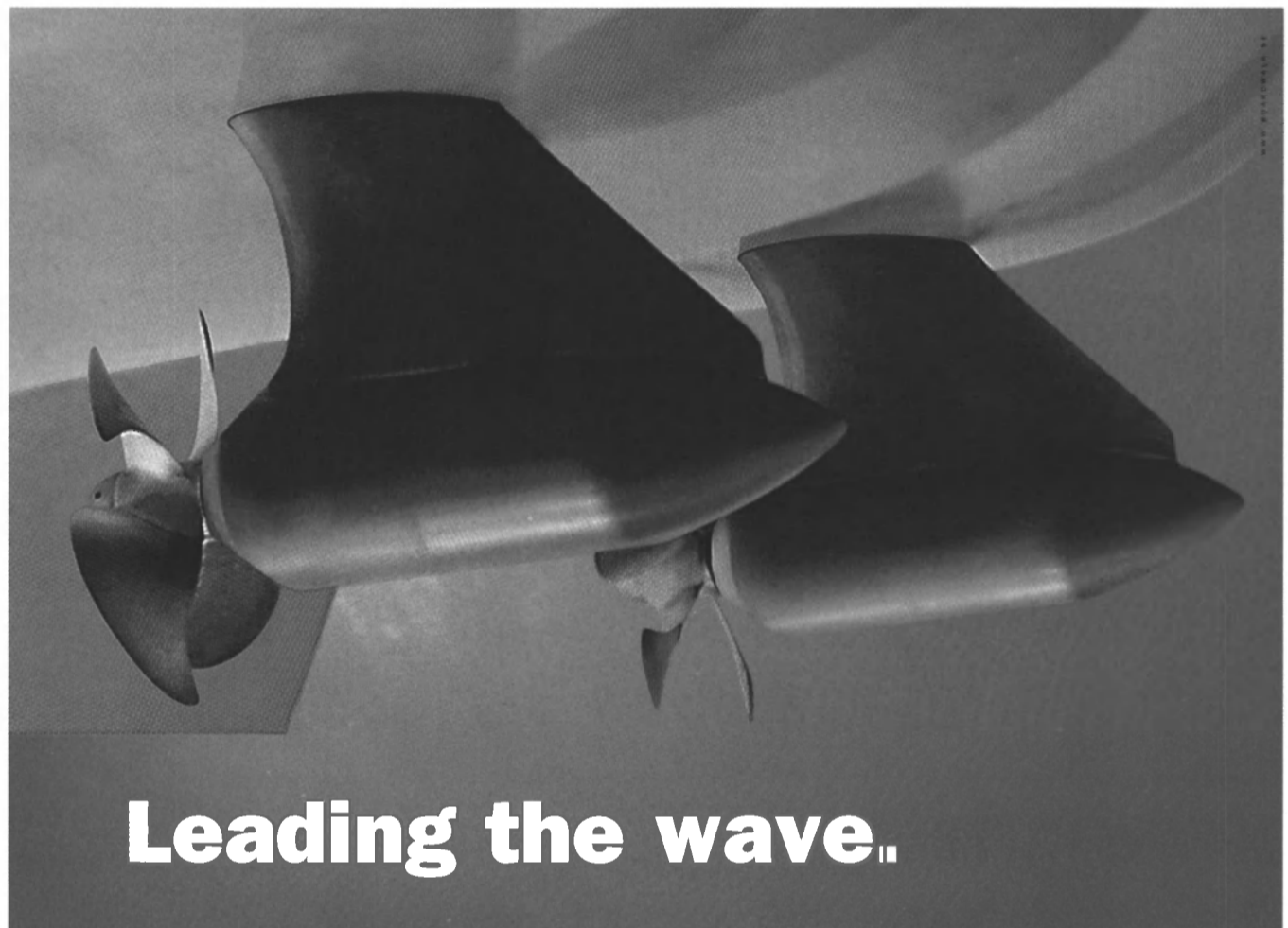
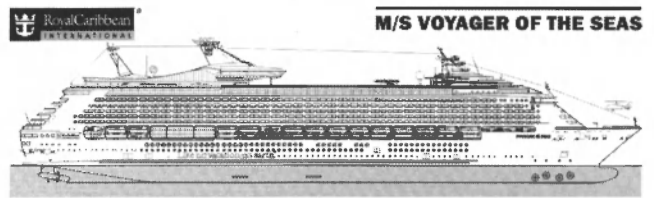
Voyager has occupied some of the best minds in interior design as well as some of the most innovative minds in naval architecture. The vessel furthermore denotes the attainment of a new milestone in the passengership domain as regards marine engineering technology, expressed in its refined diesel-electric power and propulsion system incorporating a triple Azipod configuration. Voyager of the Seas is emphatically also

a new showcase for the concept of redundancy, applied to the main shipboard operating systems, and signifying central concerns with issues of reliability and safety.

The design of the new leviathan succeeds in combining the largest-ever cruiseship passenger capacity with spacious staterooms and public areas, accentuated by the truly remarkable,

four-deck high, interior promenade, culminating at each end in an 11-deck high atrium. Evocative of the renowned Burlington Arcade in London, the Royal Promenade extends for 394 ft. (120 m) through the heart of the vessel, flanked by a wide selection of shops,

restaurants and entertainment areas, and incorporating special lighting and coloring effects to change its ambience, just as the day turns into night. The fact that



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Main Particulars

Flag Liberia
Classification Det Norske Veritas
Length, (o.a.) 1,021 ft. (311.1 m)
Length, (b.p.)	..... 901 ft. (274.7 m)
Breadth, (max.)	..... 156 ft. (47.4 m)
Breadth, (molded)	..... 127 ft. (11.7 m)
Depth (to promenade)	..... 70 ft. (21.3 m)
GT	..... 137,300
Draft, (design)	..... 28 ft. (8.6 m)
Draft, (scantling)	..... 29 ft. (8.8 m)
Air draft	..... 208 ft. (63.5 m)
Speed, service	..... 22 knots
Passengers	..... 3,840
Crew	..... 1,180
Main engines	..... 6x Wartsila 12V46C, medium speed
Output	..... 12,600 kW @ 514 rpm each
Alternators	..... 6x ABB Industry
Output	..... 3-phase 11,000V, 60Hz
Propulsion motors	..... ABB Marine
Output	..... 3x 14,000 kW/0-140 rev/min.
Propulsion units	..... ABB Azipod Oy
Output	..... 2x 360 deg FP Azipod
Bow thrusters	..... Kamewa
Roll stabilization equipment Brown Brothers
Mooring equipment Brissonneau & Lotz Marine
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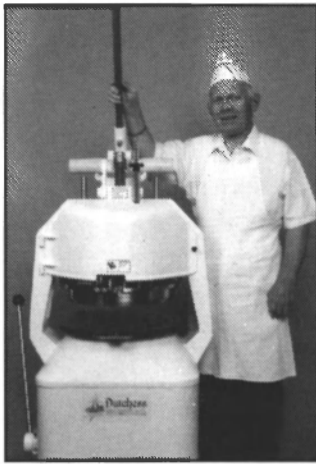
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some nine percent of the vessel's staterooms have bay windows overlooking the Royal Promenade enhances the effectiveness of this astounding central feature, and should better realize the extra revenue potential it offers. The preoccupation with the expectations of an increasingly discerning passenger market is reflected in arrangements whereby 69 percent of the total 1,557 passenger cabins have a view, either seaward or into the mall, while 49 percent incorporate a balcony. The conceptual design for Project Eagle, in support of the \$1.5 billion, three-ship series entrusted to KMY's Turku yard, was provided by Kvaerner Masa-Yards Technology - highly regarded worldwide for its innovative approach to ship design - in close co-operation with Royal Caribbean. The combination of the wider-than-Panamax beam, affording the extra stability for a still greater breadth in the main passenger decks, and the longitudinal division of the superstructure by way of an indoor arcade, or promenade, have been fundamental to the Eagle concept.

The idea of a central mall running through the ship was first applied in the Finnish domain almost a decade ago, in the Turku-built ferries Silja Serenade and Silja Symphony. At the time of their delivery in 1990/91, the 58,400-gt sisters had signified a major new stage in the evolution of the Baltic cruise ferry concept.

Voyager of the Seas provides a new window on Finnish engineering in a number of sectors, not least as regards her cycloconverter-based, ABB electric propulsion system and array of podded propulsors of the proven Azipod type. The trials results met or exceeded expectations, with the vessel having achieved a forward speed of 25 knots, compared with an anticipated, maximum service speed requirement of 22 knots, and made an incredible 17 knots astern. Moreover, she was worked athwartships at five knots, such a relatively high rate of lateral travel being achieved using the two azimuthing units within the three-pod configuration, in conjunction with the four tunnel thrusters in the foreship section. Each Azipod offers an output of up to 14-MW, the centerline, fixed propulsor being flanked by two 360-degree rotatable units, while a total of 12 MW is available from the staggered line of bow thrusters.

A crash stop distance of less than six ships' lengths, with full control available throughout the maneuver, and a highly responsive, precise action in very slow-speed navigation through the rock-bound leads of the archipelago, also helped endear the vessel to her handlers.

The 75,600-kW primary power concentration engendered by Wärtsilä 46-series diesel machinery, whereby six 8-cylinder engines drive the main gensets, testifies to Finnish strengths in medium-speed engine design and manufacturing. Inevitably, the speed with which a vessel of such considerable passenger and crew capacity might be safely evacuated in the event of a casualty in difficult weather and sea conditions is always a point of interest. Certainly, she has been designed and equipped to meet the toughest regulatory requirements in that regard. However, in keeping with the principle of risk minimization and the philosophy that the ship herself should be the safest haven in all circumstances, Voyager of the Seas incorporates an exceptional degree of system redundancy and, furthermore, offers the highest design integrity.

It is claimed that she could take a 40-degree angle of heel before suffering water ingress although, of course, she has been designed and equipped mindful of passengers' tolerance of little more than a level platform at all times. Not without cause has she assumed the mantle as the first vessel to receive Det Norske Veritas' Comfort-class notation. The high level of engineering redundancy is reflected in the DNV Redundant Propulsion (RP) certification, as an acknowledgement of features such as the divided main machinery plant and main electricity distribution system. Moreover, she has been equipped with a dual, integrated bridge system from Litton for all key navigation and command functions, as reportedly another 'first' in the industry.

Builder Astilleros Españoles
Vessel name Stolt Sea, Stolt Sun
Vessel type Parcel tankers
Owner Stolt

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This flexible cargo section is divided into 36 integral tanks and four deck tanks, designed to carry IMO type 1 and 2 chemicals, plus hazardous and corrosive cargoes by means of two longitudinal bulkheads vertically corrugated. An exception to this would lie in cargo tanks numbered one, two and 13, where the longitudinal bulkhead is arranged in the centerline.

Cargo tank capacity amounts to 25,220 cu. m. with payload cargo reaching a 24,720 cu. m. total at 98 percent cargo tank capacity.

Each tank is served by its own submerged hydraulically driven cargo pump and associated piping made of 316L stainless steel. A fully integrated cargo service system controls and monitors every operation and includes, in each cargo tank, temperature sensors at three levels, an internal cone antenna for level indication, transmitter gauges, remote pressure sensor of vapor space and independent high level (95 percent), and overfill (98 percent) alarms. This

system is topped off with individual independent heating and cooling systems. Additionally, each cargo tank is fitted with three, two or one multi-stage fixed tank cleaning machine. Fully equipped with an integrated navigation bridge, fulfilling the one man bridge notation, the vessels also feature a set of systems that include one voyage data recorder system and one rate of turn indicator (ROTI) system with three

repeaters. The bridge system integrates a variety of functions such as digital radars, adaptive track pilot and position sensors.

Able to apply a service speed of 15.2 knots, the vessels' structure includes a double skin design and double bottom running the entire length of the cargo section plus the engine room. The double sides protect the cargo area by way of longitudinal flat bulkheads.

Main Particulars

Classification	DNV
Length, o.a.	533 ft. (162.6 m)
Length, b.p.	505 ft. (154.1 m)
Breadth (molded)	78 ft. (23.7 m)
Depth (molded)	44 ft. (13.3 m)
Draft	10.1 m
Deadweight	22,460
Propulsion power	6,500 kW
Service Speed	15.2 knots
Capacity	25,220 cu. m
Crew	28



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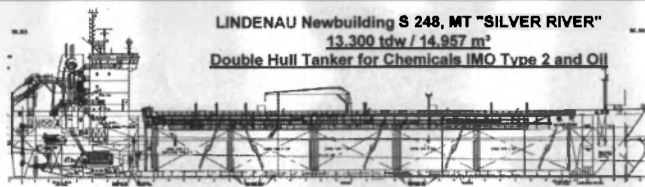
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Great Ships

Builder Lindenau GmbH,
Vessel Name Silver River
Vessel type DH chem/oil tanker
Owner China Changjiang Shipping Group

Designed for the economical, international and ecological transport of oil and



LINDENAU Newbuilding S 248, MT "SILVER RIVER"
 13,300 tdw / 14,957 m³
 Double Hull Tanker for Chemicals IMO Type 2 and Oil



chemicals, Silver River, constructed by German-based Lindenau was delivered to one of the largest Chinese shipowners - China Changjiang Shipping Group on June 26, 1999. Classed by Germanisch-

er Lloyd as a Chemical/Oil Tanker, the vessel is the third out of a four-part series built within 1.5 years by Lindenau.

This newbuilding, which joined its sister vessel Gold River delivered on March 1, 1999, is a member of Lindenau's Tanker Class 2000 featuring internationally patented Lindenau bulbous bows - allowing the vessels to reach speeds of 14.8 knots at a constant engine output of 2,920 kW. Adding to Lindenau's trademark bows, which allow for high speed at low fuel consumption, Silver River fulfills all relevant regulations such as MARPOL, IMO Resolutions and Charter Requirements.

Advantageous features of this vessel include minimum risk of environmental pollution, increased collision resistance, minimum effort for tank cleaning and minimum loss of energy for heated cargo.

Silver River's high flexibility due to various cargo tank sizes and high cargo tank volume also offers a centralized cargo control via control desk in the cargo control room - providing economical and practical automated cargo and ballast handling.

Consisting of Framo hydraulic-driven pumps, which are directly connected to five manifold lines, the vessel can carry up to ten different cargoes - separate loading and discharging up to five cargoes is possible. All valves, except the manifold valves are remote-controlled from the control desk in the cargo control room. Ballast valves and pumps are also controlled from the cargo room.

Silver River is suitable for transporting oil and chemical products in 11 cargo/sloptanks and has a larger loading flexibility due to its well-balanced damage stability and increased longitudinal strength.



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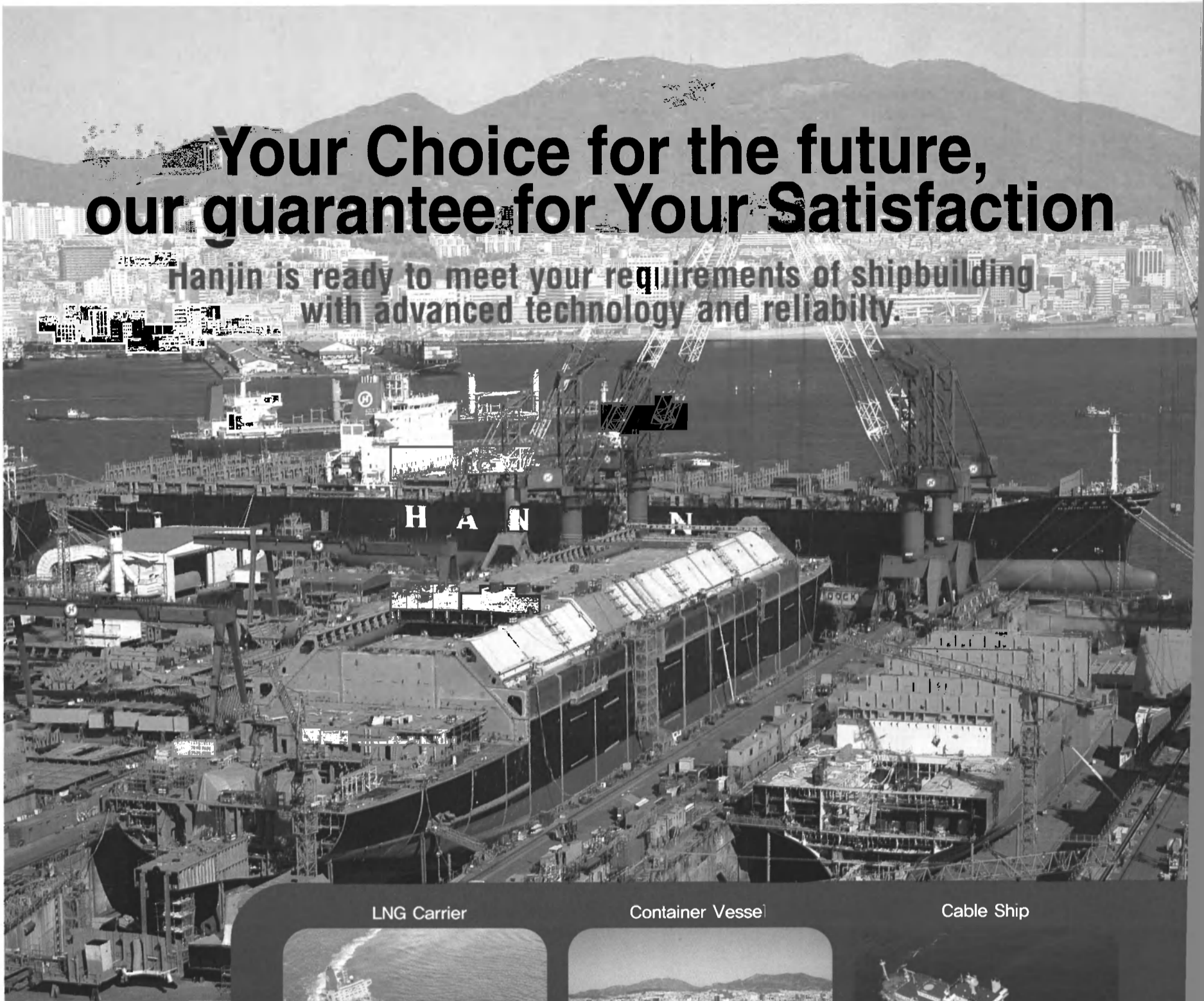
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Main Particulars	
Flag	St. Vincent/Grenaden
Classification	Germanischer Lloyd
Length, (o.a)	145.6 m
Length, (b.p.)	138.5 m
Breadth	19.6 m
GT	8,041
Deadweight	13,300 tons
Draft	8.36 m
Speed	15.6 knots
Main engine	MaK 9 M 32 @ 4,200 kW
Auxiliary engines	Wartsila 6L20
Propeller	Lips
Generators	AvK
Couplings	Vulkan
Reduction gears	Renk
Engine controls	Janssen
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Great Ships of 1999

Builder Avondale Industries
Vessel name Endeavour
Vessel type Tanker
Owner Arco

Though not scheduled for delivery until the summer of 2000, Arco's Endeavour, which is under construction at Litton Avondale Industries in New Orleans, is such an achievement that review of the ship's progress is necessitated in this year's grouping of Great Ships. When the Arco Millennium tanker project was announced in 1997, it was recognized as one which would require exceptional adherence to technical excellence in the design, construc-

tion and outfitting of what could arguably be described one of the more advanced oil tankers in the world.

With its operation in and around the environmentally super-sensitive U.S. West coast (it was designed primarily for the 2,400 mile round-trip voyage between Valdez, Alaska and Cherry Point, Wash.) the tanker is designed to meet and exceed the provisions of OPA 90. The total contract includes three firm orders and two options, each of which will be uniquely equipped to navigate the rigors inherent in the winter seas of the Alaskan Gulf. Capable of carrying one million barrels of oil in 12 cargo tanks, the inner and outer hulls of the Millennium Class are separated by 10 ft., a measure which exceeds the legal requirement by 50 percent.

The ship series was developed utilizing some of the more outstanding minds and resources, including John J. McMullen Associates (JJMA), MCA Engineers, Inc., SSPA Maritime Consulting AB, Herbert Engineering Co., Glosten Associates Inc., Knutsen Shipping and Astilleros Espanoles, S.A.

Endeavour measures 895 x 152 ft. (273 x 46.3 m) with a depth of 83 ft. (25.3 m). With a cubic capacity of



1,017,161 barrels, the 125,000-dwt vessel will travel at more than 16 knots, powered by a pair of B&W 7550 MCC slow speed diesel engines, which generate a combined 30,030 hp. The tanker's continuous operation - even in the case of emergency - is ensured by the fact that it features two fully independent engine rooms separated by a fireproof, watertight bulkhead. Each engine powers separate, reversible pitch propellers, which are capable of going from full ahead to full astern in seconds, without reversing the direction of rotation. Controls onboard are state-of-the-art as well, as a fully integrated joystick are capable

of controlling the rudders, propellers and bowthruster from a single lever. The vessels can make a complete 360-degree turn within the ship's own length at slow speed or zero speed.

The new vessel will be outfitted with the latest navigational tools, including: ECDIS, three automatic plotting collision avoidance radars, and GMDSS. All data needed to operate the ship will be available on a single system, presented in a concise form to the operator, allowing the operator the ability to spend much less time gathering data and more time to analyze and formulate correct response.

Main Particulars

Length, (o.a.)	895 ft. (273 m)
Length, (b.p.)	846 ft. (258 m)
Beam, molded	152 ft. (46 m)
Depth, molded	83 ft. (25.3 m)
Draft, design	54 ft. (16.3 m)
Draft, scantling	58 ft.
Lightship weight	33,188 metric tons
Deadweight (at design draft)	127,005 metric tons
Deadweight (at scantling draft)	140,122 metric tons
Displacement (at design draft)	160,193 metric tons
Displacement (at scantling draft)	173,310 metric tons
Speed	16 knots
Engines	2x B & W 7550 MCC
Cargo tanks	161,706 cu. m.



Builder Hanjin Heavy Industries
Vessel name Hanjin Muscat
Vessel type LNG Carrier
Owner Hanjin Shipping Co.

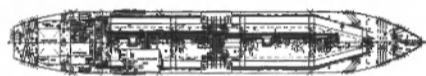
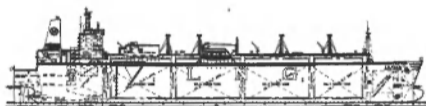
Built by Hanjin Heavy Industries for the transportation of liquefied natural gas (LNG) between Oman and Korea, Hanjin Muscat is a 918 ft. (280 m), 68,524-dwt ship using Gaz Transport's No. 96-2 membrane cargo containment system. The vessel was built with only four cargo tanks, contained within a complete double side/bottom/bulkhead/deck trunk structure, with top and bottom wing tanks. The side and bottom spaces from integral port and starboard water ballast tanks, divided by the duct keel. This double-hull structure not only protects the tanks from external damage, but insulates the outer hull against critical steelwork fractures caused by the low temperatures (-163 degrees C and atmospheric pressure) at which cargo is transported.

Tank insulation is formed by primary and secondary membranes of 0.7 mm Invar (36 percent nickel steel) sheets, in conjunction with expanded perlite beads contained in plywood boxes attached to the inner hull by stud bolts. This combination is able to sustain the liquid pressure, also static and dynamic loads, and to limit the daily boil-off rated to 0.15 percent of cargo volume. Within

each tank, the filling line and two Ebara 1,700 cu. m./hr. electric submersible pumps are arranged on a tripod mast.

These pumps are used for unloading purposes, loading being carried out by shore pumps, with vapor produced in the operation returned to shore by the ship's two 32,000 cu. m./hr. compressors. Other equipment includes a 26,000 kg/hr. main vaporizer, and 7,600 kg/hr. forcing vaporizer, 13,800 N cu. m./hr. inert-gas generator, two 140 N cu. m./hr. nitrogen generators and two 1,250 cu. m./hr. vacuum pumps. Four 50 cu. m./hr. stripping/spray pumps, 550 cu. m./hr. emergency cargo pump, and two sets of 20,000 kg/hr. boil off/warm-up heaters are also fitted.

Two crew members can operate and monitor the entire ship from a centralized administration and control center on accommodation deck D, using two separate



Yamatake-Honeywell TDC 3000 Basic automation systems. These serve cargo/ballast operations and machinery/electric generation, respectively, with Whessoe tank

level gauges, a Foxboro custody transfer systems, and Mitsubishi total boil-off gas control system. Mitsubishi also supplied a loading calculator to assist cargo operations, also an automatic combustion control, burner management and main turbine controls. Other equipment includes an AMCO turbo feed pump control system and Kvaerner ship performance monitors for the machinery installation.

A Mitsubishi MS 40-2 cross-compound steam turbine developing 38,900 shp drives a fixed propeller through a double-reduction gearbox to give a service speed of 20.3 knots, with steam generated from two vertical, two-drum watertube boilers, burning oil or boil-off gas, or

a combination of both. Two 3,450 kW turbo alternators and a similar sized diesel-alternator set satisfy electrical requirements. A water scoop system is provided for cooling the main condenser. A Mitsubishi total navigation system is integrated with three radars, echosounder, a Doppler sonar and docking system supplied by Atlas Elektronik, with additional aids including a Tokimec chart plotter and two GPS navigators.

Main Particulars

Flag Panama
Classification KR, BV
Length, (o.a) 919 ft. (280 m)
Length, (b.p.) 881 ft. (268.5 m)
Breadth 141 ft. (43 m)
Depth 86 ft. (26.2 m)
GT 93,765 tons
Deadweight, design 68,524 tons
Deadweight, scantling 75,463 tons
Draft, design 37 ft. (11.3 m)
Draft, scantling 39 ft. (12 m)
Speed, service 20.3 knots
Liquid cargo volume 138,366 cu. m.
Daily fuel consumption 201.19 tons/day
Main engines MHI, MS 40-2 steam turbine
Gearboxes Mitsubishi
Boilers 2x Mitsubishi @ 68,000 kg/h
Mooring equipment BLM
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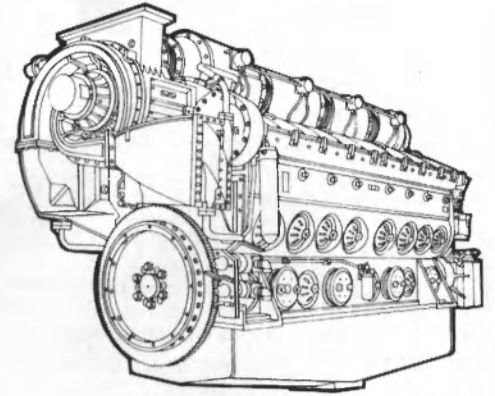
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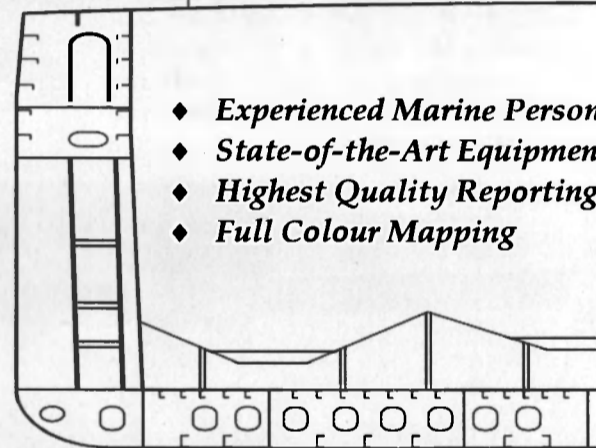
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Great Ships of 1999

Builder Daewoo
Vessel name OKHA
Vessel type FSO
Owner ICB Shipping



Originally planned and designed as the third vessel in a trio of three conventional Crude Oil Tankers ordered by ICB Shipping, Daewoo constructed the 158,000-TDW Okha - modification to FSO. Although the vessel had been aimed at operating not only in tanker mode, but also

in FSO, efficient design and construction had been achieved economically through ICB & SBM's operational experience.

Prior to its designation as a crude oil tanker during the first half of 1999, Okha, which was delivered on May 11, is currently being operated as a FSO unit at Sakhalin oil field.

The vessel houses six pairs of cargo tanks and a pair of slop tanks in three segregation and 15 ballast tanks including peak tanks, which form double skin meeting MARPOL requirements. Accommodation stands at 36 with four tiers and a navigation bridge. Total cargo capacity is 173,300 cu. m. and ballast capacity is 54,560 cu. m. As a noted FSO Unit, the vessel has equipment consisting of a bow cargo loading station, stern cargo offloading station and turbine type of metering unit with the steel support structure and a laboratory unit. Two sets of quick release mooring hooks provide for the single point mooring with a SALM buoy and an electro-hydraulically driven deck crane of offshore type is provided on the starboard side for handling offloading goods from the supply boat, cargo hoses and Suez mooring boat. One bow loading pipe of ND 300mm is arranged from loading station at portside and connected to the manifold cross-over line in midship, and a fire safe type ESD (Emergency Shut Down) ball valve at loading station is remotely/hydraulically controlled from CCR and the wheelhouse.



Builder Hyundai Heavy Industries
Vessel name Bunga Melati
Vessel type Chemical Tanker
Owner MISC

In early July, Hyundai Heavy Industries delivered a 30,000-dwt chemical tanker to Malaysia International Shipping Corp. (MISC). The vessel, dubbed Bunga Melati 4, is a double bottom and double skin chemical tanker with 34 cargo tanks including 16 stainless steel tanks. Classed by LR, the vessel is a single screw diesel engine driven ship of flush decker with forecastle and poop, with bulbous bow and open water type stern. The cargo area is divided by two longitudinal corrugated bulkheads and nine transverse corrugated bulkheads. In the cargo tank section, the vessel has a double hull with side ballast tanks and a double bottom. The ship is designed to carry chemical cargoes type 2 and 3 as specified in the IMO IBC Code.

The cargo tank section of the Bunga Melati 4 comprises 34 cargo tanks including 16 stainless steel 316 LN tanks, 16 coated (phenolic epoxy 300 mic) tanks and two slop tanks, each equipped with a hydraulic motor driven centrifugal submerged cargo pump (Framo type), with a capacity of 450-250 cu. m./hr. for cargo tanks and 190 cu. m./hr. for slop tanks.

The internal parts of the stainless steel cargo tanks have been pre-treated by a local company that specializes in marine and industrial services, a company which also took care of degreasing, pickling and passivation for the cargo tanks.

This pipeline arrangement allows the connection of each tank separately to either starboard or port manifold outlet. For cargo heating and tank cleaning purposes, all cargo tanks are fitted with stainless steel heating coils and cleaning machines.

Heating is by steam. Gas freeing of the tanks is with mechanical ventilators, which are installed in a fan room.

N2 gas supply system with N2 bottle is provided for the ullage space of cargo tanks to compensate for normal losses during transportation. Each cargo tank and slop tank is provided with pressure sensor type level gauge.

The ship is powered by a six-cylinder in-line low speed, two stroke marine diesel engine, a Hyundai-B&W 6S50MC, which develops an MCR of 9,600 bhp at 119.6 rpm.

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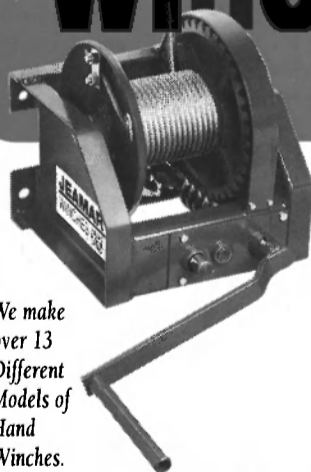
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Great Ships of 1999

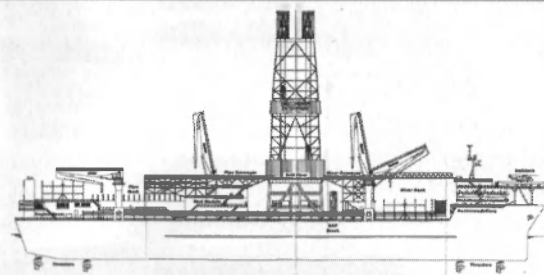
Builder (Hull) Astano
Modules Integration Ingalls
Vessel name Discoverer Enterprise
Vessel type Drillship
Owner Transocean Offshore

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struction and field development performance.

Transocean Offshore owns the vessel, which was constructed at El Ferrol, Spain. Supplementary to this is Ingalls Shipbuilding's test and trials contract with BP-Amoco Corporation. The Pascagoula-



based shipyard completed the rigs outfitting and erected all of its major modules.

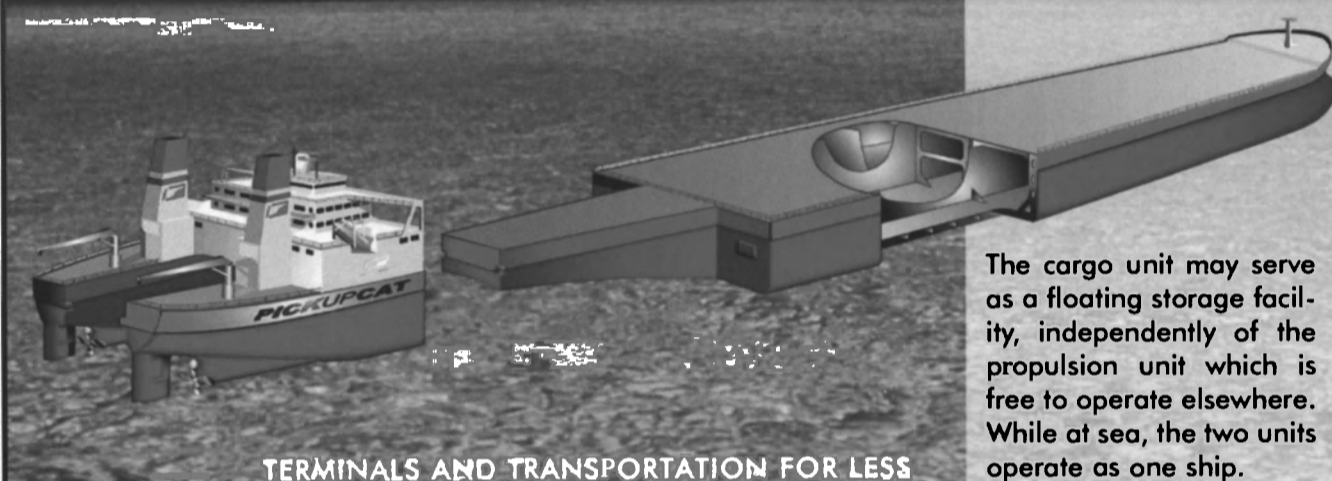
Both massive and multipurpose, Discoverer Enterprise can drill, test and complete wells to 35,000 ft. in water depths up to 10,000 ft. It is equipped to provide extended well testing and storage capabilities and allows a variety of subsea operations, including the potential for j-laying ultra-deepwater pipelines.

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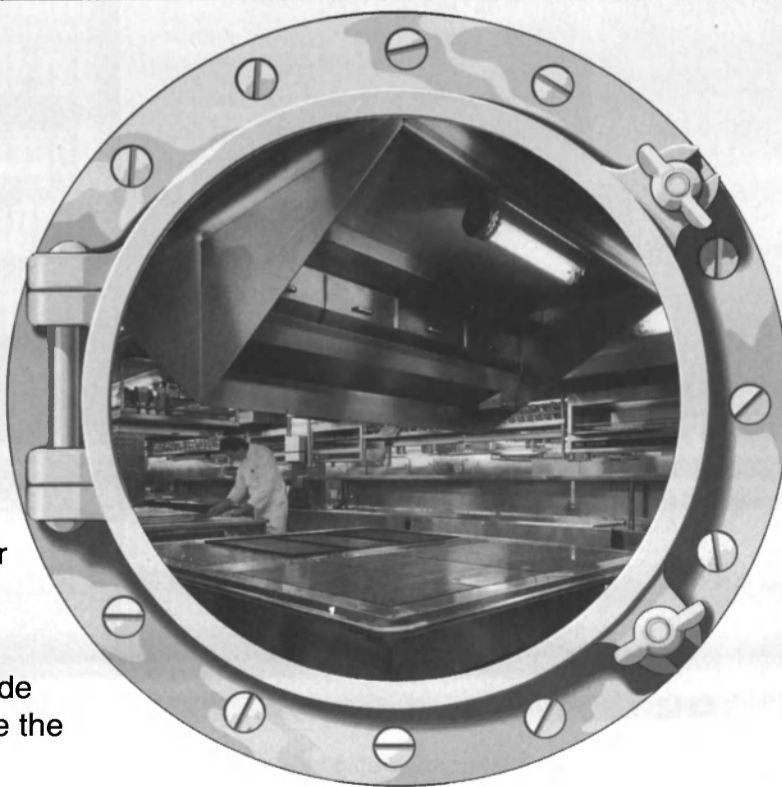
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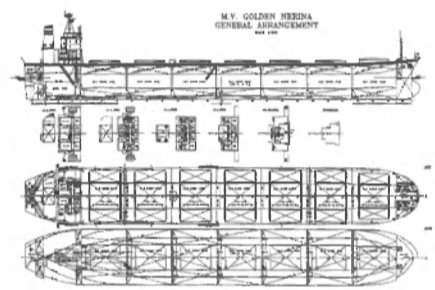
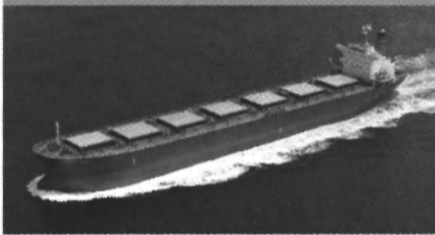


Main Particulars

Flag Panama
Classification DNV
Length, (o.a.) 835 ft. (255 m)
Breadth 125 ft. (38 m)
GT	..... 63,003 metric tons, 63,190 tons
Displacement	..... 100,000 metric tons
Deadweight	..... 93,117 metric tons
Draft	..... 12 m, plus 6 m for thruster
Speed	..... 12 knots
Fuel consumption	..... 191 g/KWH - engine
Main engines	..... 4 Wartsila 18V32 and 2 12V32
Total hp	..... 52,200
Thrusters	..... Kamewa
Generators	..... ABB Vetco
Emergency generator	..... Wartsila
Motor starters	..... ABB
Engine controls	..... Woodward/Simrad
Coatings	..... Hempel Coating System
VHF radio	..... Skanti and Sailor
Radar	..... Furuno
Compass	..... Gyro Compass
GPS	..... Leica
Autopilot	..... Robertson
SATNAV	..... Kongsberg Simrad
Pumps	..... Hamworthy
Heat exchangers	..... Alfa Laval
Lifeboats	..... Norsafe
Waste management system	..... Omnipure
Derrick	..... Dual activity 226 ft. Dresco design
Pipe handling	..... Varco PRS-5
Tensioners	..... Hydralift
Mud pumps	..... National

Two full-capability, full-capacity drilling stations - specifically two separate drilling rigs - are located under the single derrick providing the conceptual simultaneous drilling operations. A drill floor, which is more than twice as large as one that is usually implemented, includes two full sized rotary tables. Full integration of the two rigs is supplied by an automated pipe-handling system with each rig capable of running, pulling and standing back 135 ft. long stands of pipe (vs. the standard 93-ft. stands), thus decreasing the number of drilling and tripping connections.

Builder Hitachi Zosen
Vessel name Golden Nerina
Vessel type Bulk Carrier
Owner Golden Door



Ordered by Golden Door Corporation of Liberia, Golden Nerina, a 75,484-dwt bulk carrier was constructed by Hitachi Zosen's Maizuru Works for an August 5 delivery.

Registered in Panama, the vessel is the 97th Hitachi Panamax and second Hitachi Panamax jumbo vessel that houses various upgrades over the original version. It is the fourth bulk carrier in the series built with an ABS Safe Hull; deadweight tonnage and cargo capacity are considerably greater than previous vessels.

Golden Nerina is equipped with an energy-efficient Hitachi Zosen MAN B&W main diesel engine with the Hitachi Zosen Super Stream Duct (SSD) at its stern. The vessel holds exceptional propulsion efficiency and fuel economy as well.

Main Particulars

Flag Liberia
 Classification ABS
 Length, (o.a.) 712 ft. (217 m)
 Breadth 106 ft. (32.2 m)
 Depth 63 ft. (19.1 m)
 Full draft 45 ft. (13.8 m)
 DWT 75,484 metric tons
 Main engine Hitachi Zosen-MAN B&W
 Speed 16 knots

Builder
Vessel name
Vessel type
Owner

Meyer Werft
Clipper Harald
Gas tanker
Solvang ASA

Joining its sistership, Clipper Viking, which was delivered in December 1998, Clipper Harald was delivered to its owners Solvang ASA in July.

Built in cooperation between Papenburg-based Meyer Werft and Thyssen Nordseewerke of Emden, Clipper Harald measures 146.4 m in length with a breadth of 20.5 m. and boasts a cargo tank volume of 12,660 cu. m. Able to move at a top

Main Particulars

Flag Norwegian
 Classification Det Norske Veritas
 Length, (o.a.) 480 ft. (146.4 m)
 Length, (b.p.) (135.4 m)
 Breadth 67 ft. (20.5 m)
 Draft 25 ft. (7.7 m)
 Deadweight 13,700 tons



speed of more than 18 knots, the gas tanker is capable of carrying products such as ethylene, vinyl chloride monomer, ammonia and propylene oxide in three bilobe tanks.



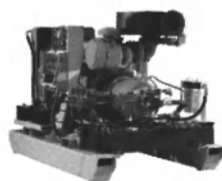
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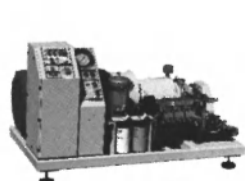


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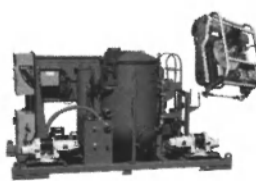
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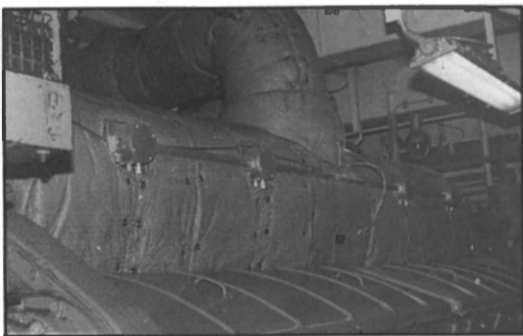
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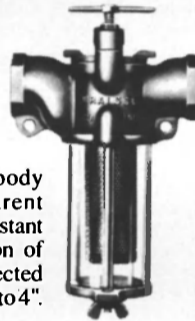


Model 72 Simplex & Duplex Strainers

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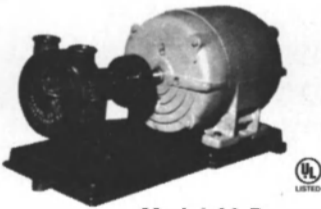
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Great Ships of 1999

Builder
 Vessel name
 Vessel type
 Vessel owner

Samsung Heavy Industries
 SK Supreme
 LNG Carrier
 SK Shipping Co.



Samsung Heavy Industries Co. is scheduled to deliver by year's end, the largest size LNG carrier of GTT Mark-III membrane type and is scheduled to deliver two more vessels within 2000.

Supreme, a 138,000 cu. m. LNG Carrier has been designed and constructed with the regulation of ABS and KR classification societies and the membrane

cargo containment system developed by GTT (Gaz Transport & Technigaz) in France.

The cargo tanks are protected by a complete double side/bottom, cofferdam between each tanks and trunk at topside. For the hull and cargo containment system of cargo tank, Dynamic Load Analysis and extended fatigue analysis have been carried out to ensure the vessel's high reliability and long lifetime.

Cargo will be carried at -163 degrees C in the near atmospheric pressure with an insulation of 250 mm and membrane of 1.2 mm thick corrugated stainless steel sheet.

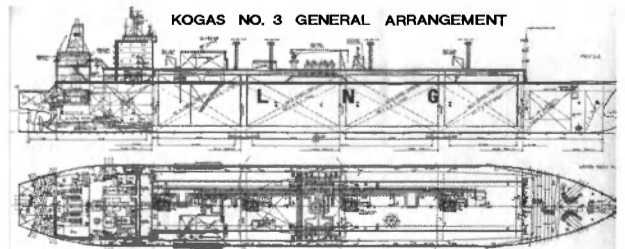
The GazTransport & Technigaz Mark-III system offers a low boil-off rate, in this case 0.15 percent/day of total cargo volume. Each cargo tank is fitted with two 1,700 cu. m. /h submerged centrifugal pumps, which are capable of unloading cargo within 12 hours. Cargo loading is carried out by shore-based pumps, after the tanks have been pre-cooled by LNG spray. Vapor produced during this process is returned ashore through the ship's high-duty compressors. Boil-off gas generated on voyage is heated and delivered as fuel gas to the main boiler by a low-duty compressor and boil-off gas heater.

An elevated walkway over the tanks affords access from the Centralized Administration and Control Center (CACC), located at the fourth tier level of accommodation deckhouse the wheelhouse, to the compressor room and deck. The CACC provides a central command station for cargo and ballasting operations, as well as monitoring, remote control of the propulsion plant, integrated automation and shipboard management systems.

The propulsion machinery comprises a 39,500 SHP Kawasaki steam turbine set driving a fixed propeller through a double reduction gearbox. The vessel's service speed stands at 20.8 knots with a 21 percent sea margin. Steam is generated by two Kawasaki boilers, capable of burning fuel oil, boil-off gas or a combination of both. Electrical power is derived from two turbo-alternators, each producing 3,450 kW, and a 'stand-by' 3,450 kW diesel-driven set.

Fire safety measures include dry powder and water spray for the cargo tank areas, and a water spray for the deckhouse front. Accommodation is provided for 48 persons.

Mooring arrangement and hull parallel body have been especially designed to suit the cargo loading/unloading at worldwide LNG terminals. Cargo cooling, also loading and unloading operations will be done, utilizing two Atlas Copco high duty compressors (32,000 cu. m. /h), a main vaporizer (21,300kg/h) and two heaters





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Great Ships of 1999

Main Particulars	
Flag	Panamanian
Classification	ABS
Delivery Date	Dec. 30, 1999
Length, (o.a.)	915 ft. (278.8m)
Length, (b.p.)	873 ft. (266 m)
Breadth	140 ft. (42.6m)
Depth	85 ft. (26m)
GT	93,000
Draft	37 ft. (11.3 m)
Service speed	20.8 knots
Cargo capacity	138,200
Propeller	HHI
Turbo-alternators	MHI
Hose handling cranes, mooring winches	SHI-BLM
Cargo pumps	EBARA
Cargo control, Ballast control systems	Yuken
Bridge control system	Norcontrol
Fire detection systems	Saraco-Thorn
Fire extinguishing systems	Namyang-Kidde(N.K.)
Radars	Norcontrol
SatNav	Trimble
Gyro compass/Autopilot	Raytheon Anschutz

(1,560 kW), while forced boil-off, and the handling of gas fed to the main propulsion boilers, is served by two ATLAS COPCO compressors (8,500 cu. m. /h), a forcing vaporizer (7,000 kg/h) and a combined heater (540 kW). Inerting of the insulated space and cargo tanks is by means of two Permea nitrogen generators (90 m³/h) and a MOSS inert gas generator (14,000 cu. m. /h). A particular feature of design is the adoption of a single control room for engine room and cargo spaces.

The high degree of automation fitted includes an operating control conditions, optimization of ship and machinery control conditions, ship management and vibration monitoring. A distributed control system incorporates four twin and three single workstations, with electronically self-contained screens capable of controlling any ship function, provided the operator presents the correct badge. Also included are 30 main and 70 submimic boards. New insulation material such as reinforced polyurethane foam and triplex are applied, having excellent quality and reliability, and fabricated by well-established Korean subcontractors. Gas trials have been successfully fulfilled in Korean LNG terminal (Incheon) this past November. Samsung began to invest and develop LNG technology in 1986, and acquired the technologies of engineering and construction from GTT in 1990.



Builder Daewoo
Vessel name SK Summit
Vessel type LNG
Owner SK Shipping

Main Particulars	
Flag	Panama
Classification	KR, DNV
Length, (o.a.)	909 ft. (277 m)
Length, (b.p.)	873 ft. (266 m)
Breadth, molded	142 ft. (43.4 m)
GT	95,400
DWT	69,000
Draft	11.3 m
Speed	20.5 knots
Cargo capacity	138,000 cu. m. in four tanks
Water ballast	52,000 cu. m.
Fuel consumption (daily)	202.6
Main turbines	KHI
Turbo generator	HHI-EMD
Bow thrusters	KHI
Generator engines	Ssang Yong HI
Generators	HHI
Reduction gears	Kawasaki
Engine controls	Nabco
Steering gear	Tongmyung Heavy Industries
Deck machinery	Brissonneau & Lotz marine
Shafting	Daewoo
Bearings	Kobelco
Coatings	Hempel
VHF radio	Japan Radio Co.
Radar	Kongsberg Norcontrol
Compass	Raytheon
GPS	Trimble
Lifeboats	Hyundai Precision
Liferafts	Viking Lifesaving

Designed and constructed to comply with the requirements of Korea Register of Shipping (KR), SK Summit, a 135,000 cu. m LNG Carrier was delivered in August 1999 to SK Shipping by DHI Okpo Shipyard. Registered under the Panamanian flag, Summit will transport Liquefied Natural Gas from Qatar to Korea. The vessel has a continuous upper deck with aft sunken deck, as well as a raked stem with bulbous bow and bow thruster. A fixed pitch propeller is driven by a marine steam turbine. Four cargo tanks, which are capable of holding a capacity of 138,000 cu. m. capacity are designed as GTT membrane type and will keep the LNG at a temperature of -163 degrees C under the condition of maximum daily boil-off rates less than .15 percent of fully loaded cargo volume. Via the cargo hold length, underdeck passageways are situated port and starboard in trunk deck space and also center passageway (pipe duct) with trolley system is arranged in the double bottom. A six-tier deckhouse located aft offers accommodation for 48 with vibration levels in living areas designed especially low at normal operating condition.

The vessel holds a typical cargo handling system, which has been upgraded on membrane type of LNG carriers. Liquefied cargo handling equipments such as a double set of main cargo pumps, one set of spray/stripping pump, and one set of capacitance type level gauge is present.

Summit is constructed to comply with ship/shore compatibility of the LNG loading terminal in Qatar, Oman (Qalhat); Indonesia (Arun/Bontang); and Malaysia (Bintulu) - as well as discharge terminals in Korea. Mooring arrangement, fender contract flat area, gangway landing position/support, manifold arrangement and ship/shore communication systems for these LNG terminals are considered sufficiently in this vessel.

The main powering unit is comprised of the Kawasaki cross compound steam turbine with high and low pressure turbine, double reduction gear and main condenser including astern turbine. The main condenser is designed to be cooled by a scoop cooling sea water system at normal sea going condition and by main sea water circ. Pump at the low load under 65 rpm of main turbine.

Consisting of three switchboards (main, cargo and emergency) the electric distribution system is located in separate rooms. Power is supplied to the main switchboard by three (two steam turbine-driven, one diesel engine-driven) 3,450 kW generators at 440VAC, 3-phase, 60Hz. A diesel-driven emergency generator of 850 kW capacity is connected to the emergency switchboard to meet statutory requirements and to provide for restricted operations if the main generators are unavailable.

Service speed of the SK Summit is confirmed at 20.8 knots fully loaded at 100 percent MCR with 21 percent sea margin, by sea trial, which is increased by .3 knots than the contracted speed of 20.5 knots.

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Builder Qiu Xin Shipyard
Vessel name Maria Desgagnes
Vessel type Tanker
Owner Groupe Desgagnes

Constructed in China at the Qiu Xin Shipyard in Shanghai, Maria Desgagnes is a state-of-the-art double-hulled, ice class 1A, type 2 oil and chemical tanker, which is able to transport 12 different types of cargo at once. Featuring a total capacity of 15,570 cu. m., the vessel measures 394 x 69 ft. (120 x 21 m) requiring an investment of more than \$35 million.

The vessel is chartered by Petro-Nav, a subsidiary introduced by Groupe Desgagnes in 1996 with two other shareholders - Nicolas Gravino and Richard P. Carson - to develop the bulk liquid transport side of the business. The tanker joins two others in the fleet - Thalassa Desgagnes and Petrolia Desgagnes, as well as Rigel Shipping Canada tankers for which Petro-Nav has signed a long term charter agreement.

Known as one of the best-equipped oil tankers in the Canadian fleet, Maria Desgagnes is considered a milestone within the maritime industry. According to research completed by Groupe Desgagnes, aside from the construction of ferries for governments - or passenger ships - this is the first new Canadian-owned merchant vessel to join Canada's shipping fleet since 1984 and the first oil tanker since 1982.

This technologically-driven vessel includes a loading program that calculates ship stability when intact or damaged, among other things; a computer-

ized monitoring system for cargo and ballast tanks, including ullage, temperature, high-level alarm, etc; and stainless steel heating coils for the cargo oil and slop tanks.

With a loading and discharge capacity of 1,800 cu. m., the vessel's main engine houses a shaft alternator, while maneuvering bow thrusters assist in docking and navigation in restricted waters.



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Main Particulars

FlagCanadian
ClassificationLloyd's
DesignerSkipskonsulent A.S.
Contract date	.....August 16, 1996
Length, (o.a.)	.....394 ft. (120 m)
Length, (b.p.)	.....375 ft. (114.4 m)
Depth	.....40 ft. (12.3 m)
GRT	.....8,848
Displacement	.....17,726
Deadweight	.....13,199
Draft	.....30 ft. (9 m)
Engine manufacturer	.....Hudong Heavy Machinery
Engine	.....MAN B&W, 8,370-bhp, 6,150 kW
Engine controls	.....NorControl
Steering controls	.....Tenfjorg
Generators	.....3 x Caterpillar @500 kW
Bow thruster	.....1 750-bhp
Reduction gears	.....Flender type PTO 1200
Deck machinery	.....Hatlapa
Bearings	.....Simplex seal White Metal
VHF radio	.....Furuno
Compass	.....C. Plath
Heat exchangers	.....Alfa-Laval
A/C	.....Airtech
Liferafts	.....Viking
Lifeboats/Davits	.....Norsafe
Waste management system	.....ODME
Ballast control system	.....Danfoss, Ian Conrad System
Cargo control	.....Danfoss, Framo, Ian Conrad
Average speed	.....14 knots
Consumption at sea	.....22 mt/day fuel
Consumption in port4 mt/day diesel
Tank capacity	
Fuel1,126 cu. m.
Ballast5,651 cu. m.

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Great Ships of 1999

Builder Port Weller Drydocks
(A division of CSE)
Vessel name CSL Niagara
Vessel type Two belt self unloader
Owner Canada Steamship Lines

M.V. CSL Niagara, which was delivered by Port Weller Dry Docks this past

July, is the largest seaway capable vessel on the Great Lakes. The two self-unloader resulting was formulated by joining the aft end of M.V. J.W. McGiffin to a complete new forebody built and outfitted by PWDD. Beginning with the new forebody being floated out of the building dock, McGiffin was then

docked and its old forebody was cut and floated off — the new forebody was re-docked and joined to McGiffin's stern shortly after. Taking advantage of new maximum seaway dimensions resulting in cargo lifts, the vessel was selected to celebrate strong



links between Canada Steamship Lines and the Niagara Region.

Resulting from the handiwork of CSL's technical team and CSE Marine Services, the objective at hand was to produce an efficient design that would span for another quarter-century. Niagara's cylindrical bow design provides more displacement and an additional 600 tons of cargo lift over other designs.

From a structural standpoint, the vessel is longitudinally framed — unlike traditional lakers. As a result, there is a lighter, more efficient design, which is complimentary to PWDD's state-of-the-art production processes. Bulb sections provided by Fundia were utilized due to their stability for application of the high quality coating system by International Paints. Other steel shapes were supplied by Salit Steel, while the steel manufactured by Algoma Steel and supplied by Samuel Plate was blasted and primed by both PWDD and Blastech Corporation.

By far, the total concept of the vessel is its self-unloading system. The existing boom and loop belt were retained and joined to a new arrangement of hold and transfer conveyors. In cooperation with EMS-Tech, the system was designed to be efficient and maximize cargo cubic and discharge at 6,000 STPH. A total of 146 suspended roller track gates were constructed by Pascol Engineering for installation by Port Weller adding to the two conveyor belts, which were implemented on garland rollers from Haak Industries. Unloading and ballast systems are remotely controlled by 14 closed-circuit television cameras installed by Canal Marine, while cargoholds are serviced by a series of hatches, fitted with one-piece steel covers, removable by crane. Outstanding in this vessel is a new 1,000 kW Kamewa bow thruster that was installed to assist the bigger vessel when maneuvering. Utilizing the same idea, a new Pascol-constructed steering nozzle was installed.

Rotating and Speed Control Units

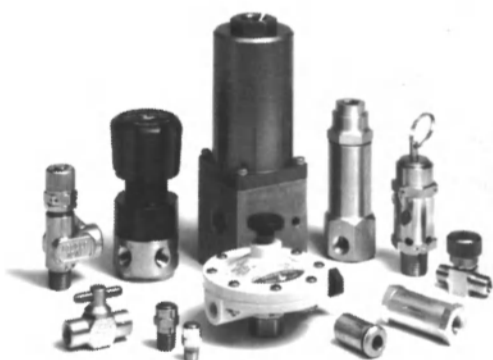
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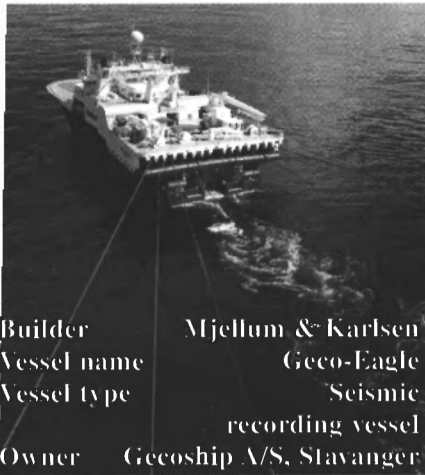
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Main Particulars

Flag	Canadian
Classification	Lloyd's
Designer	CSE Marine Services
Length (o.a.)	740 ft. (225.5 m)
Length (b.p.)	730 ft. (222.5 m)
Breadth	78 ft. (23.8 m)
Deadweight	35,560 tons
Draft	30 ft. (9 m)
Speed	13 knots
Cargo capacity	40,200 cu. m.
Bunker	435 MT
Water ballast	19,250 MT
Coatings	International Paint
Cargo control system	Canal Marine



Builder Mjellum & Karlsen
Vessel name Geco-Eagle
Vessel type Seismic recording vessel
Owner Gecoship A/S, Stavanger

streamers deployed for well over a year and have encountered barnacles and other growths of amazing proportions. With its five-year docking interval, Geco Eagle streamers are likely to spend a very long time continuously deployed in the water.

The uniquely shaped Geco Eagle is helping Schlumberger to survey larger areas more time and cost efficiently in the quest to continually discover resources in deeper waters.



Signifying the best of an outstanding new crop of seismic vessels, the Norwegian-built wedge-shaped Geco Eagle sports a 121 ft. (37m) wide back deck to store and deploy more recording equipment than any other vessel afloat, but the unique shipshape does not lead to a trade-off in capacity.

The ability to survey more territory in a time and cost efficient manner has directly led to the tremendous push for deeper water resources exploration.

Geco-Prakla routinely deploys 6 km streamers and the slim Nessie-4 streamers and large streamer reels will enable Geco Eagle to easily deploy streamers over 8km.

Geco Eagle is equipped with the Monowing* II deflector system, which coupled with lightweight towing leads, has already been proven to deliver 1,400 meter wide spreads without the help of other vessels.

The highest capacity vessels previous to Geco Eagle in the Schlumberger fleet were already deploying footprints up to 8 sq. km. Geco Eagle — if you can excuse the expression — effectively knocks all existing records out of the water with its massive footprint up to 11 sq. km.

With 20 tow points, Geco Eagle is able to shoot very high-resolution 3-D. It is not only the vessel's capacity, but also its flexibility that sets Geco Eagle apart.

Geco Eagle has a specially designed 36-ft. (10.9 m) workboat that is easy to deploy, is completely self-contained — with enclosed cabin and navigation system and is very fast moving. It can pick up, exchange and store 100 m streamer sections, has underwater cameras and a unique streamer cleaning system. Geco-Prakla vessels have already kept

Main Particulars

Flag	Panama
Length, (o.a.)	311 ft. (94.8 m)
Length, (b.p.)	281 ft. (85.8 m)
Breadth, (molded)	79 ft. (24 m)
Breadth, (extreme)	121 ft. (37 m)
Draft	25 ft. (7.5 m)
GT	10,846
Main engines	4x 4,050 kW
Auxiliary engines	Volvo Penta 250 kW
Speed	16 knots
Lifeboats	Norsafe



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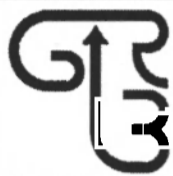
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BAIER MARINE HATCHES...

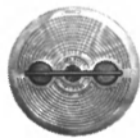
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Builder
 Vessel name
 Vessel type
 Owner

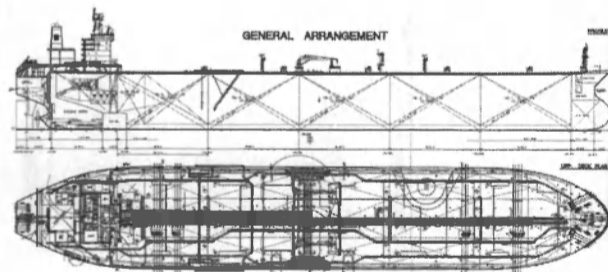
Samsung Heavy Industries
 Frank A. Shrontz
 VLCC
 Chevron



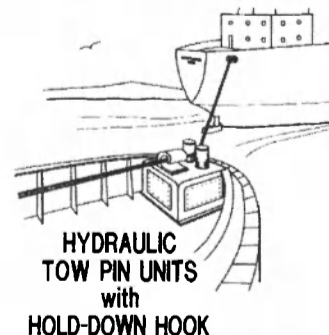
This vessel has been designed and constructed with five center and five pairs of cargo tanks (plus two slop tanks aft) included with a double-skin hull, complying with the latest regulation of MARPOL 13F and OPA 90. The double-skin design is capable of totally separating the cargo tanks from the sea, and providing five pairs of fully segregated water ballast tanks with the wide space of double hull for easy maintenance and access.

In addition, the water ballast tank has been coated with a light color tar free epoxy (two coats) throughout.

Particular attention has been paid to arrange cofferdam between side shell and heavy fuel oil tanks which are arranged in both side of engine room. Dynamic Load Analysis and Spectral Fatigue analysis have been conducted, along with ABS Safe Hull analysis, to ensure high design integrity and long life (For example, the design life time of critical side shell is 50 years). Three grades of cargo can be handled simultaneously, using three steam turbine driven cargo pumps, fitted in a pumproom at forward end of the engine room.



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Circle 284 on Reader Service Card

Zodiac Aids With New Self-Righting Design

Zodiac International has developed a patented, self-righting technique to comply with the updated RoRo ferry lifeboat regulations. Formulated by a team of technical engineers, the design is patented in both France and the U.S. - to be followed shortly by other jurisdic-

tions. The self-righting design enables liferafts to automatically turn from a capsized position to an upright position on the surface of the water, regardless of whether they inflate in the inverted position underwater or on the surface of the water, or capsizes for any reason pro-

ceeding inflation.

The company has been granted all significant approvals for its 150-person self-righting model raft, as well as for its 37-person and 25-person self-righting rafts, also available as davit launched rafts.



All are equipped with a Solas "A" pack for long international and Solas "B" pack for short international voyages.

Circle 7 on Reader Service Card

Foran Signs Agreement With PSC

Foran has signed a contract for the licenses and associated services with the Malaysian shipyard PSC Naval Dockyard. The Foran contract includes licenses for all the Subsystems, employing about 30 work-seats who will collaborate with Foran at the shipyard's offices in Lumut. Foran has already been successfully carried out in Lumut and the standard training of users. A two-week induction course for managers, which is already underway, will be complete this month. Windows NT was the operating system selected.

ACR Introduces DistresS.O.S.

ACR Electronics, Fort Lauderdale, Fla., has developed an innovative alternative to hazardous pyrotechnic devices to comply with USCG signal requirements — the DistresS.O.S. The product is a non-flammable, safe, buoyant, battery powered, USCG compliant night visual distress signal that flashes S.O.S. — the international Morse Code for distress. With more than 50,000 candela of light intensity after six hours of continuous use, DistresS.O.S. has more than 22 nautical miles of visibility at sea level.

Circle 53 on Reader Service Card

SeaJets Take Off For Grand Bahama Island

SeaJets, the Palm Beach-based Jetfoil, left the Port of Palm Beach on November 6, inaugurated regular service of the jets into Grand Bahama Island.

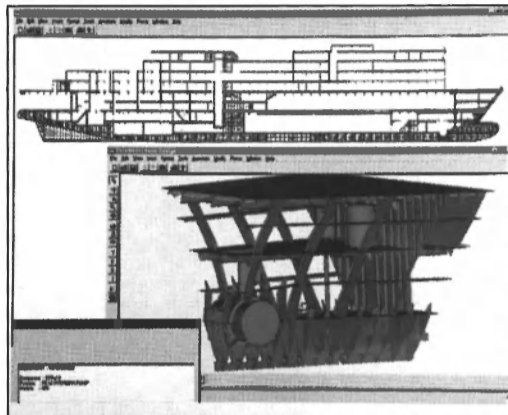
SeaJet Kara will depart from the Port Thursday through Monday at 9 a.m. and 4:30 p.m. with scheduled arrivals on Grand Bahama Island at 11 a.m. and 6:30 p.m., respectively. Departures from the Island will be at 11:30 a.m. and 6:50 p.m., arriving in Palm Beach at 1:30 p.m. and 8:30 p.m., respectively.

Combining their innovative and high speed operation, the jets are able to cover the 65 nautical miles between the Port and the Island in 99 minutes flying time. Flying over the sea's surface, the JetFoils leave no wake and can absorb shock waves up to 19 ft. (5.7 m) - with little or no movement in passenger cabins. The only two JetFoils operating from U.S. ports, the jets can accommodate up to 250 passengers.

December, 1999

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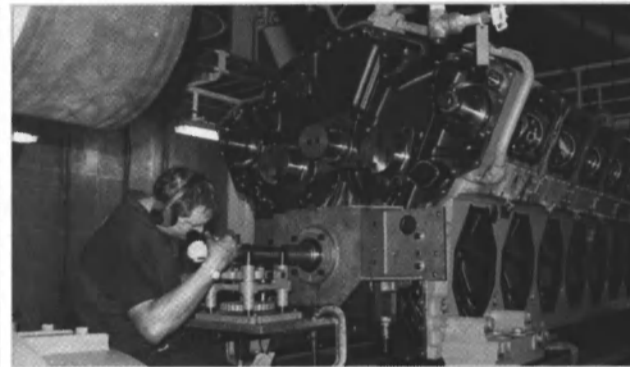
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Urethane To Provide For Supply Center

The Fleet and Industrial Supply Center at Pearl Harbor, Hawaii has granted Urethane Products Corp. (UPC) another contract for six 10 ft. diameter x 16 ft.-long Marine Guard foam-filled marine fenders. The fenders are constructed for energy absorbing capacity of 1,081 ft. kips with a reaction force of 402 kips.

The fenders will be delivered to the Naval Station at Pearl Harbor.

Circle 5 on Reader Service Card

MaK Signs Letter Of Intent For Its Subsidiary

MaK Motoren GmbH & Co. has signed a letter of intent for the sale of its marine sales and service subsidiary MaK Scandinavia to Geveke - the parent

company of Geveke Power Systems, which represents Caterpillar in Norway, Sweden, Denmark and the Netherlands.

Circle 6 on Reader Service Card

United States Lines Floats Again

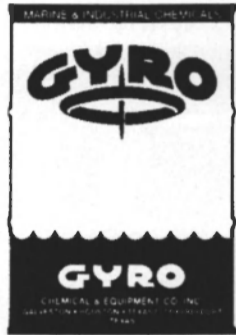
American Classic Voyages has acquired one of the most storied and renowned names in the history of ocean-

going passenger transportation - United States Lines - to be used for its fleet cruise ships being developed under the company's Project America initiative.

Known as one of the most prominent names in passenger shipping throughout the era of the trans-Atlantic crossing - period that spanned from the early 1900's through the early 1960's. The last remaining vessel of the fleet, SS United States, was decommissioned in 1969.

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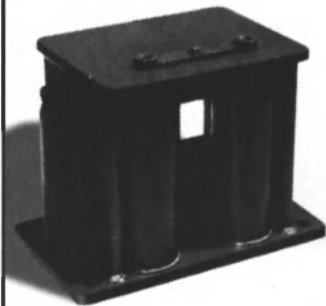
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DHI's construction of membrane type LNG carriers



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(Summary of Fuel Oil Samples analyzed at select ports, October 15, 1999)

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BALBOA, PANAMA											NEW YORK, NY											
AVERAGE	981.6	362.6	14.8	0.06	0.26	2.6	166	12	13	0.01	AVERAGE	986.9	242.7	13.4	0.07	0.34	2.65	227	17	26	0.05	
MAX	988.2	388	16.5	0.08	0.5	3.87	277	23		0.02	MAX	992.1	360.4	17.7	0.09	0.7	2.96	304	40		0.09	
BUSAN, KOREA											NORFOLK, VA											
AVERAGE	966.3	319.5	11	0.01	0.08	2.89	83	7	20	0.01	AVERAGE	988.2	208.8	10.6	0.06	0.2	2.95	186	11	14	0.02	
MAX	979.3	467	14	0.02	0.25	3.46	168	17		0.02	MAX	991.3	252.6	10.9	0.06	0.3	3.23	241	14		0.03	
CEUTA, SPAIN											PHILADELPHIA, PA											
AVERAGE	982.4	170.5	15.3	0.05	0.3	2.92	209	14	23	0.02	AVERAGE	989.5	234.3	13.5	0.06	0.39	2.86	229	14	15	0.05	
MAX	987.6	177	17	0.06	0.35	3.07	230	14		0.03	MAX	995.4	354.4	16.8	0.11	1.5	3.18	339	33		0.09	
DURBAN, SOUTH AFRICA											PIRAEUS, GREECE											
AVERAGE	990.2	149	17.8	0.03	0.05	3.44	146	13	25	0.07	AVERAGE	968.7	337	11.2	0.03	0.08	3.01	129	13	16	0.12	
MAX	990.7	150	17.9	0.04	0.05	3.58	180	14		0.09	MAX	990	372	18.9	0.04	0.1	4.04	204	34		0.7	
FOS, FRANCE											PORT ARTHUR, TX											
AVERAGE	989.2	339.5	15.1	0.01	0.1	2.59	59	27	26	0.01	AVERAGE	979.8	330.5	15	0.04	0.11	2.91	90	6	8	0.43	
MAX	989.8	344	15.4	0.02	0.15	2.75	70	27		0.02	MAX	989	384	17.3	0.3	0.3	3.78	197	10		5	
FUJAIRAH, UAE											ROTTERDAM, NETHERLANDS											
AVERAGE	971.1	331.3	14.7	0.03	0.24	2.81	104	23	9	0.86	AVERAGE	993.8	370.2	14.1	0.03	0.26	2.71	103	15	22	0.03	
MAX	988	379.4	17	0.06	0.5	3.48	187	48		6	MAX	1008.7	465	18.2	0.06	0.65	3.54	144	34		0.11	
GENOVA, ITALY											SAN FRANCISCO, CA											
AVERAGE	979.8	331.7	13.1	0.01	0.3	3.59	93	17	18	0.01	AVERAGE	983.3	288.3	12.3	0.05	0.11	2.05	97	25	11	0.02	
MAX	990.4	379	15.5	0.02	0.75	4.01	114	20		0.01	MAX	988.4	375	17.5	0.07	0.2	3.16	124	74		0.04	
GIBRALTAR, SPAIN											SEATTLE, WA											
AVERAGE	885.5	314.2	14.6	0.03	0.19	2.89	131	27	24	0.03	AVERAGE	977.1	262.2	10.8	0.02	0.2	1.65	46	11	15	0.02	
MAX	991.4	377	18	0.06	0.85	3.45	202	47		0.08	MAX	990.2	381.5	13.9	0.05	0.6	2.2	87	24		0.06	
GOTHENBURG, SWEDEN											SINGAPORE											
AVERAGE	984.6	339.6	14.2	0.03	0.1	2.52	135	17	29	1.14	AVERAGE	981.1	313.2	14.7	0.02	0.18	3.24	79	10	21	0.11	
MAX	990.4	369	16.6	0.07	0.3	2.86	170	38		9	MAX	994.2	380	18.2	0.05	0.75	3.88	212	21		3.42	
HOUSTON, TX											SOUTHAMPTON, UNITED KINGDOM											
AVERAGE	988	261.9	15.4	0.05	0.17	3.32	133	10	16	0.02	AVERAGE	986.9	338.3	11.8	0.02	0.05	1.98	75	7	13	0.01	
MAX	995.7	405.4	18.3	0.11	1	4.05	250	74		0.08	MAX	989.6	370	12.8	0.03	0.05	2.29	96	20		0.02	
LOS ANGELES, CA											SUEZ, EGYPT											
AVERAGE	986.8	276.9	10.2	0.05	0.19	1.7	129	17	21	0.03	AVERAGE	956.8	306.8	10.6	0.03	0.11	2.75	108	17	9	0.02	
MAX	996.3	624	14.3	0.07	0.7	2.11	273	30		0.1	MAX	958.2	321	11.1	0.04	0.3	3.13	184	23		0.03	
MARSEILLE, FRANCE																						
AVERAGE	983.8	173.3	13.3	0.03	0.06	2.51	81	22	20	0.02												
MAX	989.5	206	14.3	0.06	0.1	2.88	118	40		0.03												
MOBILE, AL																						
AVERAGE	983.8	266.3	13.7	0.04	0.08	2.97	120	25	9	0.01												
MAX	990.6	332	14.2	0.06	0.1	3.49	148	29		0.02												
MOIN, COSTA RICA																						
AVERAGE	988.8	186	14.9	0.05	0.08	2.76	114	9	17	0.01												
MAX	990.7	209	16.5	0.05	0.1	2.96	140	12		0.01												
MONTREAL, CANADA																						
AVERAGE	983.4	289.9	15.4	0.04	0.1	1.36	101	8	31	0.06												
MAX	989.9	349.6	17.6	0.09	0.2	1.71	129	16		0.1												
NEW ORLEANS, LA																						
AVERAGE	987.4	286.1	15.2	0.05	0.17	3.64	138	24	17	0.04												
MAX	990.5	364	18	0.07	0.4	4.12	297	56		0.24												

KEYCODE

@15c: Density at 15 degrees centigrade.
V@50c: Viscosity at 50 degrees centigrade.
MCR %: Microcarbon Residue %.
Ash %: Ash level in fuel.
H2O %: Percent water in fuel.
S%: Percent sulfur.

V: Vanadium in ppm.
NA: Sodium in ppm.
AL+SI: Combination of aluminum
..... and silicon expressed as ppm.
TSP%: Percent total dissolved solids

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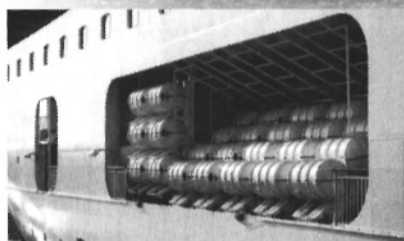
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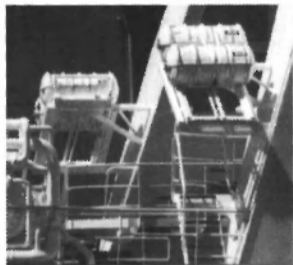
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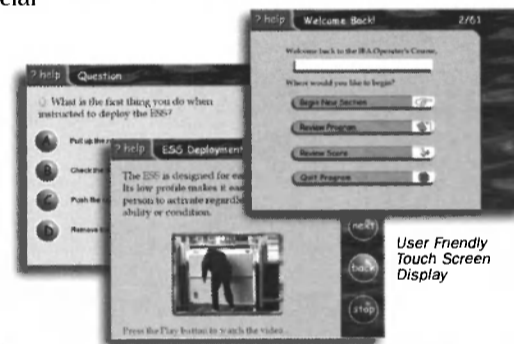
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OWNER OPERATOR	COUNTRY SO	SHIPYARD	TYPE	No	TEU	DWT	DELIV	M U
CHINA STEEL CORP.	TAIWAN	CHINA SHIPBUILDING CORP.	BULK CARRIER	4	—	176,000	2002/2003	1
SA SHIPPING / RESTIS	CYPRUS	HYUNDAI HEAVY INDUSTRIES (HHI)	BULK CARRIER	2	—	171,800	2001	
CYPRUS MARITIME	CYPRUS	IMABARI SHIPBUILDING	BULK CARRIER	1	—	170,000	2000	2
TAIWAN NAVIGATION	TAIWAN	OSHIMA SHIPBUILDING	BULK CARRIER	1	—	91,000	2002	18.
FIRST SS	TAIWAN	TSUNEISHI	BULK CARRIER	1	—	76,300	Jun-01	
LYKIARDOPULO	GREECE	HITACHI ZOSEN	BULK CARRIER	2	—	75,000	2000/2001	
SARUBIA SHIPPING	—	KANASASHI CO.	BULK CARRIER	1	—	75,000	2000	
ARCADIA SHIPMANAGEMENT	GREECE	HYUNDAI HEAVY INDUSTRIES (HHI)	BULK CARRIER	1	—	74,900	2002	
DIAMANTIS LEMOS	GREECE	HUDONG SHIPYARD	BULK CARRIER	1	—	74,500	2001	20
NISHIN KISEN	JAPAN	NAMURA ZOSENSHO	BULK CARRIER	1	—	74,000	2001	
YAMAMOTO KAIUN	JAPAN	NAMURA ZOSENSHO	BULK CARRIER	1	—	74,000	2001	
MOSAMOTO KAIUN	JAPAN	NAMURA ZOSENSHO	BULK CARRIER	1	—	74,000	2001	
EMBRICOS	—	DAEWOO	BULK CARRIER	2	—	74,000	2001	4
FIRST SS	TAIWAN	TSUNEISHI	BULK CARRIER	1	—	52,300	2001	1
GTRC	CANADA	JING JIANG	BULK CARRIER	6	—	52,000	—	—
VICTORIA STEAMSHIP	U.K.	JING JIANG	BULK CARRIER	2	—	52,000	2001/2002	3
NORDEN	DENMARK	OSHIMA SHIPBUILDING	BULK CARRIER	2	—	50,800	2002	—
PAPPADAKIS	GREECE	DAEWOO	BULK CARRIER	1	—	50,000	2001	19.
NIOVIS SHIPPING	GREECE	DAEWOO	BULK CARRIER	1	—	50,000	2001	19.
TORVALD KLAVENESS	NORWAY	OSHIMA SHIPBUILDING	BULK CARRIER	2	—	49,900	2001	—
UBT SHIP/WALLEM.	U.K.	SANOYAS CORP.	BULK CARRIER	2	—	48,000	2001	39.
SETAF SAGET	FRANCE	NANTONG COSCO KHI	BULK CARRIER	2	—	47,980	Feb-01	30
ORIENT HAKUSAN SHIPPING	PANAMA	TSUNEISHI	BULK CARRIER	1	—	45,300	2000	—
GRIEG SHIPPING	NORWAY	DAEWOO	BULK CARRIER	2	—	45,000	2003	76
UNKNOWN	UNKNOWN	KANASASHI CO.	BULK CARRIER	2	—	32,000	2000/2001	—
ALLIED MARITIME	GREECE	KANDA SHIPBUILDING CO.	BULK CARRIER	2	—	28,200	2001	—
SINCERE SHIPPING	TAIWAN	TSUNEISHI	BULK CARRIER	1	—	28,000	2000	—
CLIPPER GROUP	DENMARK	JIANG JIANG	BULK CARRIER	2	—	27,000	Feb-01	30
PETER DOHLE SCHIFFAHRTS	GERMANY	MUTZELFELDTWERFT	BULK CARRIER	2	—	7,580	2001	—
ENTERPRISE SHIPPING & TRADING	GREECE	HYUNDAI HEAVY INDUSTRIES (HHI)	BULK CARRIER	2	—	172,000	2001	—
FIRST SS	TAIWAN	HASHIHAMA	BULK CARRIER (OS)	1	—	76,300	2001	—
EGON OLDENDORFF	GERMANY	DAEWOO	BULK CARRIER (OS)	2	—	76,000	2001	80
ENTERPRISE SHIPPING & TRADING	GREECE	DAEWOO	BULK CARRIER (OS)	2	—	75,000	2001	44.2
ANANGEL SHPG. ENT.	GREECE	DAEWOO	BULK CARRIER (OS)	4	—	75,000	2001/2002	88
BRAVE MARITIME	GREECE	JIANGYANG	BULK CARRIER (OS)	2	—	74,500	2001	40
ITOCHU CORP.	JAPAN	NAMURA DOCK	BULK CARRIER (OS)	2	—	74,000	2001	—
KC MARITIME	CHINA	SUMITOMO	BULK CARRIER (OS)	2	—	73,500	2000/2001	44
CHELLARAM SHIPPING	CHINA	SUMITOMO	BULK CARRIER (OS)	1	—	73,500	2002	—
SILVER LAKE	GREECE	SUMITOMO	BULK CARRIER (OS)	2	—	73,500	2001	—
NEDA MARITIME	GREECE	HITACHI ZOSEN	BULK CARRIER (OS)	1	—	65,500	2001	—
PARAKOU SHIPPING	HONG KONG	DAEWOO SHIPBUILDING	BULK CARRIER (OS)	1	—	50,500	2001	19.25
ERATO MARITIME	GREECE	SHANGHAI SHIPYARD	BULK CARRIER (OS)	2	—	48,000	Feb-02	36.5
IRAN ISLAMIC REPUBLIC	IRAN	PERSIAN GULF	CONTAINER	6	2,500	35,000	2002/2003	207
RICKMARS BERTRAM	GERMANY	HANJIN	CONTAINER	2	1,200	14,300	2001/2002	39
NORDCAPITAL	GERMANY	SAMSUNG	CONTAINER	2	5,500	—	2001	100
CONTI REEDEREI	GERMANY	HANJIN	CONTAINER	3	5,600	—	2000	180
VROON	NETHERLANDS	HANJIN	CONTAINER	2	1,600	—	Dec-00	46
LEONHARDT & BLUMBERG	GERMANY	GUANGZHOU	CONTAINER	2	1,200	—	2001	—
GEBAB	GERMANY	DAEWOO	CONTAINER	3	6,500	—	2002	—
DELMAS	FRANCE	CHINA SHIPBUILDING CORP.	CONTAINER	3	2,200	—	2002	90
FESTIVAL CRUISES	GREECE	CHANTIERS DE L'ATLANTIQUE	CRUISE SHIP	1	—	—	Mar-02	277
RESIDENSEA	NORWAY	FOSEN MEK VERKSTEDER	CRUISE SHIP	1	—	—	Dec-01	262
P&O/ARKONA TOURISTIK	UK/GERMANY	AKER MTW WERFT	CRUISE SHIP	2	—	—	2002/2003	372.4
PT VISAKHAPTAM	INDIA	HINDUSTAN SHIPYARD	DREDGER	1	—	—	2000	5.9
NEL LINES	GREECE	LEROUX ET LOTZ	FERRY	1	—	10,000	Jun-01	66.67
NEL LINES	GREECE	LEROUX ET LOTZ	FERRY	1	—	8,000	May-01	48.9
CNOOC	CHINA	DALIAN NEW	FSO	1	—	—	2001	—
MODEC INC. (MITSUI GROUP)	JAPAN	HITACHI ZOSEN	FSO	1	—	—	2000	—
HAN YANG	KOREA	HAEDONG	GENERAL CARGO	1	—	3,300	2000	—
FRANK DALE	NETHERLANDS	PATTJE S. OF WATERHUIZEN	GENERAL CARGO	4	—	1,800	2001	—
JOHANN HEEREN	GERMANY	PETERS SCHEEPSWERF	GENERAL CARGO	1	—	—	2000	—
DUTCH INTERESTS	NETHERLANDS	DAEWOO MANGALIA HEAVY IND.	GENERAL CARGO	8	132	—	2000	—
FRANK DAHL	DENMARK	BODEWES VOLHARDING	GENERAL CARGO	3	—	—	2000	—
DUTCH INTERESTS	NETHERLANDS	DAEWOO MANGALIA HEAVY IND.	GENERAL CARGO	1	132	—	2001	—
DUTCH INTERESTS	NETHERLANDS	DAEWOO MANGALIA HEAVY IND.	GENERAL CARGO	3	132	—	1999	—
DUTCH INTERESTS	NETHERLANDS	DAEWOO MANGALIA HEAVY IND.	GENERAL CARGO	3	132	—	1999	—
OCEAN DOUBLE HULL CARRIERS	PHILIPPINES	ATLANTIS	LPG	2	—	3,500	2001	—
INCAT CHARTERING	AUSTRALIA	INCAT AUSTRALIA	MH PASSENGER/FERRY	1	—	—	2000	—
GERMAN INTERESTS	GERMANY	ZHEJIANG	MULTI-PURPOSE	5	364	—	2001	24
FINNMARK FYLKES	NORWAY	TRONDHEIM VERFT	PASSENGER	1	—	—	2000	—
MINOAN LINES	GREECE	FINCANTIERI	PASSENGER / FERRY	2	—	—	2001/2002	215
GERMAN GOVERNMENT	GERMANY	ZHEJIANG	PASSENGER / VEHICLE/FERRY	1	—	—	2000	—
JAPANESE INTERESTS	JAPAN	HAKODATE DOCK	PASSENGER / VEHICLE/FERRY	1	—	—	2000	—
TSAKOS GROUP	GREECE	KOYO DOCK	PRODUCTS TANKER	1	—	75,000	2001	—
TSAKOS GROUP	GREECE	IMABARI SHIPBUILDING	PRODUCTS TANKER	1	—	68,000	Mar-02	30
VROON	NETHERLANDS	HANJIN	PRODUCTS TANKER	2	—	30,000	2001	50
SAM HO SHIPPING	KOREA	HAEDONG	PRODUCTS TANKER	1	—	4,990	2000	—
RAY SHIPPING	ISRAEL	GDYNIA	PURE CAR CARRIER	1	—	—	2001	—
MINOAN LINES	GREECE	SAMSUNG	RoRo / FERRY	1	—	—	May-01	75
OSKAR WEHR	GERMANY	SZCZECIN SHIPYARD	RoRo GENERAL CARGO	2	—	7,300	2002	—
HAVILA SUPPLY SHIPS	NORWAY	KLEVEN MEK	SUPPORT VESSEL	2	—	—	2000/2001	31
PACIFIC RICHFIELD	SINGAPORE	PAN-UNITED SHIPYARD	SUPPORT VESSEL	1	—	—	2000	—
NS LEMOS	GREECE	SAMSUNG	TANKER	2	—	308,500	2001	138
HELLESPONT STEAMSHIP	GREECE	SAMSUNG	TANKER	2	—	308,000	2001/2002	141
EMBRICOS	—	DAEWOO	TANKER	1	—	300,000	2001	69
WORLD-WIDE SHIPPING	BERMUDA	DAEWOO	TANKER	2	—	300,000	2001/2002	138
BESIKTAS SHIPPING	TURKEY	HYUNDAI HEAVY INDUSTRIES (HHI)	TANKER	1	—	165,000	2001	44
POLEMBROS SHIPPING	GREECE	DAEWOO	TANKER	1	—	158,000	2001	—
POLEMBROS SHIPPING	GREECE	DAEWOO	TANKER	1	—	105,000	2001	—
JAPANESE INTERESTS	JAPAN	MATSUURA TEKKO	TANKER	1	—	2,170	2000	—
NAVITANKER MANAGEMENT	GREECE	SAMSUNG	TANKER	6	—	—	2001/2002	250
SPANISH OWNER	SPAIN	BARRERAS	VEHICLE CARRIER	1	—	2,900	2000	—

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FLOATING PRODUCTION SYSTEMS

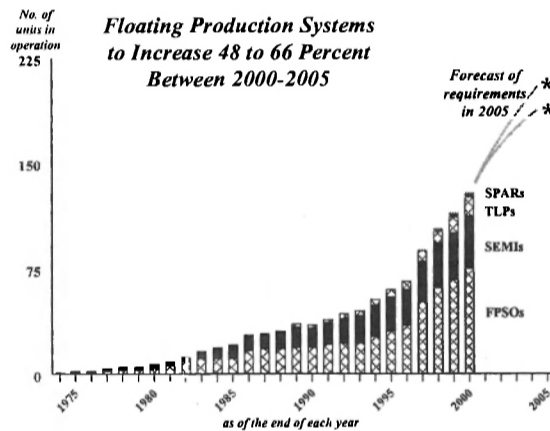
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- ◆ assess underlying business conditions driving future activity in floating production
- ◆ provide details for floating production systems planned, on order and recently delivered
- ◆ identify recent developments impacting floater technology and companies



Contents of the August 1999 Report

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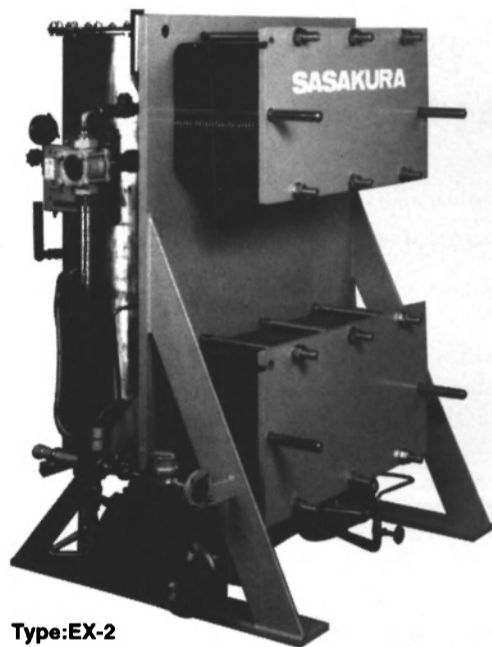
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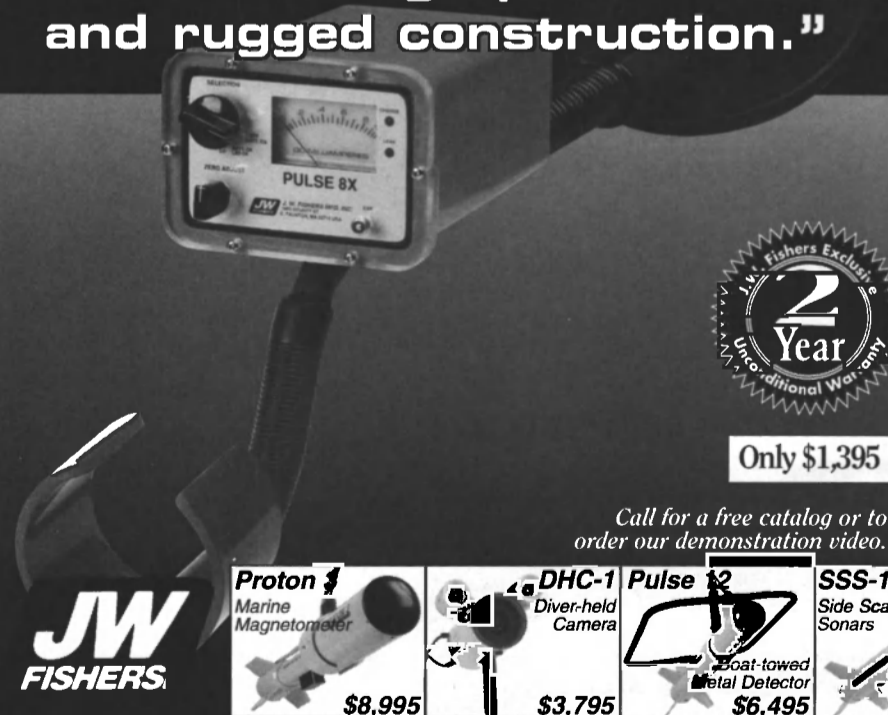
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Circle No. 117

Kelvin Hughes

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IMO Pump

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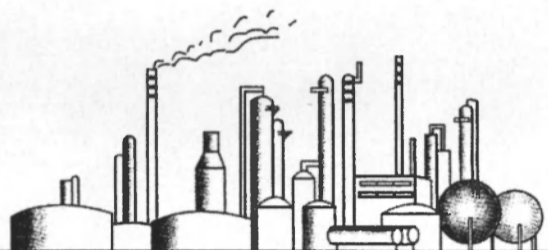
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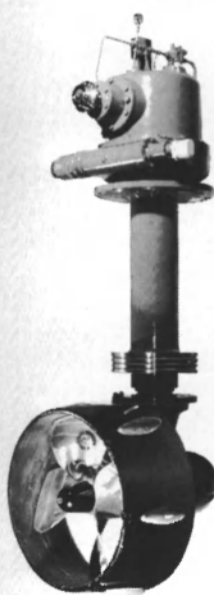
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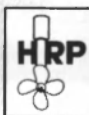
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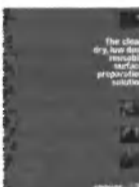
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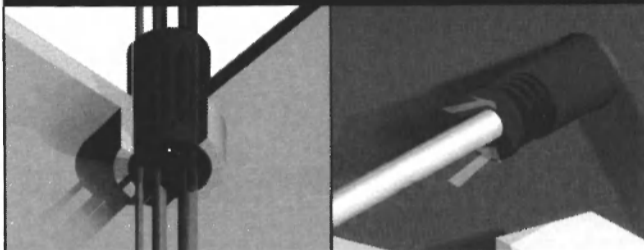


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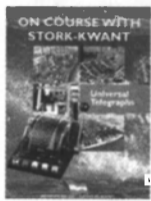
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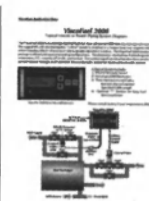
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Mowbray's Tug & Barge Sales Corp., 35 De Hart St., Morristown NJ 07960

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;

U.S.A. Reps: Simplex-Turmar Inc., P.O. B. 168, Little Neck, NY 11363-0168

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

King Wholesale Supply, Co., Inc., P.O. Box 4002, New Orleans, LA 70178-4002

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 Intl., Inc. P.O. B. 498985, Cincinnati, OH 45249

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

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

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

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

CAPSTANS

Superior Lidgerwood Mundy, 1101 John Ave., Superior, WI 54880

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 Heatex, 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

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

CLEANING EQUIPMENT

Drew Marine, 1 Drew Plaza, Boonton, NJ 07005

CLEATS

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

CLUTCHES

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

Fetterolf 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 Intl, 60 Inip Drive, Inwood, NY 11096

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

CRANE-HOIST-DERRICK-WHIRLEYS

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

Kroll Cranes, 17432 Chelmeur Hwy, New Orleans, LA 70129

Liebherr-Werk Nenzing GMBH, A-6710 Nenzing/Austria.

Tschaleng 3, P.O. Box 10

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

CRANKSHAFT DEFLECTION ANALYZER

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

CRANKSHAFT GRINDING

Goltens - New York Corp., 160 Van Brunt St., Brooklyn, NY 11231

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

CRANKSHAFT REPAIR

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

Goltens - New York Corp., 160 Van Brunt St., Brooklyn, NY 11231

CUSTOM CLOSURES

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

CUTTING AND WELDING MACHINES

Bug-O-Systems, Inc., 3001 W. Carson St., Pittsburgh, PA 15204

CYLINDER LOAD ANALYZER

General Thermodynamics, 210 S. Meadow Rd., Plymouth, MA 02360

DAVIT SYSTEMS

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

Wellin Lambie N.A. Inc., 18 Ridgecrest Drive, Bridgewater Nova Scotia, Canada B4V 3 V8

DECK MACHINERY - Cargo Handling Equipment

Markay 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

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

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

E.H. O'Neill, 1405 Chippendale Rd., Lutherville, MD 21093

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

Pusnes, PO Box 102, N-4818, Faervik, NORWAY

Schoellhorn-Albrecht, 575-105 Rudder Rd. St 63026, St. Louis, MO 63116

Smith Berger Marine Inc., 7915 10th Ave. S., Seattle, WA 98108

Timberland Equipment, P.O. Box 490, Woodstock, Ontario N4S 7Z2 CANADA

Waterman Supply Co., P.O. Box 596, Wilmington, CA 90748

Superior Lidgerwood-Mundy, 1101 John Ave., Superior, WI 54880

Jered Industries Inc., P.O. Box 904, Brunswick, GA 31521

DECK STRUCTURES

Carolina Cockpit, P.O. Box 83037, Portland, OR 97283

DEHUMIDIFIERS

Dry Air Technologies, 313 N. Oak St., Burlington, WA 98233

Munters Corp., 79 Monroe St., Amesburg, MA 01913

DESALINATION - REVERSE OSMOSIS

Matrix Desalination, 3295 S.W. 11th Ave., Fort Lauderdale, FL 33315

Reverse Osmosis of South Florida, 12301 SW. 133 Court, Miami, FL, 33186

DESIGN CONSULTING

Fleet Technologies, 311 Leggett Dr., Kanata, Ont, K2K 1Z8 Canada

DIESEL ENGINE ANALYZER

Drew Marine, 1 Drew Plaza, Boonton, NJ 07005

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

Icon Research, 8 Market Street, Ellesmere, Shropshire SY12 OAN, England

Hermont Marine Inc., 3528 Griffith, St. Laurent, Quebec Canada

DIESEL ENGINE - Spare Parts & Repair

Scardana Americas Bkg., 502 Empire St., Greenfield Park, J4V1V7 Canada

Alaska Diesel, 4420 14th Ave., NW, Seattle, WA 98107

Brigantine Services Ltd, 48 Wang Lok St., Yuen Long

Hermont Marine Inc., 3528 Griffith, St. Laurent, Quebec Canada

Industrial Estate, New Territories, HONG KONG

Caterpillar, Inc., Engine Div., P.O. Box 610, Mossville, IL 61552-0610

Metairie, LA 70006

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

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

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

Prime Mover Controls, 3600 Gilmore Way, Burnaby V5G 4R8 Canada

Raytheon Marine Co., 676 Island Pond Rd., Manchester, NH 03109

Electronic Marine Systems, 800 Ferndale 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

Tano Corp., 5700 Citrus Blvd., Suite E, New Orleans, LA 70123

G.R. Bowler, 261 Lake Rd., Ontario, NY 14519

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

CORDAGE

Yaie Cordage, 26 Morin St., Biddeford, ME 04005

COUPLINGS

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

Centa Corp., 815 Blackhawk Dr., Westmont, IL 60559

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

Fetterolf 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 Intl, 60 Inip Drive, Inwood, NY 11096

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

CRANE-HOIST-DERRICK-WHIRLEYS

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

Kroll Cranes, 17432 Chelmeur Hwy, New Orleans, LA 70129

Liebherr-Werk Nenzing GMBH, A-6710 Nenzing/Austria.

Tschaleng 3, P.O. Box 10

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

CRANKSHAFT DEFLECTION ANALYZER

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

CRANKSHAFT GRINDING

Goltens - New York Corp., 160 Van Brunt St., Brooklyn, NY 11231

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

CRANKSHAFT REPAIR

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

Goltens - New York Corp., 160 Van Brunt St., Brooklyn, NY 11231

CUSTOM CLOSURES

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

CUTTING AND WELDING MACHINES

Bug-O-Systems, Inc., 3001 W. Carson St., Pittsburgh, PA 15204

CYLINDER LOAD ANALYZER

General Thermodynamics, 210 S. Meadow Rd., Plymouth, MA 02360

DAVIT SYSTEMS

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

Wellin Lambie N.A. Inc., 18 Ridgecrest Drive, Bridgewater Nova Scotia, Canada B4V 3 V8

DECK MACHINERY - Cargo Handling Equipment

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

EVACUATION SYSTEMS

DBC, 12351 Bridgeport Rd., Richmond, BC Canada

EVAPORATORS

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

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

EXPANSION JOINTS

Silex Inc., 7850 Tranmere Dr., Mississauga, Ontario L5S1L9
 Applegate Industrial, 1440 Government Street, Baton Rouge, LA 70802

FAIRING COMPOUND

Philadelphia Resins, P.O. Box 309, Montgomeryville, PA 18936

FANS - VENTILATORS - BLOWERS

Dry Air Technologies 313 N. Oak St., Burlington, WA 98233
 Jon M. Liss Associates, Inc., 411 Borel Ave., San Mateo, CA 94402

FASTENERS

Jamestown Distributors, P.O. Box 348, Jamestown, RI 02835
 Superbolt, P.O. Box 683, Carnegie, PA 15106

FENDERING SYSTEMS/BUOYS - Dock & Vessel

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

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

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

Urethane Products Corp., 17007 South Broadway, Gardena, CA 90248

Promar, 115 Industrial Blvd., Kearneysville, VA 25430

Schuyler Rubber Co., 16901 Wooded Rd., Woodinville, WA 98072

FILTERS/FILTER SYSTEMS

Boll-Filter Corp., 15 Int'l Dr., E. Granby, CT 06026

Luber-Finer, Inc., 200 South 4th St., Albion, FL 62806-1313

FIN STABILIZERS

Blohm & Voss Industries GmbH, P.O. B. 112289, D-2042 Hamburg 1, GERMANY

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

Ralko Ltd., Loudwater, High Wycombe, Bucks

Hamshire ENGLAND HP109QV

FIRE & SAFETY PRODUCTS

Brookdale International, 1-8755 Ash St., Vancouver BC, V6P6T3

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

IMSSCO, 2040 Harbor Island Dr., Suite 201A, San Diego, CA 92101

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 Systems, 835 Sharon Drive, Westlake, OH 44145

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

FLUID HANDLING EQUIPMENT

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

FRESH WATER GENERATOR

Sasakura Engineering, 7-32 Takeshima, 4-chome, Nishiyodogawa, KY, Osaka 555, Japan

FUEL CONSERVATION

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

FUEL DECONTAMINATION

Algae X Int'l, PO Box 4011, Ft. Myers Beach, FL 33932

Fuel Dynamics, 707 Mullet Dr. #110, Cape Canaveral, FL 32920

GALLEY EQUIPMENT

Cospolich Refrigerator Co., 949 Industry Rd., Kenner LA 70062

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

Lang Manufacturing, 6500 Merrill Creek Pkwy, Everett, WA 98203

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

Richard Galley Supply, PO Drawer 4035, Houma, LA 70361

GANWAYS, LADDERS

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

Schoellhorn-Albrecht, 575-105 Rudder Rd., St. Louis, MO 63026

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

Wooster Products Inc., 1000 Spruce St., P.O. Box 896, Wooster, OH 44691

GASKETS/CLEATS

Harbor Industries, Inc., 9471 Baymeadows Rd. Ste 307, Jacksonville, FL 32256

GEARS & GEAR REPAIR

Goltens - New York Corp., 160 Van Brunt St., Brooklyn, NY 11231

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

Baylor Co., 500 Industrial Blvd., Sugarland, TX 77478

Insulude Recycling B.V., Deccaweg 3, 1042 AT Amsterdam, NETHERLANDS

QMD&S

International Communications, 813 Diligence Dr. Ste 120, Newport News, Va. 32606

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

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

HATCHES AND DOORS

Schoellhorn-Albrecht, 575-105 Rudder Rd., St. Louis, MO 63026

Railway Specialties Corp., 2979 State Rd., P.O. Box 29, Bristol, PA 19007

HEAT EXCHANGERS

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

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

Computube (Britanna Heat Transfer) Ltd., 15-20 Coleshill Industrial Estate, Station Road, Coleshill, Birmingham B46 1UP UK

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

Tranter, Inc., 1054 Claussen Rd., Augusta, GA 30907-3215

Tranter, Inc. (Texas Div.) P.O. Box 2289, Wichita Falls, TX 76307

HEAT TRANSFER FLUID

Paratherm Corp., 1050 Colwell Rd., Conshoocken, PA 19428

HOISTS

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

HORNS/WHISTLES

Airchime Mfg. Co. Ltd., 5478 267th Street, Gloucester Industrial Estate, Langley, B.C. Canada V4W 3S8

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

Kockum Sonics, Inc., 933 Industry Rd., Ste105, Kenner, LA 70062

HYDRAULICS

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

Dayton T. Brown, 555 Church St., Bohemia, NY 11716

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 Intafables Boats, 410 Oak St., Friendsville, MD 21531

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

HYDRAULIC TRAINING

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

INCINERATORS

Therm-Tec Inc., PO Box 1105, Tualatin, OR 97062

INFLATABLES

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

Zodiac of North America, P.O. Box 400, Thompson Creek Road, Stevensville, Sparks, MD 21152

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 Energies Inc., P.O. Drawer 386, Groves TX 77619

INTEGRATED MONITORING SYSTEMS

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

INTERIORS

Bauer Interiors, 733 Dante St., New Orleans, LA 70118

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

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 Int'l, Inc. P.O. Box 498985, Cincinnati, OH 45249

Branton Int'l., 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

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

KEEL COOLERS

R.W. Fernstun & Co., 1716 Eleventh Ave., Menominee, MI 49858

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

The Walter Machine Co., Inc., 84-98 Cambridge Avenue, Jersey City, NJ 07307

LASER ALIGNMENT

Boland Industrial & Consulting Services, P.O.B. 91360, Mobile, AL 36691

LAUNDRY EQUIPMENT

Richard Galley Supply, PO Drawer 4035, Houma, LA 70361

LIFEBOATS/RAFTS

American Eagle Mfg., Inc., 780 Pearte Jensen Way, LaConner, WA 98257

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

LIFEBOATS REPAIR

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

Willem Pot, P.O.B. 29102, 3001 GC Rotterdam

LIFESAIVING EQUIPMENT

MGI International, 119-225 West 1st St., North Vancouver, B.C. CANADA

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

Zodiac of North America, PO Box 400, Thompson Creek Rd., Stevensville, Sparks, MD 21152

LIFT EQUIPMENT

JLG Industries, Inc., JLG Drive, McConnellsburg, PA 17233-9533

LIFT EQUIPMENT TESTING

Water Weights Inc., 5139 Brooks St., Suite E, Montclair, CA 91763

LIGHTING SYSTEMS / EQUIPMENT

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

Archway Marine, 4501 Swan Ave., St. Louis, MO 63110

Gotten 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, Peanand, TX 77588

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

LIQUID OVERFILL PROTECTION SYSTEMS

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

LOGISTICS

VL Logistics Consultants, Inc., 3420 Bienville Blvd., Ocean Springs, MS 39564

MACHINERY MAINTENANCE, REPAIR, OVERHAUL, AND TESTING

Goltens - New York Corp., 160 Van Brunt St., Brooklyn, NY 11231

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

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

MANAGEMENT SYSTEMS & SERVICE

Homblower Marine, Pier 3 Ferboat Santa Rosa, San Francisco, CA 94111

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

MARINE ACCOMMODATIONS

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

MARINE BUILDING SUPPLIES

King Wholesale Supply, Co., Inc., P.O. Box 4002, New Orleans, LA 70178-4002

MARINE CEILING

Hydro-Aluminum, Vik Verk, N-5880 VIK I SOGN, Norway

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

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

MARINE CONSULTANTS

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

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

Boland Industrial & Consulting Services, P.O.B. 91360, Mobile, AL 36691

Schoellhorn-Albrecht, 575-105 Rudder Rd., St. Louis, MO 63026

MARINE DECKING A FLOORING

Hopeman Brothers, Inc., P.O. Box 820, Waynesboro, VA 22980

E.H. O'Neil, 1405 Chippendale Rd., Lutherville, MD 21093

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

Polyspec Corp., P.O. Box 1600, Sapulpa, OK 74067

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

Lonseal Inc., 928 E. 238th St., Carson, CA 90742

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

MARINE DRILLING & BLASTING

Marine Drilling & Blasting, Inc., P.O. Box 18098, Beverly Hills, CA 90209-4098

MARINE ELECTRONICS

Frank L. Beier Radio, 2001 Ridgeway Dr., Metairie, LA 70001

Autronica 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

PROPELLERS—Repairs

Kahlenberg Bros, P.O. Box 358, Two Rivers, WI 54241
Byrne Rice & Turner, 1172 Camp St., New Orleans, LA 70130
Holland Roer Propellers, 2273 Batataria Blvd, New Orleans LA, 70072
Rice Propeller, Av Rios Espinoza No. 88, Col. Benito Juarez, Mazatlan, Sin, Mexico 82180
Proper Pitch, P.O. Box 314, Seybyville, DE 19975

PUSHPION EQUIPMENT

—Bowthrusters, Diesel Engines, Gears, Propellers, Shafts, Turbines

Avondale Industries, Harvey Quick Repair, P.O. Box 116, Harvey, LA 70058
American Air Filter, P.O. Box 35690, Louisville, KY 40432
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
Aquamaster-Rauma Ltd., Box 220, SF-26101, Rauma, FINLAND
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

Kawasaki Heavy Industries, Ltd.,
Tokyo Head Office, World Trade Center Bldg.,
4-1 Hamamatsu-cho 2-chame, Minato-ku, Tokyo 105-6116 Japan
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 60561
The Falk Corp., PO Box 492, Milwaukee, WI 53201-0492
Fincantieri, Diesel Engines Div.—GMT, Bagnoli della
Rosandra 334, Trieste, ITALY
GEC ALSTHOM Diesels Inc., 10801 Kempwood Dr. Ste 1,
Houston, TX 77043-1412
Goltens Worldwide, 160 Van Brunt 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
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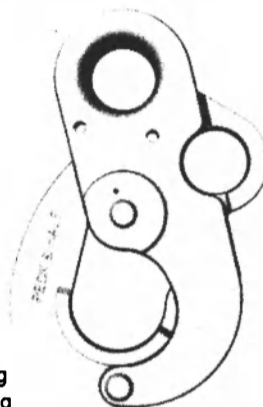
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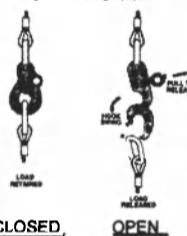
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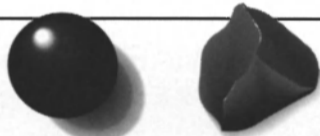
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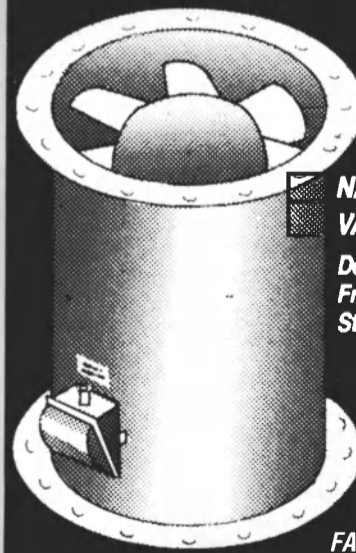
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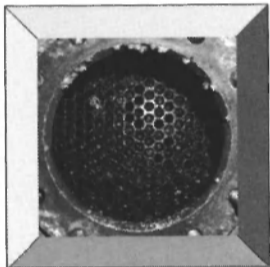
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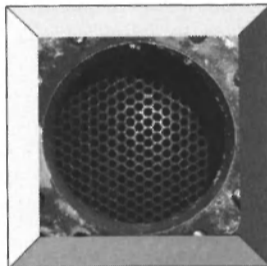


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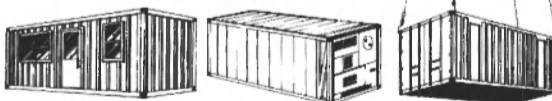
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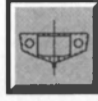
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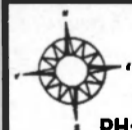
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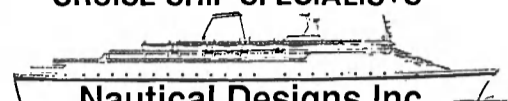
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Norstream Christened At Aker Finnyards

Aker Finnyards' newbuilding No. 425, the 11,500-dwt RoRo carrier for the



Dutch company Bore Stream BV was recently christened Norstream by **Ann von Rettig**.

P&O North Sea Ferries will operate the vessel, which began regular service between Continental Europe and the U.K. on the Zeebrugge-Tessport route in

October. The vessel is designed mainly for transporting trailers, trucks and containers providing fast unloading and loading, and is also equipped with two stern ramps. Measuring 591 ft. (180 m), with a beam of 83 ft. (25.2 m) and draft of 21 ft. (6.5 m), the vessel moves at a speed of 20 knots powered by two medium-speed diesel engines at 18,900 kW. Norstream's sistership Norsky was delivered to the Bore Company this past June.

Friede Goldman and Halter Complete Merger

Friede Goldman International, Inc. and Halter Marine Group Inc. have announced the two companies have completed their previously announced merger and the name of the combined company is now Friede Goldman Halter, Inc.

The new company began trading on the New York Stock Exchange on November 4, under the new symbol "FGH."

Moore Stephens Warns Of Internet's Risk

Moore Stephens has alerted the shipping industry to be wary of the Internet. Per the most recent edition of its in-house newsletter, *Bottom Line*, the company informs that while the Internet is a useful communication tool, it can also be time consuming and risky.

The firm stresses upon problems such as security, validity and other concerns, which shipping businesses may encounter when using the Internet, either as an information resource for e-commerce or communication.

According to Moore Stephens, companies can take precautions such as establishing a computer security policy and statement of practice, as well as educating staff on the risks and viruses that often plague computer networks.

Pilots Train At MarineSafety

A group of Hadera Pilots is following shiphandling training at MarineSafety Rotterdam (MSR) focusing on the main issue of investigating the maximum capabilities of the new tugs presently operating in Hadera Port. This was a significant week of training since MSR combined its shiphandling training of Hadera with Jawaharlal Pilots from

India, which provided a positive practical insight into the maximum possibilities of the new tugs.

The first training session occurred two years ago, prior to the arrival of the new tugs in the Port of Hadera. This time around the pilots had already grasped the usage of the tugs but wanted to try out the maximum capabilities of the tugs using large vessels. Eventually the pilots learned that the safest way to experiment with this was through the use of the simulator.

The training week was the first of a three part series, with the final group scheduled to train at MSR in December.

Circle 9 on Reader Service Card

Polychronidis Leads With RST Water Savers

Polychronidis International, which specializes in technology for the hotel and shipping industry has been supplying technology systems to the passenger shipping market since 1996.

The forefront of the company's product line is RST water savers — a complete, easy-to-install system that can reportedly deliver water savings between 50 and 70 percent.

The Greek-based company also manufactures the Durasafe high-tech electronic safe boxes, which are operated by both digital code and magnetic bank cards.

Circle 10 on Reader Service Card

Griswold Introduces New Pump Series

Griswold Pump Company, Thomasville, Ga., presented two new series of high head self-priming pumps available in 3, 5, 7.5, 10, 15 and 20-hp. With heads to 260 ft. (110 PSI) and flow to 325 GPM, the pumps are suited for applications where greater flows and higher heads are necessary.

Circle 1 on Reader Service Card

Delta Marine President Participates In Conference

Ken Hughes, president of Delta Marine International was a participant at the Research Vessel Operator's Committee (RVOC) Meeting and Conference hosted by Harbor Branch Institution of Oceanography.

The conference, which occurred on November 3 in Fort Pierce, Fla., presented more than 30 research vessels from the world's oceanographic community represented at the RVOC, as well as the National Science Foundation.

Topics covered at the conference were the science and application technologies of ozone for marine and maritime uses, and water and air purification with ozone.

T.A.S.T. Appointed Exclusive U.S. Rep For Vancouver

Effective November 1, T.A.S.T. Corporation was elected as exclusive representative in the U.S. for Vancouver Shipyards Co. With offices in North Caldwell, N.J. and Kingwood, Texas, T.A.S.T. represents a variety of shipyards located throughout the world.

Drew Marine Offers Technical Guide

The Drew Marine Division of Ashland Specialty Chemical Company has developed a solvent-free air cooler cleaner, which eliminates the hydrocarbon fumes, surface residues and sludge potential associated with the use of many conventional products. ACC/ME air cooler cleaner safely and efficiently maintains the surfaces of air cooler fins and tubes in the engine's air charging system to promote good heat transfer and efficient engine operation. Its patented formulation removes the oil, grease, soot and dust deposits that form when compressed air from the turbocharger passes through the cooler. A

technical brochure available from Drew documents the new cleaner's benefits regarding efficient air cooler maintenance.

Circle 12 on Reader Service Card

KVH Garners Best Product Awards

For the second year running, two communications systems and two navigation products from KVH Industries have earned "best product" awards from The National Marine Electronics Association (NMEA). TracVision® 3, a new system for 1999 based upon last year's TracVision II, was named Best Satellite Television System, while Tracphone® 25 was designated best Satellite Telephone System. The company's new Azimuth® GyroTrac™ was voted Best Gyro Compass and the Azimuth 1000 won for Best Electronic Compass.

Circle 11 on Reader Service Card

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Known as one of the cleanest technologies for disposing human waste, Incinolet electronic incinerating toilets have been used on workboats for more than 20 years. The product is equipped not to dump, is U.S. Coast Guard certified and does not require any pumping or chemicals.

Rydex Selects Keysystems As Greek Distributor

Rydex has appointed KeySystems as its exclusive distributor for the Greek and Cyprus markets. The Athens-based company has achieved major sales success in the Greek shipping market with the MarineKey document management system. KeySystems belongs to the Hadji-Ioannou Group of companies that include Stelmar Tankers and the EasyJet airline company.

Petrobras 36 Sets World Record



Petrobras 36, the 31,183 ton Offshore Oil and Gas Platform left Sept-Iles, Quebec for Brazil on November 11. The Floating Production System is recorded as the heaviest load ever carried by a submersible heavy lift vessel. Performed by Dockwise of Belgium, the operation entailed the usage of the company's Modern Servant I heavy lift ship and the vessel, together with its large cargo, was scheduled to arrive in Rio de Janeiro by mid-November.

Formerly known as the Spirit of Columbus, Petrobras 36 had been at Quebec City Davie Industries undergoing upgrades for the past two years — making the vessel into one of the largest platform of its kind. When in operation at the Roncador Field located offshore Brazil, the vessel will produce 180,000 barrels of oil and 7.2 MM cu. m of gas per day from a water depth of 1,350 m.

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