

**MARITIME  
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AND  
ENGINEERING NEWS

MARCH 1999

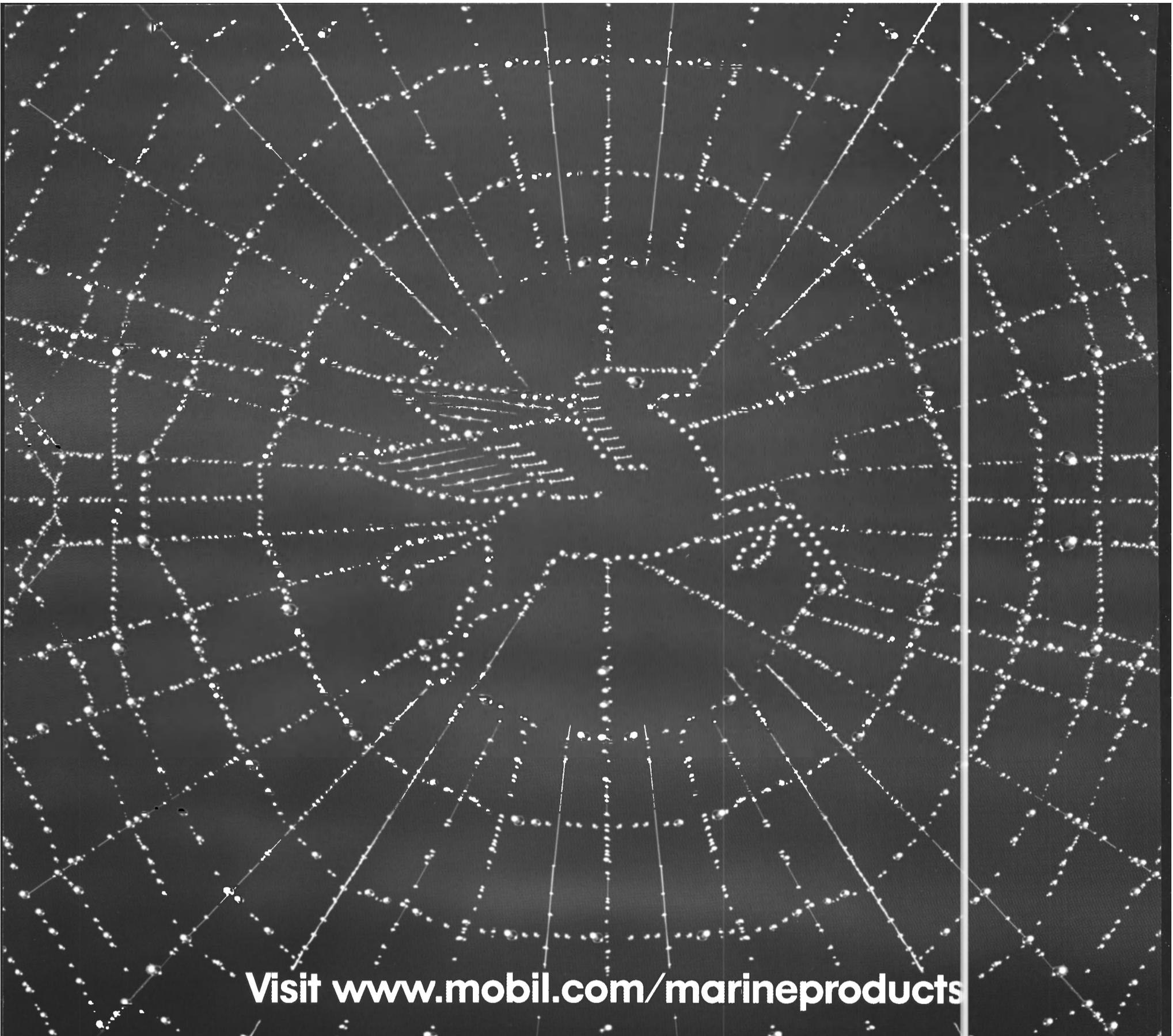
# Fixing The Fleet



- **Marine Electronics Directory**
- **Satellite Communication Solutions**
- **Paints, Coatings & Corrosion Control**
- **Hull Construction Materials**
- **Information Technology/Software Solutions**

**Inside Edition:**  
The psychology of simulation training

**Spain:**  
Yards stay on high-tech, high-value course

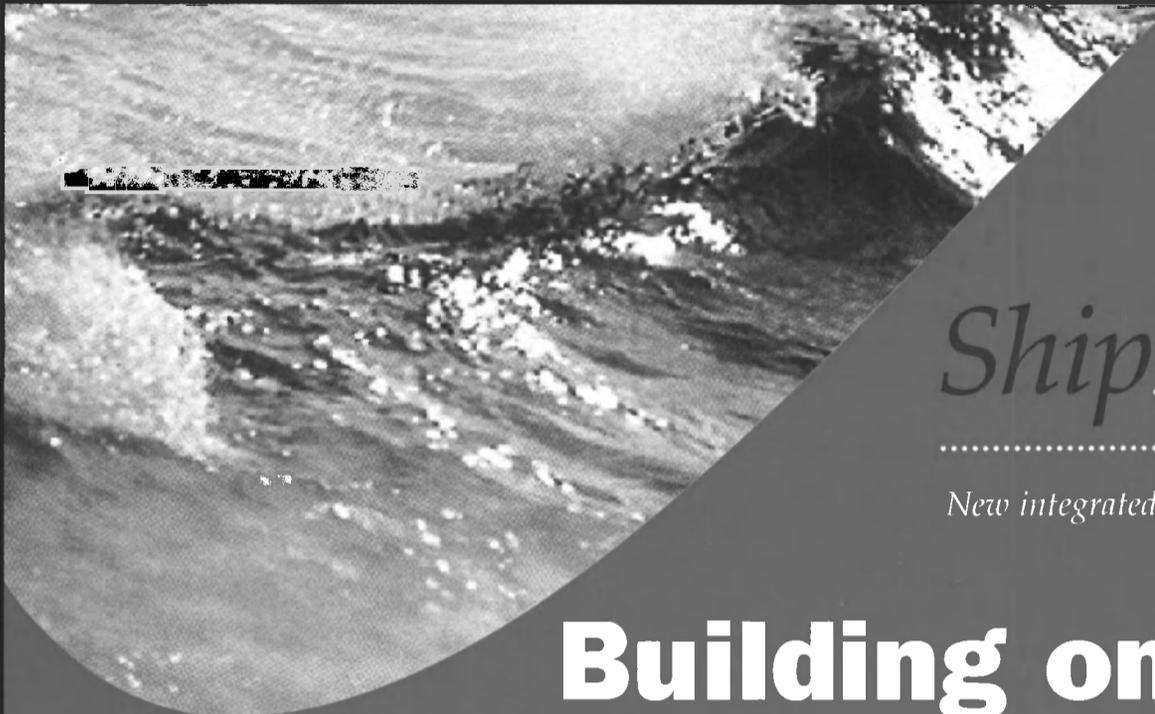


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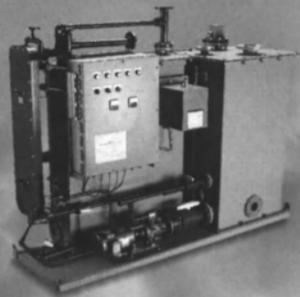
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Pictured on this month's cover is ABS inspector **George Revezikas**. ABS says, "One of the most effective programs to have been implemented to improve the safety of aging bulk carriers is the enhanced survey program. This requires a close-up inspection of specified critical areas within a ship's structure." Ship repair and conversion technology is the feature of the March edition, beginning on page 32.

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The new Arco tanker under construction at Avondale features a host of new and innovative marine technologies. — by David Tinsley
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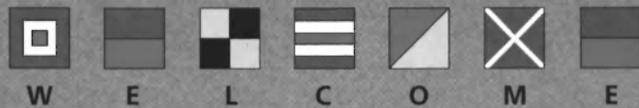
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## EDITOR'S NOTE

"Fixing the Fleet," as this month's cover loudly bellows, is a good general proclamation for the remainder of the year's editorial agenda. It seems that these days everything — from the aging fleet, to the Y2K problem, to navigational and communication capabilities, to engine emission and propulsion performance — is in some need of repair or improvement.



Take for example the U.S. Navy fleet, which for years has been subjected to crippling budget cuts which has severely limited the number of newbuilds and left active ships with less repair and maintenance dollars than some industry insiders deem necessary. Now that the fleet is reduced to the bare minimum (and some argue, below bare minimum) to meet the country's defense agenda, it appears that funds will start flowing toward navy newbuilds and repairs.

This is a scenario B. Edward Ewing banked-on when he started building his national ship repair and conversion network several years ago, buying shipyards in the downcycle in anticipation of the inevitable upturn. With the recent takeover of Norshipco, the newly named United States Marine Repair now boasts a presence on both coasts (with San Francisco Drydock and Southwest Marine) and is prepared to push even harder for a larger share of Navy repair money. A profile of Mr. Ewing and his company's efforts starts on page 32.

Marine Electronics, both on the navigation and communication fronts, have been ripe for quantum leaps in technological innovation during the previous few years. Crews at sea today are able to operate bigger ships with fewer staff, oftentimes more efficiently and safely due to the advent of advances which allow them to monitor shipboard information, detect potential hazards ahead, and gather and utilize information in a vastly superior and efficient manner. There is an initiative underway in Scandinavia which promises to deliver an advanced vessel identification system using VHF, in an effort to improve vessel, crew and cargo safety, particularly during times of bad weather or when sailing through dangerous waterways. This story, part of our Marine Electronics Directory, starts on page 50.

*Gregory R. Franthum*

### Coming Up In MR/EN in 1999

#### April

International Offshore Annual • **World Ship Repair Atlas & Directory** • U.S. West Coast Report

#### May

Nor-Shipping '99 • **Fuels, Lubricants, Additives & Filters Review** • *Country Focuses: Finland & Canada*

#### June

The Annual YEARBOOK Edition • *Country Focus: U.K.*

#### July

Diesel Power Annual • **Cruise Industry Report** • Safety Products Review • **CAD/CAM Systems** • **SatCom Suppliers** • **Deck Machinery & Cargo Handling Equip.**

#### August

**U.S. Ship & Boatbuilding Annual** • Software Solutions • **Fast Ferry Technology** • Engine Performance Equipment • **Country Focus: Germany**

#### September

SNAME Annual • **Marine Propulsion Technology** • Ship Maintenance/Safety Products • **Information Technology**

#### October

**60th ANNIVERSARY EDITION** • Satellite Communication Innovations • **Vessel Overhaul & Maintenance** • Regional Focus: U.S. East Coast • **Country Focus: Sweden**

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# Geared for success



by David Tinsley,  
technical editor

ARCO Marine's eclectic approach to the development of a mold-breaking new generation of crude carriers to handle coastwise shipments out of Alaska has provided a broad platform for marine engineering technology. Just as experience culled from North Sea shuttle tanker operations helped build the technical basis for the Millennium tanker project, distinguished by its emphasis on service dependability, system redundancy and environmental compatibility, proven engineering plant design has formed the foundation for an innovative concept of oil carrier.

Reliability, durability and a tried and tested design derivation have been common threads in the selection of machinery, albeit applied in an unusual configuration comprising two, low-speed engines, twin propellers and shaftlines, each with a high-capacity shaft alternator driven off a power take-off (PTO)

gear, and twin rudders. Each main engine and allied equipment is separated from the other by a longitudinal bulkhead, and each 'side' of the power train can be operated independently of the other.

While 'proven' engineering design and practice is a watchword for the project, the nature of the ship operating criteria laid down by ARCO has resulted in the adoption of the latest or newly-developed version of each individual element in the overall package. German marine transmissions specialist Renk, for example, has provided PTO gears which individually cover a generator power of 8,600 kW, and has developed a new disconnection clutch to enable the shaft alternator to be driven by the respective main engine with

the propeller shaft stopped.

For Vulkan Kupplungs, another German expert in a particular discipline, the design requirement for a PTO coupling rated for 8,600 kW necessitated an extension of its range to 800 kNm nominal torque from the previous maximum of 630 kNm. It was able to draw on 10 years' operating experience with its 630 kNm couplings fitted in shuttle tankers



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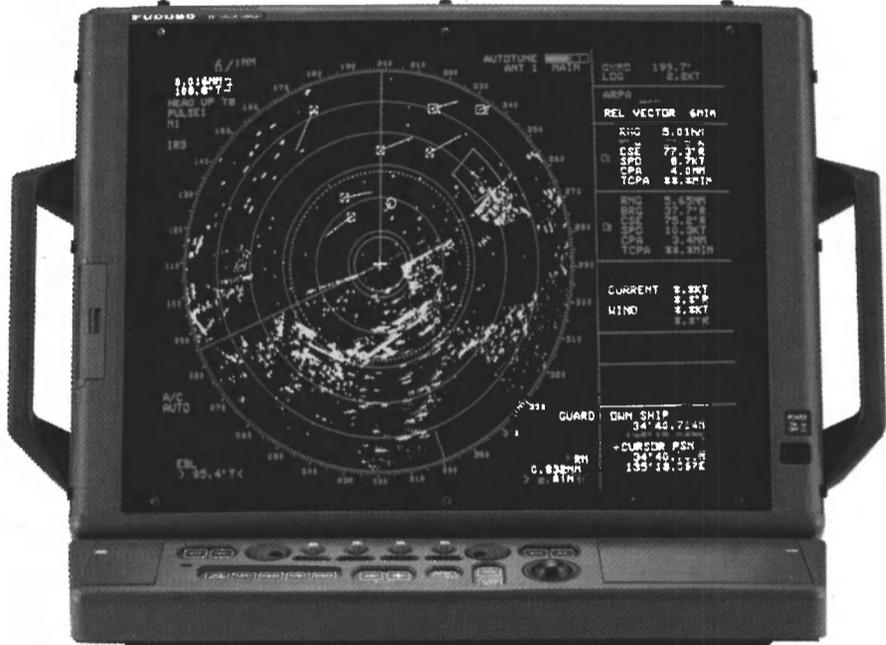
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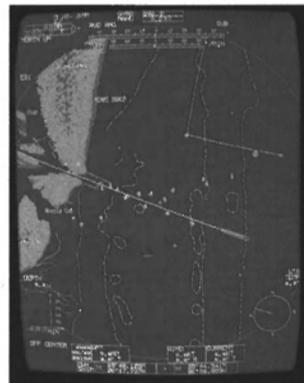
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Definition and basic design of the propulsion plant for the 125,000 dwt Millennium-class tankers was entrusted to MAN B&W licensee Manises Diesel, a Spanish enterprise owned by Astilleros Espanoles (AESAs) and MAN B&W Diesel. The selected prime mover, the

S50MC-C in its seven-cylinder version, is lighter and shorter than the preceding engine type, producing some 10 percent more power than the equivalent MC model. For each of the newbuilds at Avondale, two such engines producing 15,015-bhp (11,060-kW) apiece will be delivered from Europe.

The Renk friction clutch connecting the engine to the propeller and incorporating an integrated thrust bearing is perhaps the most innovative element of the propulsion system. The clutch allows the screw to be engaged and disengaged with the engine running at low speed, and its admissible torque is twice the

nominal torque of the engine.

Thus, with the propeller disconnected, the PTO can be employed up to the full 8,600 kW rating of the ABB shaft generator for cargo handling purposes. The arrangements mean that the plant may be operated in a total of three modes, namely sea mode, maneuvering mode and cargo mode.

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LOOK FOR THE GRID... FIND FERNSTRUM QUALITY

## Look to Norway

With the impending delivery of the first of its new, state-of-the-art seismic survey ships, Houston-based Western Atlas International has again tested the mettle of the maritime industrial infrastructure in western Norway. Ship and equipment quality and capability, and technological and operational input to design development conferring a competitive edge, are critical to the specialists in the niche business of subsea seismic data gathering.

The remit for the sophisticated new breed from Ulstein Verft called for extremely high levels of productivity and efficiency, and unerring accuracy, in undertaking advanced, three-dimensional seismic surveys in often hostile sea and weather conditions. The competitive market environment in which the vessels will operate is no less rigorous than the elements they will have to endure while deploying, trailing and recovering the multi-streamer arrays that now characterize the modern seismic ship. The pair of 298.5 ft. (91 m) newbuilds for Western Atlas, representing a combined contract value of \$91.6 million, is the product of close co-operation between customer and shipbuilding contractor, with the latter having had first-line recourse to the design and equipment companies in the Ulstein group.

The latest ship is a new showcase for the west Norwegian maritime production sector, with her engineering and propulsion systems, steering, deck and specialized cable handling equipment, automation and design, developed and manufactured in the region. She thereby provides fresh testimony to the depth and width of the Norwegian maritime cluster, and to the integrated manner in which it can operate within a region or country given sufficient critical mass.

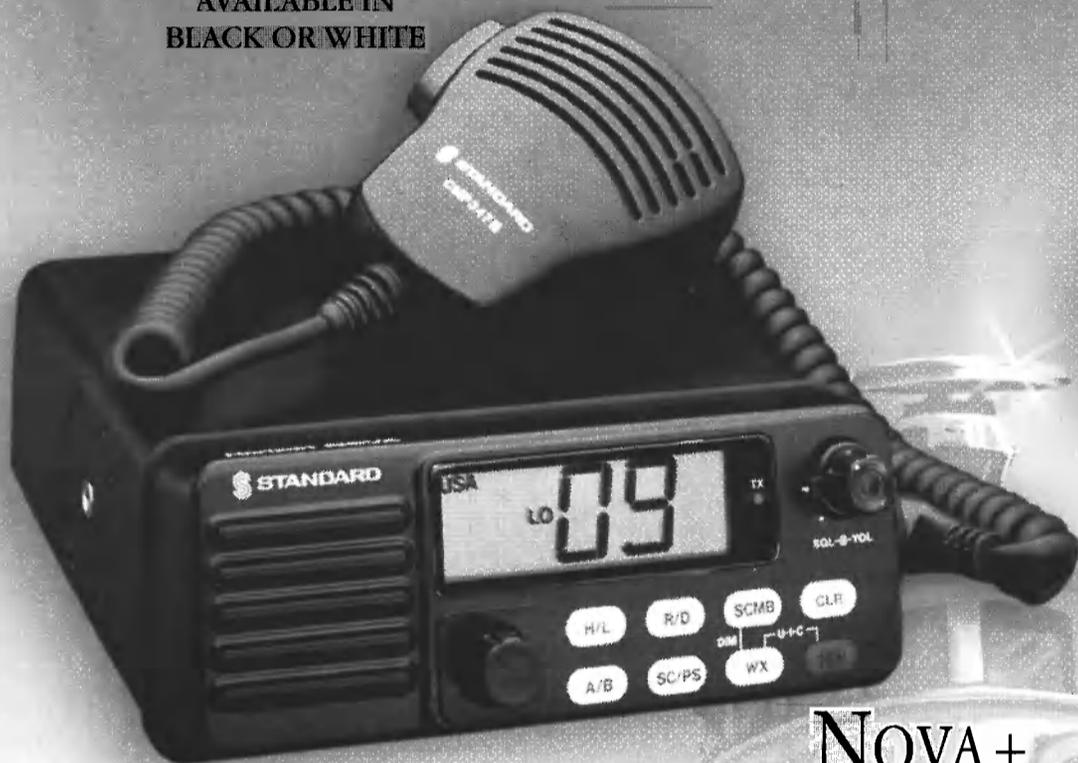
Good experience with six ships built by Ulstein Verft between 1991 and 1993 brought Western Atlas back to the county of More og Romsdal for its latest stage of fleet development. "Western requires that ships in their fleet operate efficiently, have low noise levels and can rapidly deploy and haul in the hydrophone cables. These demands are fulfilled by Ulstein vessels," said Ulstein Verft's managing director Bryn-

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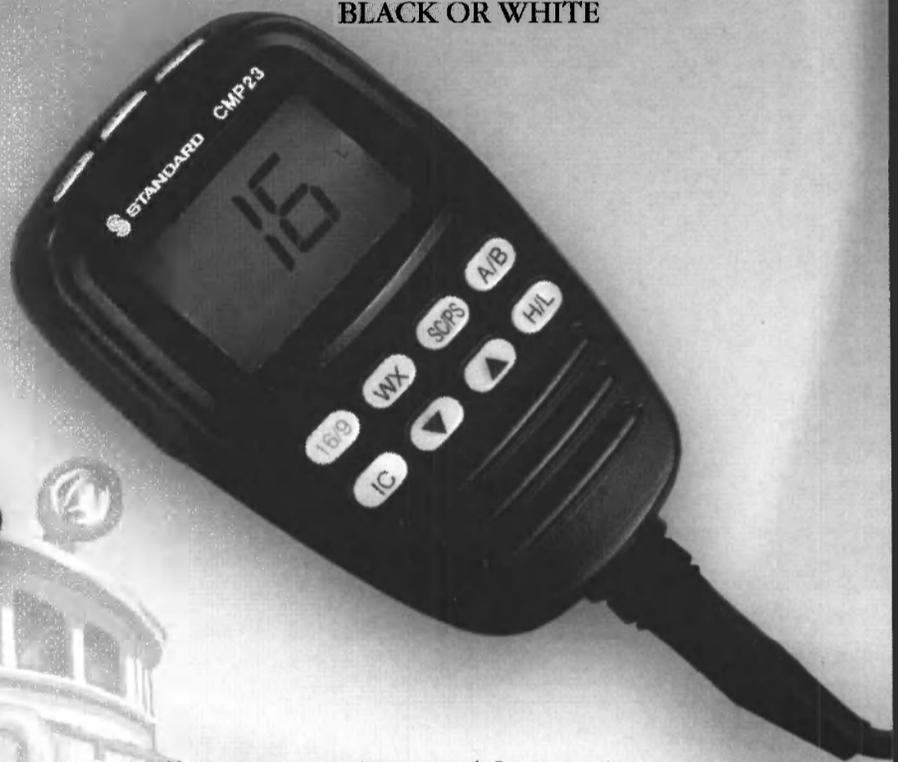
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## INVESTMENT IN DESIGN

### Julv Mugaas.

Conceived for three-dimensional seismic surveys, with the ability to tow at least 12 streamers from a specially-configured 'back' deck, the beamy UT753-class newbuilds have a substantial propulsive power concentration of 10,800-bhp. Deliveries are scheduled

for the end of March and November 1999, respectively.

The propellers, thrusters, steering gear, mooring winches and windlasses, rudders and electronic monitoring and control system have all been supplied by local factories in the Ulstein Group, while the main engines have come from

the Ulstein Bergen plant at Hordvikneset. One key element of the predominantly locally-derived equipment, engineering and technological input to the project has been the supply of streamer and tow winches plus all related handling gear from the ODIM Group. Having retained ODIM for a succession of

equipment retrofits to the earlier series of vessels, Western Atlas decided to look to the Ulstein company's product range from the outset for the two newbuilds.

The complete array of ODIM equipment supplied to each UT753 vessel is pivotal to the design requirement for each ship to be able to deploy at least 12 streamers. That part of the specification entrusted to ODIM has included streamer winches, tow winches, towing points, streamer spooling devices, vertical rollers and spooling blocks, plus hydraulic power packs, hydraulic valves, cooling filtration units, automated stowage system for birds, and also the electronic remote control system.

Notwithstanding the emergence of Vickers-Ulstein Marine, following Vickers' takeover of Ulstein's non-shipbuilding activities, the shipyard and the new entity plan to maintain a close working association to mutual benefit.

## Need To Buy Or Sell Marine Parts, Equipment And Services?

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Why not join hundreds of ship owners, operators, managers and marine suppliers around the world who have discovered the power of the ILS Parts Information Network. Each month, our subscribers send and receive hundreds of messages like those below to fill their marine equipment needs quickly, economically and efficiently. Shouldn't you? For details, contact us today.

#### Broadcast From: Skaarhamn, Sweden

"Urgent!! Urgent!! Please quote for 1 piece cylinder head complete, reconditioned, design IV 12 A34 or IV 12 A56 for Wartsila 624 TS. (Ship Manager)"

#### Broadcast from: North Point, Hong Kong

"For Sale\* New arrival of the following engine parts:  
- 1 x MAK 12 MU551 AK full engine parts-1B&W 7K90GF full engine parts  
- 1 x RD44 new cylinder liner, new cover, new piston cpl. (Trading Company)"

#### Broadcast From: Piraeus, Greece

"Top Urgent\*\* We are looking for the following \*\* Top Urgent  
1 pc Generator Set: 1500KW 6KV 50HZ, air or fresh water cooled.  
Please send your offer by fax or ILS DIRECT (Ship Owner)"

#### Broadcast From: Singapore

"Wanted for sw cooling pump. Maker: Heishin pump works type: VSK-80J S/N:111844 4pc mouth ring, 1 pc foot sleeve, 2 pc shaft sleeve, 1 pc foot cover, 2 pc neck bush, 2 pc seal cage, 1 pc packing gland, please fax your offer to (Trading Company)"

#### Broadcast From: Houston, TX

"We are looking for two (2) BBC turbochargers model VTR-354-11.  
New or used in good condition. Please respond via fax to (Service and Repair Company)"

#### Broadcast From: Spelle, Germany

"For Sale: Reconditioned crankshafts: Deutz BA16M716, RBVBM545, BV12M 628, MAK 6M331AK, 6M452AK, 8M453AK, MAN 8120/27, V8V22/30A, V6V16/18, MWM TBD510-6, TBD440-8, TBD441-16, MTU 12V331, 16V396, Warstila 6R32, Daihatsu 6DS22, Pielstick 18PA6-280, SKL 8NVD48-A2 and 40 Others. (Supplier)"

For more information on companies mentioned in this article, please circle the appropriate number on the reader service card.

Astilleros Espanoles .....	.79
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MAN B&W .....	.81
Renk .....	.82
Ulstein .....	.83

## ACH Wins Cruise Ship Anti-Roll Contract

ACH Engineering has been awarded a \$2.7 million contract to supply anti-roll stabilization systems for the next two Royal Caribbean cruise ships being built at Meyer Werft shipyard in Germany.

Circle 57 on Reader Service Card

## Destroyers Powered By GE

GE Marine Engines has received a contract from Ishikawajima-Harima Heavy Industries Co. Ltd. (IHI) to supply four LM2500 aeroderivative gas turbines to be used to power two 10DD Murasame-class destroyers being built for the Japanese Maritime Self-Defense Force (JMSDF). The two 10DD destroyers are scheduled for launch in 2001 and are expected to be commissioned in 2003.

In 1998 GE announced a similar order from IHI for four LM2500 gas turbines to power two 09DD Murasame-class destroyers.

These vessels are scheduled for launch in 2000 with full commissioning in 2002. The JMSDF will have a total of 16 LM2500-powered ships.

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**LR Awarded Conoco Banff FPSO Contract**

Lloyd's Register (LR) has been awarded a \$1 million, three-year contract by Atlantic Power and Gas to provide integrity management, verification and classification services to the Ramform Banff FPSO. The contract forms an extension to LR's current contract agreement with Atlantic Power and Gas on the Texaco Gallery FPSO.

Circle 56 on Reader Service Card

**DRS Technologies Wins Ingalls Contract**

Ingalls Shipbuilding has awarded a \$2.8 million contract to the DRS Flight Safety and Communications unit of DRS Technologies, Inc. to provide Centralized Communications Systems for retrofit installation on frigates destined for the Armada of the Republic of Venezuela. DRS will supply its Shipboard Integrated Communications (SHINCOM) 2100 system which features a dual homing architecture initially developed for the Canadian Navy.

**Bermuda Company Acquires N.Y./N.J. Ferry Operator**

Sea Containers Ltd., marine container lessor, passenger transport and hotels operator of Hamilton, Bermuda has acquired Express Navigation, Inc. from Holyman Ltd. of Australia in a \$5 million transaction. Express Navigation provides services with three passenger ferries between Manhattan and Brooklyn, New York and two ports in New Jersey. **James B. Sherwood**, president of Sea Containers Ltd., said that Express Navigation is the company's first passenger transport investment in the U.S. and will form a part of a group of U.S.-based ferry services which the company will seek to initiate in the future.

**Parametric Technology Receives \$20 Million Order**

Parametric Technology Corporation (PTC), developer of the Pro/ENGINEER family of software tools used to automate mechanical product development, has recently received a five-year, \$20 million order for Pro/ENGINEER software and services from Mannesmann of Duesseldorf, Germany. Mannesmann's core business sectors are engineering, automotive, telecommunications, and tubes.

**CDI Builds New DSV**

Cal Dive is building a new DSV to replace the Cal Diver IV which has been sold. The new vessel, which will retain

the name Cal Diver IV, is under construction at R&S Fabrication, Inc. in Lockport, Louisiana. Like its predecessor, the new vessel will be ideally suited for supporting general diving such as: pipeline inspections, pipeline commissioning and decommissioning, platform inspections and repairs, wellhead

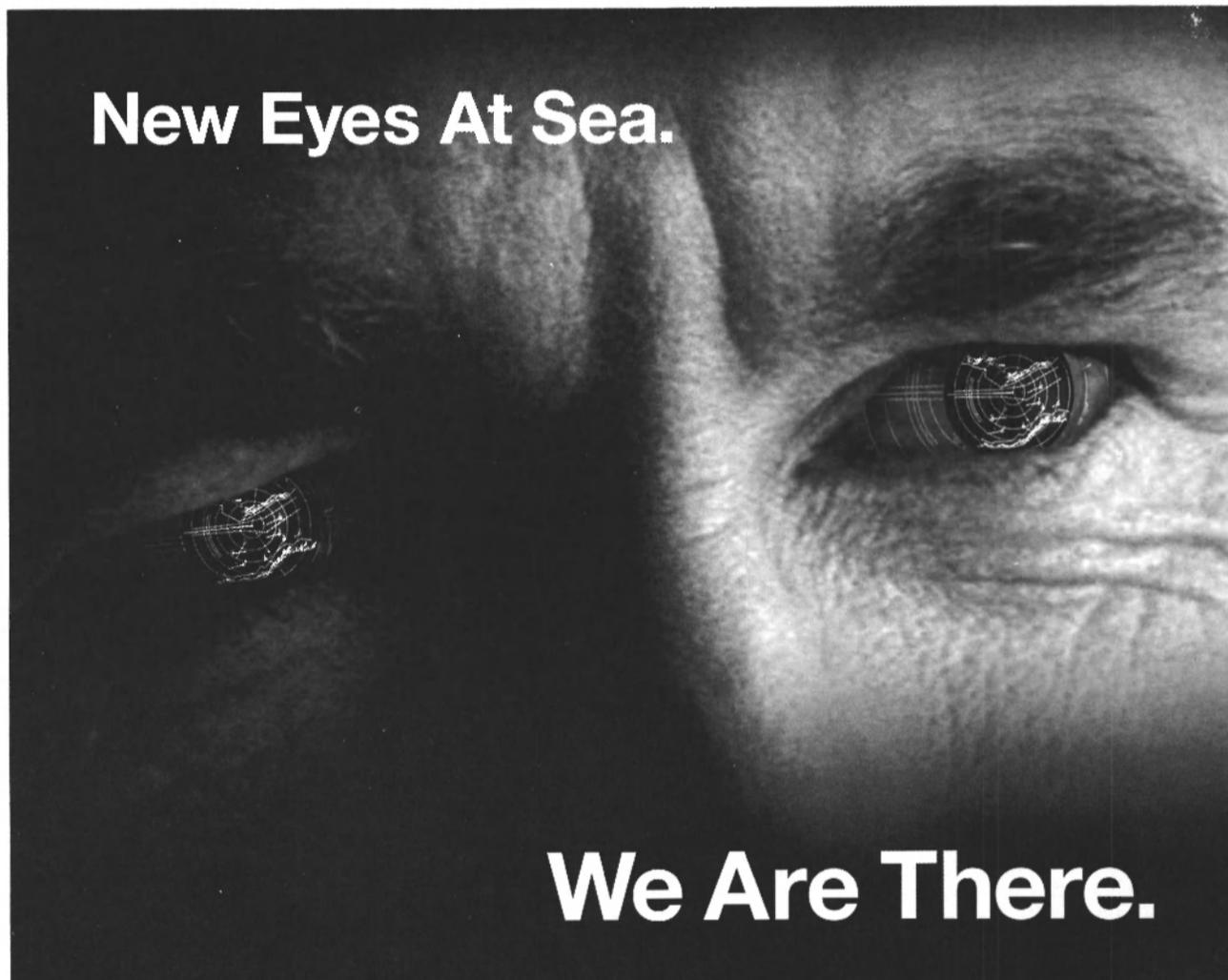
inspections, drilling rig support, and "liveboating" operations. Although the mission of the new build remains basically unchanged, its increase in size and capacity will enable it to conduct small construction projects.

CDI expects delivery in the second quarter of 1999.

**Donjon Awarded Navy Salvage Tug Lease**

The U.S. Navy has awarded Donjon Marine Co. Inc. a five-year lease of the tug USNS Powhatan. The multi-purpose tug can conduct long-distance tows and

(Continued on page 15)



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## Invasive Species: A New Opening For Environmental Regulation Of Vessel Operations?

"Invasive species" is becoming the new battle cry for many groups concerned with the marine environment. Interior Secretary **Bruce Babbitt** believes this country's response to the crisis has been "timid" and that a "full scale counterattack on bioinvaders" is needed. In particular, Secretary Babbitt is sounding the alarm on the "ecological devastation" caused by invasive species deposited in sensitive marine waters by ballast water discharges.

An Invasive Species Council has been created by President **Clinton** that will include the Secretaries of Transportation, Interior, Treasury, Defense, Agriculture, and Commerce, as well as the Administrator of the Environmental Protection Agency (EPA). The Council will be tasked with developing a national Invasive Species Management Plan to address the problems associated with the introduction of invasive species and to develop recommendations for ways in which to prevent the introduction of these species in U.S. waters. More immediately, environmental groups from eight states and the Association of California Water Agencies have targeted EPA regulation of ballast water discharges by vessels in U.S. waters. These

groups have petitioned EPA to repeal the current exemption from Clean Water Act permit requirements for discharges "incidental to normal vessel operations." Another environmental group has signaled its intent to bring citizens' suit under the Endangered Species Act to address invasive species problems.

The introduction of invasive species is not exclusively a problem of the marine industry, but ballast water discharges are an attractive and visible target. Secretary Babbitt and a number of environmental groups want ballast discharges to be considered "point sources" of pollution. Point sources of pollution discharging into U.S. waters are subject to Clean Water Act permit requirements. These requirements include water quality standards, testing, and reporting, and audits and investigations by EPA. The groups petitioning EPA to repeal the current exemption for discharges "incidental to normal vessel operations" argue that categorical exemptions are not permitted under the Clean Water Act and that such vessel discharges are only permitted in the "contiguous zone" or the "ocean." With no explicit authorization for such discharges within three miles, the groups consider the current

exemption for such discharges to be contrary to the provisions of the Clean Water Act.

If EPA grants the petition and then conducts a rulemaking to repeal the exemption and to apply permit requirements to vessel discharges, environmental regulation of vessel operations is likely to increase. If ballast discharges are a point source of pollution subject to permit requirements, other discharges from vessel operations could be as well. EPA and the Navy are already examining the need for regulation of discharges such as engine cooling water.

At a minimum, some of the groups involved in the invasive species debate want mandatory ballast exchange for all ships coming to American ports, as the need for prevention of the introduction of such species is perceived as critical.

The international maritime community is already working on how to address the problem of introduction of invasive species. The recent increase in public attention to the issue in the U.S. ensures that federal departments and agencies will be increasing current efforts to focus on these issues. How controls can and should be designed will raise significant questions for scientists and policy-

makers. Some environmental groups view invasive species as even more devastating to the marine environment than oil spills. According to Secretary Babbitt, "In the long run, these [biological spills in Prince William Sound] may change the Sound more extensively and permanently than any oil spill." While the image may be appealing to those who support focusing major new attention to this issue, it is not primarily a tanker issue. Vessels fully loaded with crude oil do not arrive in the U.S. with ballast water to be discharged; they are already fully loaded with oil. Other types of vessels are more likely to arrive with large quantities of ballast water needed to stabilize the vessel on its ocean voyage. Sound bites are not the basis upon which solutions will be found. Developing a reasonable approach to the problems created by invasive species issue will not be easy. It will require substantial work on the part of all that are involved in and affected by the debate.

*Susan Geiger, a partner with the firm of Preston Gates Ellis & Rouvelas Meeds LLP, specializes in transportation and environmental law.*

# Only Enterprise. Only Powerhouse.

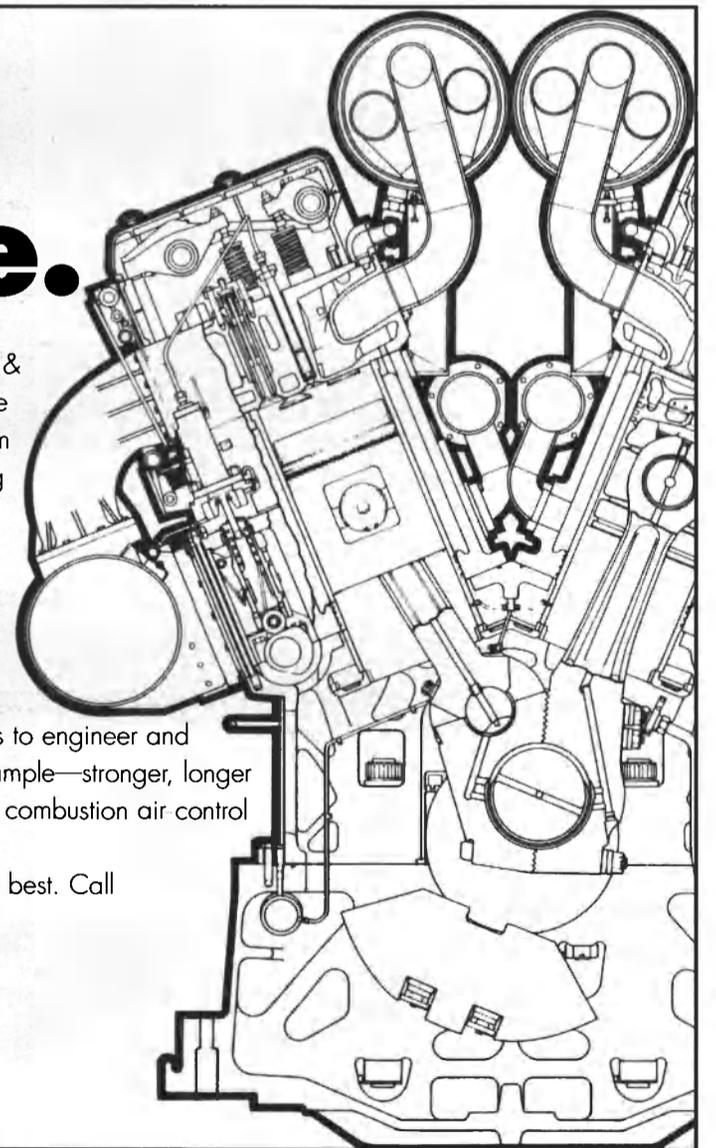
The Enterprise; a powerful engine that has a long and proud history. The Enterprise Engine & Machinery Company began manufacturing engines in the 1920's for stationary and marine service. Humble beginnings for an engine that evolved into one of the most reliable medium diesel engines of today. Enterprise engines continue to operate around the world, providing power for industrial plants, third world countries, electric generation, main propulsion in ships, municipal power plants, and in nuclear stand-by service. A proven workhorse, the Enterprise is one solid piece of engineering. This explains why so many are still in operation some 10 years after production ceased.

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**Replacement Parts for Enterprise Engines**



(Continued from page 13)

when augmented with additional crew and equipment, operate in support of fire fighting, diving and salvage missions. Minor modifications will be made to the vessel, including changing the paint scheme to Donjon's standard blue as well as reconfiguring the wheelhouse to make it more "merchant marine user friendly."

The lease of the vessel is part of Donjon Marine's plan for steady expansion into the international salvage and salvage related towing industry. USNS Powhatan will join a fleet of coastal and ocean towing vessels, crane barges, dredges, crew boats, deck barges and assorted salvage equipment.

### BP Marine Supplies Cunard Flagships

BP Marine has won a five-year contract to supply marine lubricants to the Cunard and Seabourn fleet of cruise ships, recently acquired by Carnival Corp. The contract includes supplying eight five-star vessels, including the QE II on a 24 hour 365 day basis.

Circle 71 on Reader Service Card

### Friede Goldman Signs \$143M Contract to Build Semisub

Friede Goldman International Inc. (FGI) has signed a \$143.2 million contract with Rudgil SA, a subsidiary of Schahin Engenharia e Comercio Ltda. of Brazil, for the construction of a Friede Goldman-designed "Millennium SA." The Millennium SA (South America) is the latest in new, deepwater semi-submersible designs from FGI subsidiary Friede & Goldman, Ltd., (F&G) a New Orleans-based naval architecture and marine engineering company. Equipped as a dynamically positioned semi with a DPS-2 station keeping system, the Millennium SA is capable of drilling in 5,000 ft. (1,524 m) of water with a variable deck load of 3,500 long tons. F&G will perform engineering work on the project in conjunction with Friede Goldman Offshore - East in Pascagoula, Miss., where the rig will be constructed.

The rig is scheduled for delivery 23 months from the contract signing date, contingent on the completion of rig financing. The Schahin company has a six-year contract with Petrobras, the state-owned oil company, to operate its rig offshore Brazil.

Circle 108 on Reader Service Card

### Kamewa Will Equip Swedish AHTS Vessels

Three DNV Ice Class vessels to be used for icebreaking duties in the Baltic

Sea are to be fitted with Kamewa propulsion equipment.

Kamewa is one of the world's leading designers and producers of marine propulsion systems. The state of the art, anchor-handling, tug-supply (AHTS) vessels which are being built at Kvaerner Leirvik, Norway, for Bylock & Nordsojfrakt, Sweden, will be

equipped with Kamewa twin-screw propeller systems, type 132XF5/4 which include nozzles to increase ice-breaking capability and bollard pull.

When completed the multi-purpose vessels will have an overall length of 273.6 ft. (83.7 m), a beam of 59 ft. (18 m) and a service speed of 16 knots.

The order represents a breakthrough

for Kamewa in the supply of propulsion systems for this type of vessel. The company undertook extensive research, design and testing to secure the order which also includes control and hydraulic systems. The first vessel is due to be delivered in 2000.

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## MOSAT Joint Venture Has Greek Flavor

Mobil Shipping and Transportation Company (MOSAT) has formed a joint shipping venture with two premier Greek shipping organizations, the Onassis Group and the Petros J. Goulandris Sons Group, to acquire two very large

crude carriers (VLCCs). The vessels will be employed in Mobil's worldwide system under long-term charters with the Onassis Group and the Goulandris Group collaborating in the technical management of the vessels. Delivery is

scheduled for the fall of 2000.

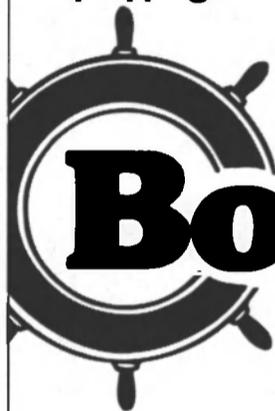
The new joint venture company, MARCARE Shipping Co., in which all three partners hold an equal share, will be the owner of the two high quality, state-of-the-art, double-hull VLCCs to be built by Hyundai Heavy Industries.

"We are pleased to undertake this joint

venture with our first class partners who each in their own right represent quality, commitment and a long history of success in the shipping business," said **Gerhard Kurz**, president of MOSAT.

Onassis Group Directors **Anthony Papadimitriou** and **John Ioannidis** joined the Goulandris Group in expressing their confidence that the MARCARE Shipping structure, in which all parties have a vested interest in the venture's long term success, represents a very welcome evolution for the shipping industry. "The experience, expertise and resources of three prominent shipping organizations, pooled to a common goal, can prove an effective force for the future," they said.

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## Kamewa Signs On With FastShip

Swedish-based Kamewa, a subsidiary of the marine division of Vickers plc, has entered into an agreement with FastShip Inc. to design and develop the world's largest ever water jets. The Kamewa water jets are to be developed for the first four vessels to be introduced as part of a revolutionary new ocean cargo transport system which will offer a premium seven-day North Atlantic transportation network for high-value time sensitive goods (HVTs).

The core of the FastShip system is a fleet of patented high-speed ships able to run at speeds of 36 to 40 knots even in rough seas. The basic design of the vessel has been verified by Det Norske Veritas. FastShip plans to begin commercial service between Philadelphia and Cherbourg, France by the year 2002. The water jet propulsion system provided by Kamewa will be an integral component of the FastShip design. With an inlet diameter of 10.6 ft. (3.25 m), the water jets will be twice the size and power output of the largest units currently in operation, and will provide 50 mW of propulsive power per unit. Each vessel will have five Kamewa water jets and each jet will be driven by aeroderivative, marinized jet engines.

"Our newly formed partnership with Kamewa will provide great support for this unprecedented venture in ocean transportation. Kamewa water jet technology will be key in helping realize FastShip's vision of revolutionizing ocean cargo to provide customers with delivery speed and reliability which is comparable to airfreight, at a cost closer to conventional shipping rates," said **Einar Pedersen**, chairman and CEO of FastShip, Inc. Kamewa is considering constructing and assembling portions of the water jets in Philadelphia.

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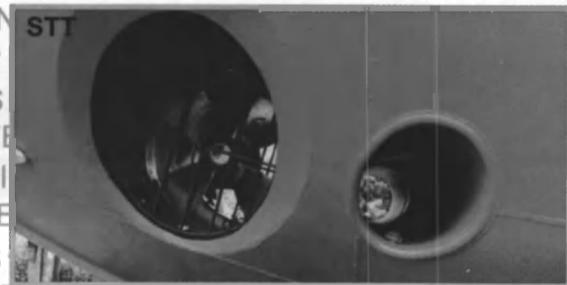
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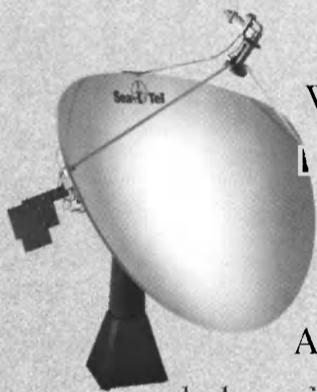
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# Increased Efficiency Through Technology And Telecom

It was 1899 and the Industrial Revolution had forever shaped the direction of business in North America and Europe. It was in that same year that Algoma Central Corporation incorporated in Ontario, Canada. Fast forward a century and again business is being shaped by a revolution – an information one. The use of enterprise software, satellite communications, the Internet and other information technologies have enabled businesses to operate more efficiently.

While Algoma Central depends on its history to retain and win new customers, the company hardly rests on its laurels, and has become adept at maximizing its efficiencies through a steadfast investment in new technologies. Two of Algoma Central's technology partnerships are with telecommunications providers such as Stratos and technology vendors like Astech Solutions. The result of its investment: a vessel positioning and scheduling system which has slashed costly vessel light time and enhanced customer service, and garnered the company the Best Transportation Solution Award at the 1997 COMMON Conference and Exposition of IBM AS/400 Users.

Today, Algoma Central stands alone as the largest inland shipping company in Canada. The company operates domestically a fleet of 28 vessels that carry cargoes of raw materials, such as coal, grain, ore, salt, stone and oil products within the Great Lakes and the St. Lawrence Seaway.

The company is also a partner in an ocean shipping company that operates a fleet of bulk cargo vessels worldwide. In 1994, Algoma Central formed a partnership with Upper Lakes Group, Inc., another Canadian shipowner, bringing together the self-unloading vessels of both companies. These vessels unload cargo in as little as six hours, while traditional bulkers may take two to three days to be unloaded using shore-side equipment. The partnership, called Seaway Self Unloaders (SSU), is charged with managing the traffic and marketing functions for the combined fleet of 21 self unloaders.

"SSU exists to market Algoma and Upper Lakes self unloaders to the customer base, and to then provide a high level of service and support to those customers," explains **Robert Cook**, manager of information services for Algoma Central. The actual operation of the vessels remains with Algoma Central and Upper Lakes. Each company retained ownership and operational responsibilities for its own vessels, 13 managed by Algoma Central and eight by Upper Lakes.

## The Tracking and Scheduling Challenge

The retention of ownership and operational responsibilities by each partner created a business challenge for SSU. Vessel tracking and scheduling information had to be shared between the operations centers at both Algoma Central and Upper Lakes, and then passed along to the vessels themselves. By overcoming this challenge there would be a significant reduction in the amount of vessel light time. Cook explains it costs the

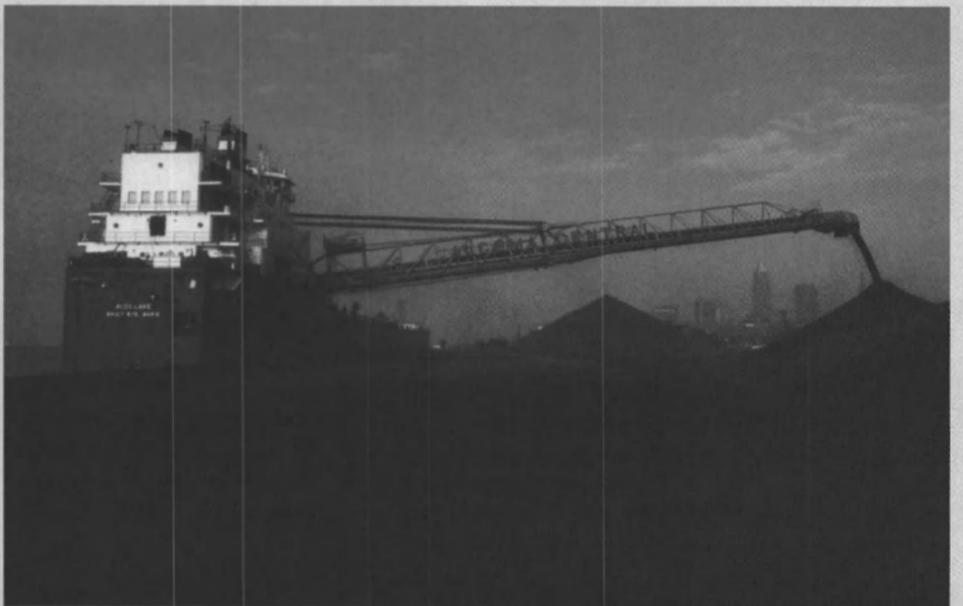
company about \$1,500 an hour to operate an empty or light ship. Thus, minimizing light time is critical to profitability. A second challenge was managing the ambitious growth objectives Algoma Central and Upper Lakes had set for SSU. There were plans to add new self-unloaders to the existing fleet as well as securing the use of a ship that had been under a long-term charter contract with another shipping company. Investments in technology had to be made to enable the existing staff to handle the additional workload.

"We needed the capability to quickly respond to customer requirements and inquiries as well as the operational challenges of running a large fleet," Cook said. "Technology increases efficiencies and reduces human error."

SSU inherited a voyage reporting system from Algoma Central which provided a base on which to build a more advanced system. This approach would allow SSU to retain the original investment Algoma Central had made while still developing a more advanced solution for vessel tracking and scheduling.

## Technology Delivers Enhanced Performance

Partnering with systems integration firm Astech Solutions of Ontario, Canada, SSU developed a comprehensive vessel tracking and scheduling system which has brought new efficiencies to its vessel operations. The two components of this enterprise solution are the Vessel Position Reporting System and the Vessel Traffic Scheduling System. Both run in a client/server environment on IBM's AS/400 Advanced Series midrange server. They incorporate a user friendly "point and click" environment providing the traffic departments at SSU with immediate access to the database of voyages, both known and anticipated. As a result, scheduling speed is greatly enhanced. Additional features of the system include desktop faxing of information to customers as well as remote access by SSU personnel. **Wayne Hennessy**, Manager Traffic and Customer Service at SSU, said "Today, we respond to customer phone queries in real time while they're still on the line. We are also preparing to roll-out customer interactive capabilities on our Web site. Each customer will receive a user ID and a password, and they can then access information regarding their



Algoma Central's partnership called Seaway Self Unloaders depends on advanced satellite communication solutions to ensure maximum efficiency.

account 24 hours a day, seven days a week."

## The Satellite Integrator

Two-way, real-time communications integrates SSU's entire vessel tracking and scheduling system. The SSU traffic department is linked with vessel personnel via a wide area network (WAN). Algoma Central had initially used cellular for its wireless communications, but incurred frequent long distance and roaming charges. In addition, vessels were often out of range of cellular as the network covers only about 10 percent of the Canadian geography. As a result, Algoma Central selected satellite service to provide the communications link and to serve as the backbone of its WAN. Working with Stratos, a multi-network satellite operator headquartered in Toronto and with offices in Canada, U.S. and Europe, Algoma Central and SSU were able to fully integrate its new vessel tracking and scheduling system.

"Satellites have proven themselves over the past 25 years as the source for the most reliable and complete communications," says **Trevor Adey**, vice president of commercial sales at Stratos. "As the communications needs of commercial shippers have expanded, advances in satellite technology have helped us keep pace."

SSU's WAN relies on Stratos' MSAT satellite network for the exchange of voice and data communications. This network utilizes a high-powered satellite which covers all of Canada and the U.S. (extending 200 miles offshore) as well as Hawaii and northern Mexico. Throughout the work day, schedule and location information is collected on each vessel and then transmitted via the Stratos MSAT satellite service to the operation center at Algoma Central. The information is then downloaded to SSU's Vessel Positioning Reporting System and the Vessel Traffic Scheduling System where it can be analyzed. Directions are then

## SATELLITE COMMUNICATION REPORT

# Tug And Barge Industry Hits The Computer Age To Save Time And Money

Transporting barges filled with petroleum products does not traditionally conjure images of a high-tech, advanced industry. In fact, the conservative nature of the maritime market as a whole is particularly true for the tug and barge segment.

This is changing, however, as economics of the business have not only forced significant amounts of industry consolidation, they have also demanded that all companies embrace new and innovative products and systems designed to save time and money.

Reinauer Transportation is a family owned and operated business which has operated in the New York and Boston Harbors, as well as along the Chesapeake for 75 years. The company has invested in satellite tracking and communication software, but to date, it had done little to automate its accounting or scheduling systems.

This changed in 1997, as the company worked toward improving its service to major oil companies as well as its smaller clients. The company hired Flash Creative Management to develop a

provided by the operations centers back to the vessels. Stratos sells time on the MSAT satellite at a flat rate charge of about \$1.19 per minute, enabling Algoma Central to more closely control costs.

"As a multi-network operator, Stratos provides a suite of satellite services based on our customer's own unique requirements," Adey explains. "As a result, we're able to provide the right service at the most competitive price. For instance, Algoma needs a regional voice and data solution which is less expensive than our Inmarsat and Iridium global services."

Wayne Smith, Vice President and General Manager of SSU, said they measure return on investment in the vessel traffic and scheduling system, and WAN in three ways: improved employee productivity; enhanced business activities; and improved customer satisfaction.

According to Smith, SSU is ahead on all three counts. "Staff levels have remained constant as growth of 25 percent was achieved during the last three years," Smith explains.

"To put it all in perspective, SSU now averages gross revenue in excess of \$10 million per employee."

Marc Hausman is a writer based in Silver Spring, MD.

user-friendly, state-of-the-art operations/tracking transportation system dubbed TBSS, which stands for Tug Barge Scheduling System.

While fears and resistance among

clients and workers was a challenge, the resultant web-based operations/tracking system allows for: better time, coordination and movement management of the fleet; secured customer access to

account information; creation of consistent terminology throughout an account; improved billing accuracy and better document and information management.

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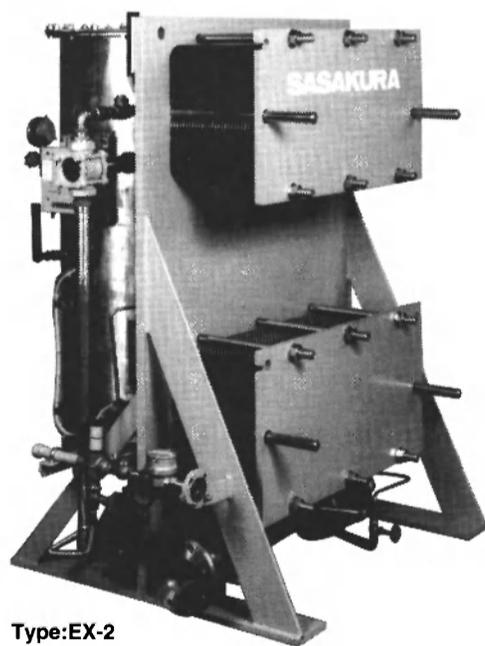
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## Inmarsat Privatization Set

April 15, 1999 is the date chosen by the Inmarsat Council of Signatories for the privatization of the organization. A letter is currently being issued to all signatories inviting nominations for company directors. The new company, which will be located in London, will be governed initially by a 14-member fiduciary board of directors: the CEO and 13 non-executive directors, three of which

will represent developing countries.

The new structure comprises two entities: a two-tier private company, (Inmarsat Holdings and Inmarsat Ltd.), that will seek an initial public offering within approximately two years of formation; and an intergovernmental body, called the International Mobile Satellite Organization (IMSO), to oversee Inmarsat's delivery of its public service obligations, including the Global

Maritime Distress and Safety System (GMDSS).

## COMSAT And France Telecom Form Indian Ocean Team

COMSAT Mobile Communications has formed an alliance with France Telecom to provide COMSAT-C services. The alliance will expand COMSAT's service offerings in the

Indian Ocean Region by adding polling, fleet management, and data reporting capabilities as well as simplifying the address for customers sending and receiving Internet E-mail.

## OSII Announces New Appointment

Offshore Systems International, Inc. has recently appointed Vernon Moore to the position of Sales and Support Engineer. Mr. Moore, previously with Maricom Electronics, will be responsible for the support of the Yokogawa Denshikiki Co. Ltd. (YDK) product line internationally and internal sales. Offshore Systems is the authorized distributor for YDK in North, Central and South America.

## Costa Cruise Lines Training At RTM STAR Center

Costa Cruise Lines of Miami, Fla. has signed a contract to receive "Crowd Management" and "Crisis Behavior Management" training from RTM STAR Center of Ft. Lauderdale. The two eight-hour STCW required courses are devoted to passenger safety and are taught on board in four-hour sessions. The sessions, structured to allow employees to maintain their shipboard work schedules, include seminars, practical exercises and written STCW assessments.

Circle 35 on Reader Service Card

## Download Free Software

MarineLogic Systems has developed a software tool to aid shipboard engineers in tracking jobs, landed materials, requisitions, and purchase orders. Virtual ME Light's easy-to-use graphical user interface and on-line help system allows shipboard engineers to use the product with minimal training. Shipboard engineers immediately benefit from the system without any start-up or overhead hassle. Virtual ME Light also allows shipboard engineers to import data from a text file rather than re-entering data from previous systems. Plans for future modules include preventive maintenance and inventory control. Virtual ME Light is available from MarineLogic's website at <http://www.marinelogic.com>.

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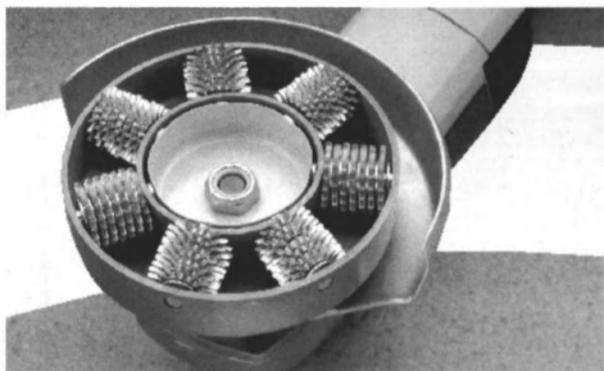
## Correction

Railway Specialties Corp. of Pennsylvania, maker of marine doors, was inadvertently omitted from the 1999 *World Maritime Directory* as a U.S. equipment supplier.

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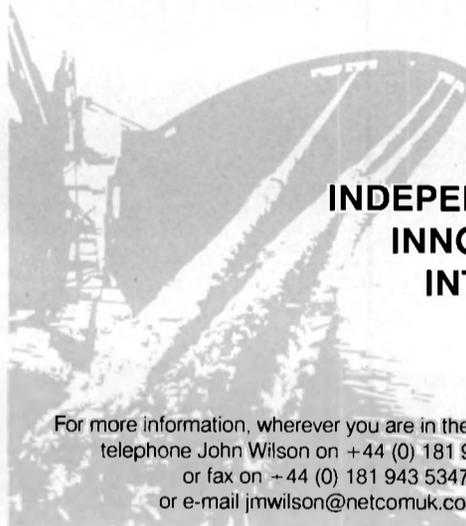
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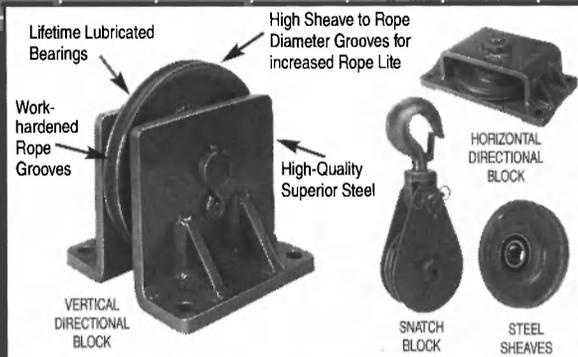
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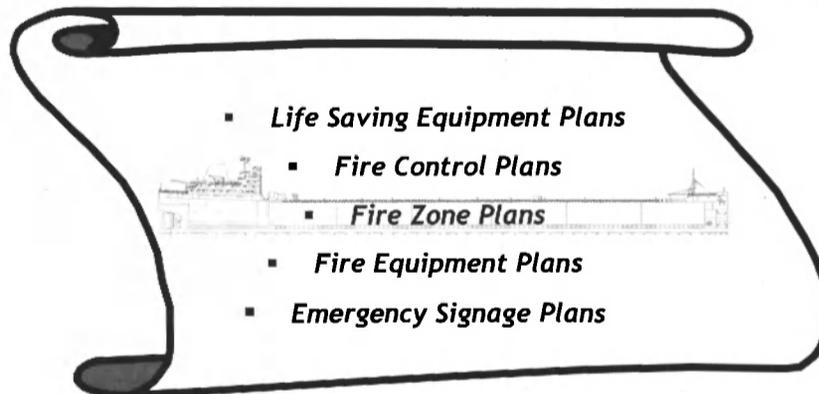
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## SOFTWARE SOLUTIONS

# Intergraph: Helping To Blaze New Trails In Shipbuilding

Intergraph Corp. of Huntsville, Ala. provides an Integrated Ship Design and Production (ISDP) System which is positioned as the tool for shipbuilders to use to ensure that ship production, from initial design through final outfitting, is performed as economically, cost effectively and technically correct as possible.

Intergraph's ISDP system supports the entire shipbuilding process, and with this software, shipbuilders are able to produce a complete 3-D ship product module that supports all engineering and manufacturing capabilities. In attempting to deliver the total solutions — rather than just one factor in the enormous equation — Intergraph's 3-D product model solution is designed to allow efficient practices such as concurrent engineering practices, which can drastically reduce production costs and improve accuracy.

In a move designed to maximize the ease of use of the system with traditional ship design as well as typical office software, Intergraph has embraced the Microsoft software environment as a central element of its next generation system. The next generation software is designed to provide clear, intuitive interfaces which will, among other things, help to reduce training for new technical applications.

The object model environment is built on Microsoft's Object Linking and Embedding (OLE) and Component Object Model (COM) technology that has been adapted by more than 400 software vendors worldwide. The company's Jupiter technology, which will be forthcoming in 1999, is an extension of the windows environment to fully utilize CAD data in a similar manner as normal office applications.

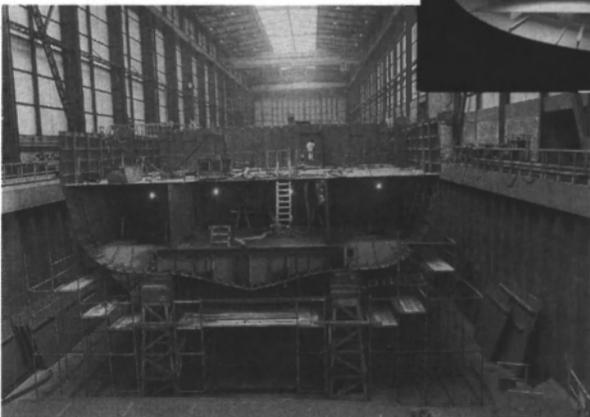
### Electronic Outfitting

With the ISDP system, ship designers can model equipment and components concurrently with the development of the ship model. Intergraph achieves this using parametric libraries, enabling designers to model many variations within a family of parts by specifying the unique attributes of each component. A key financial benefit of this process is the minimization of redundant work when modeling distributive system components and other systems and equipment.

Additionally, equipment and component models can be represented in ISDP with multiple levels of detail to match the requirements of different ship design tasks.

### Lighting The Path

In addition to its own technical



solutions, Intergraph has assumed a leading role within the international shipbuilding community via its participation in multi-dimensional R&D projects.

Intergraph recently announced the first worldwide production implementation of an Integrated Product Data Environment (IPDE). The recently deployed system is being used by the Avondale Alliance to design and build ships for the Navy's LPD 17 Program, and IPDE will eventually be deployed on board ship.

Using the Alliance's Wide Area Network and enterprise-wide data management system components, any of the 17 current Alliance sites around the U.S. and the Navy are able to retrieve relevant program information — such as access and configuration-controlled requirements, documents, drawings, and other deliverables — from a distributed, but logically centralized repository at the Avondale site. Using the newly deployed Web-enabled interface "LPD Navigator", authorized users can retrieve and review files in their native format. This not only promotes concurrent engineering during ship design, but also helps manage constant engineering changes.

Using Intergraph's hardware and software infrastructure throughout the distributed enterprise, the Alliance has deployed the first production release of the IPDE, which includes computer-aided design, engineering, and manufacturing, data management, life-cycle support, and configuration management capabilities. Working within an Alliance-wide Integrated Process and Product Development environment, Intergraph also provides system implementation and integration services for the LPD 17 Program.

According to **Albert L. Bossier**, chairman, president, and CEO of Avondale Industries, Inc., "What the deployment of the IPDE means for the LPD 17 Program is that there is now a "bridge" between design, production, and future management functions — as well as Alliance members. We have allowed more time for conceptual design so the on going detail design will be more accurate and the actual construction of the ship will be faster. All of this will result in significant cost savings for the ship throughout its life cycle."

The Avondale Alliance comprises the prime contractor, Avondale Industries, Inc., Intergraph Corporation, Bath Iron Works Corporation (a subsidiary of General Dynamics), and Raytheon Corporation.

Intergraph is the information technology partner to the Avondale Alliance, providing the computing infrastructure for the engineering and logistics teams designing the LPD 17. The program's information technology requirements include workstations, servers, network-

ing components, shipbuilding and data management software, and system implementation services.

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Circle 289 on Reader Service Card

## First Harbor Master For Windows Available

Zihua Software LLC has released Version 4.0 of Harbor Master — ocean tide and tidal current prediction software for Macintosh and now for Windows operating systems. Harbor Master includes tides and tidal currents at over

6,000 locations in the U.S., Canada and Mexico. Users may select from two regions, East Coast or West Coast of North America, and data is available through the year 2001. Data can be displayed in a table, graph or calendar format. The program can also be customized to show data in real time.

Circle 38 on Reader Service Card

## New Marine Data Service Formed

Smiths Industries Plc and Fugro Holdings Ltd. have formed ChartCo Ltd. for the broadcast by satellite of marine navigation and weather data to ships at sea. ChartCo broadcasts weekly notices to mariners and tracings to vessels

worldwide using the Inmarsat point to multipoint service. In addition to the core service, daily weather forecasts and differential GPS corrections are broadcast to vessels subscribing to these services.

Circle 39 on Reader Service Card

## GL Software Updated

The POSEIDON software package from Germanischer Lloyd (GL) had been updated to Version 1.5. For all types of ships, the design and calculation software for the interactive dimensioning of ship structures is designed to give yards and design offices a number of advantages in terms of enhanced quality and cost efficiency. Version 1.5 offers several new features including the integrated GL Rules covering the current state of rule development; additional commands permitting faster input; extension of the automatic generation of loads for FE models; 3D visualization of the geometry using FEMPL; improvements in the description of the transverse bulkheads.

Circle 40 on Reader Service Card

## Trace Shipments Via Internet

Crowley American Transport has debuted a new Internet application on its website which will allow Crowley customers to trace their own shipments. Using bill of lading, booking, equipment, dock receipt, vehicle identification (VIN) and/or shipper reference number, customers will be able to go to the Crowley website (<http://www.crowley.com>) and receive detailed information about the status of their shipments. Information indicating the status date, the current status of the shipments, and the vessel, voyage, discharge date and location is provided. Customer service agents will still be available to track shipments by telephone.

Circle 41 on Reader Service Card

## Focus On E-Mail Legality At Shipping Conference

At GN Comtext's European Shipping Users Group forum, **Selva Naidu**, an IT law specialist with the London firm Holman, Fenwick and Willan, spoke on the legality of e-mail messages sent for contractual purposes. According to Mr. Naidu, national laws adopt different approaches to contractual agreements and evidence, but e-mails could achieve legal status within a defined user group if members set up and observed their own terms and conditions which address the uncertainties and gaps in national legal systems. Confirmation that a message had been delivered and opened, as provided by GN Comtext's tracking system, might have some evidential value in some cases, he said.

There are other intelligent communication systems at sea



## SYSTEM 4000 GMDSS

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Less equipment — more communication. It is often said that big is beautiful, but sometimes it can also be rather inconvenient. On board a ship, for instance, where space is often very limited, size does make a difference.

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size and performance in the GMDSS market.

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invested in the future. Sailor is not content simply to supply superior communication systems — we also provide safety and satisfaction to our customers.

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## SOFTWARE SOLUTIONS

# LR: A Register For The Millennium

The register book is at the heart of LR, and its evolution can be traced back to LR's earliest beginnings. Today's three volume Register of Ships, containing 5,700 pages with data on 85,000 self-propelled merchant ships of 100 gt and

above, irrespective of their classification society, is the descendant of a clever marketing ploy invented by Edward Lloyd, who ran a coffee shop in the City of London in the 18th Century. Lloyd attracted the custom of important ship-

ping businessmen of the day, providing them with shipping information by means of announcements made by a servant from a pulpit.

LR has now launched the Register Books on CD-ROM. Although the format of the LR register book has changed over the years, the aim behind it -- the provision of accurate and up-to-date

information on merchant shipping -- has remained the same for more than two centuries.

Today, LR has 36 editorial staff dedicated to looking after marine information in the world, and the world's largest maritime database. Each ship is identified by a unique LR number, and in 1996 IMO adopted these LR numbers for its international identification system. Since that time, all merchant ships of 100 gt and above are required to carry the LR number aboard, for identification by Port State Authorities. LR runs a service providing information about vessel identification, and in the last 10 years it has received around 20,000 queries. By introducing register books on CD-ROM, LR is combining the integrity and accuracy of the information with the flexibility and speed of modern technology. So far, three packages and two add-ons are available:

- Shipfinder - an index to the Register of Ships
- The Register of Ships on CD-ROM - fully integrated databases of the Register of Ships and List of Shipowners, with added search, query and report-building functionalities.
- The Ultimate Guide to Ships - an integrated suite of publications including the Register of Ships, List of Shipowners, Register of International Shipowning Groups and Register of International Ship Managers.

Subscribers to the latter two products also receive:

- Ship and company history: (historical details over the past five years)
- New construction: details of ships projected, on order and under construction.

The Register of Ships on CD-ROM and Ultimate Guide to Ships are updated every quarter with a new CD, and from spring 1999, LR will supply weekly updates via the Internet.

Circle 110 on Reader Service Card

## LR Issues Version 3 Of Service Craft Software

Lloyd's Register (LR) has just issued the latest version of its Special Service Craft Rules software.

Version 3 of the software, part of LR's Rules and Regulations for the Construction of Special Service Craft (SSC) package, is designed to simplify and speed up the design approval and verification process. It includes tools covering the design approval of main and auxiliary machinery, gearing and shafting arrangements against LR's Rule requirements. It also covers the analysis of rudders, midship section modulus, anchoring and mooring equipment requirements.

Circle 111 on Reader Service Card

Maritime Reporter/Engineering News



All the boats in the Whitbread Around the World Race 1997/98 have chosen Inmarsat terminals from Nera to keep in touch with the rest of the world during this extremely tough regatta.

Nera's well-tested Saturn B and Saturn C terminals ensure the participants standard phone connections, fax, e-mail and video recording transmission.

By the end of 1997 Nera had delivered nearly 2 000 B Marine terminals, which represents a market share of more than 40 percent.

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During the autumn of 1997, Nera introduced a new satellite station which is well suited for small crafts and pleasure boats, but also ideal as



relief or back-up for larger commercial vessels or passenger ships. The Nera WorldPhone Marine is small, light, easy to use and install, and above all, affordable.

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All Nera Inmarsat terminals are at the cutting edge of operational safety and connection quality. Nera are the world's leading supplier of Inmarsat stations, with a worldwide service network of subsidiaries and agents.



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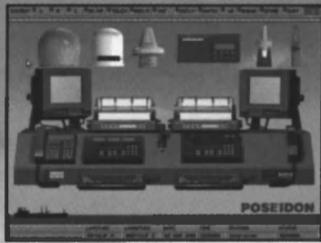
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## SOFTWARE SOLUTIONS

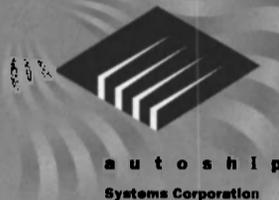
### Kelvin Hughes Offers PC Maritime Products

Kelvin Hughes now offers a range of PC-based marine software products from PC Maritime, including navigation products for commercial and leisure marine markets, and a demo CD-Rom of the new

marine software range. Navmaster Office is a planning tool for use in tracking ship's routes and emergency response planning. Navmaster Professional is designed for installation on-board ships as an aid to positional awareness and to assist in the transition to ECDIS.

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### Bring The Weather And Sea To Your PC

DTN Weather Center, a service of Data Transmission Network Corporation (DTN) has introduced DTN Marine Center OnBoard, a new service using DIRECTV technology which permits DIRECTV subscribers to download weather maps and sea conditions to a PC. DTN OnBoard subscribers receive all the information contained in DTN Marine Center, such as coastal sea condition forecasts, marine buoy data for wind and weather, temperature conditions and sea surface temperature maps. In addition, OnBoard subscribers can select from hundreds of national and local maps and offshore forecasts for locations along all major U.S. coastal areas and lakes. DTN OnBoard can be received using an 18 in. DIRECTV dish or a specialized tracking dish while under way. The signal is sent from the dish into the subscriber's PC with a specialized processor card provided by DTN and viewed on a high-resolution computer monitor.

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# Training in the Virtual World

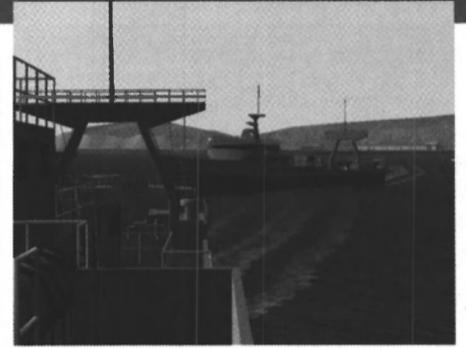
The process of human comprehension of the world and accumulation of social norms and professional skills essential for life runs in continuous contact with reality and involves assimilation, overcoming and reorganization of the physical and social conditions of existence, and adoption of the experience acquired by previous generations. The result of this development of each human being is the formation of an individual image of the world in which, in addition to all the other factors, professional aspects of each person's social life are recorded.

At the threshold of the third millennium, mankind has approached an unprecedented change of paradigms connected with the upbringing, socialization and formation of a personality, and, as a specific case, professional training: man has entered virtual worlds. These worlds are encountered everywhere: at recreation centers, schools, universities, training centers and even at home on the computer screen. Man migrates from one virtual world to another acquiring new knowledge, new experiences (not always positive), and new personality qualities.

Without dwelling on details about the entire diversity of this virtual life's aspects, this article will only touch upon those which are connected with the familiarization with professional environment and evolution of knowledge and skills adequate to the profession's requirements. As a rule, the final part of any education process is the specialist's practical training. By this time, theory has already been absorbed, examinations passed, the little that remains to be done is to implement in practice that bulk of professionally significant information which was acquired in the years

of studies. And this is exactly where the problems start. The modern engineering and technology world is extremely com-

plicated. Controlling this world is a task of great responsibility, as any mistake may bring about irreversible conse-



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Alex Koukharenko, the Transas Vice-president who is the ideologist of all simulator development in Transas.

## SIMULATION TRAINING

quences, the remedy of which incurs serious financial costs, mobilizing of expensive resources and the like.

Further still, modern equipment per se costs quite a lot of money. Operation of this equipment also requires ever growing expenses, and as the mastering of its use is a process stretched out in time, economic components of the training

become increasingly important. It is only natural that with each new generation of engineering and technology this situation should be successively aggravated, and as a logical limit, one could conjecture a situation whereby the next generation of engineering and technology will not be unable to come to life due to the fact that the preceding one has not



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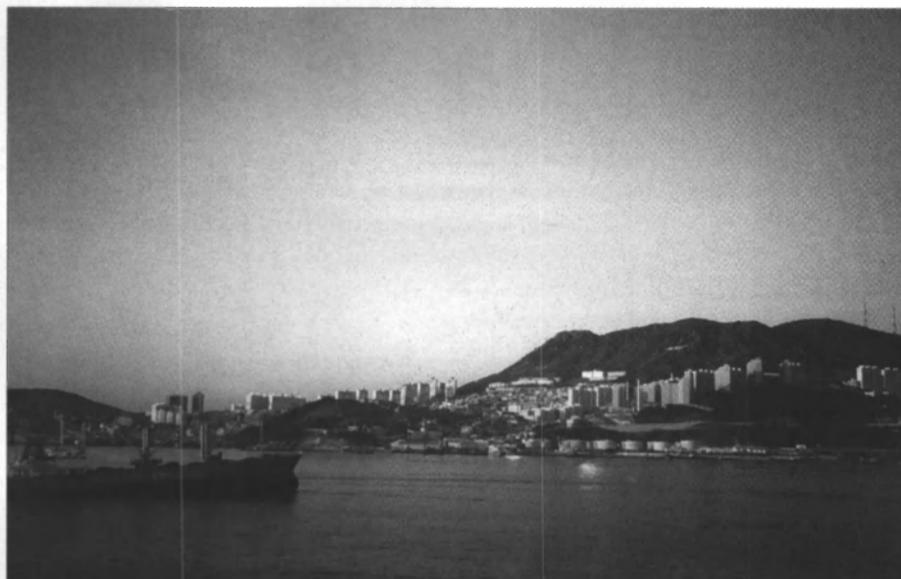
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yet become a standard of professional existence for mankind — not having been assimilated within the life span of a single human generation.

This is where virtual training environments come to man's assistance. A computer in combination with video and audio facilities synthesizing the virtual world's laws becomes the basis of an infinite diversity of educational environments — a kind of mediator between the physical world and this world's internal ideal image which is the foundation of each person's consciousness.

This virtual world is safe: any collisions and even disasters within this world will pass unnoticed by nature. To create it does not require any serious investment; its maintenance and modification does not involve any barriers which are hard to overcome; it is cost

efficient. In a single day the instructor can let the trainee control utterly dissimilar vessels in widely diversified weather conditions in ports all around the world. Various emergencies, faults, and fires may occur on these vessels — ships may even sink leaving a sinister and lethal oil spill on the surface. Could this be afforded in the actual world? The answer is definitely NO. Must a professional navigator be able to take the most adequate decision in such situation? The answer does not even require any discussion.

For the virtual world, however, to become useful in training, its principal features should be isomorphic both to man's internal experience, and to the laws inherent in the physical world. It is

(Continued on page 76)



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# Making It A Clean Sweep

by Greg Trauthwein, editorial director

There is no finer way to lead-off *Maritime Reporter & Engineering News'* Ship Repair Technological Guidebook than with a profile of a man who is perhaps most proud of using nothing more sophisticated than a broom (both literal and figurative) to help clean-up the ship repair and conversion business in the U.S.

This is a man who, up until three years ago, knew nearly nothing about the ship repair and conversion business, and to this day reckons that his professed solutions to ship repair and conversion's economic woes could be dead wrong. But beneath this veil of novice lies a confidence, passion and intellect that is going to power his company to the leading ranks of U.S. ship repair and conversion yards.

And if you need a stylish solution to solving your company's "curb appeal" woes, look no further.

Meet **B. Edward Ewing** — scholar, line worker, salesman and self-described cheerleader, the charismatic CEO of the U.S.' largest non-nuclear ship repair, modernization and conversion company, United States Marine Repair.

Ed Ewing has been on the corporate fast-track since entering his first job at International Harvester more than 25 years ago. Along the way he has ascended the executive ranks of many of our nation's top defense contractors (General Dynamics and Lockheed Martin), and has been directly responsible for building nearly all types of transportation vehicles.

After spending just one hour with Mr. Ewing it becomes abundantly clear that the man has a passion not for ship repair and conversion, not for trucks, planes or tanks, but a passion for business itself. To put it simply, Mr. Ewing likes to make money, and as he plainly states: "losing money is not an option."



Success at Southwest Marine included creating what is possibly the cleanest shipyard in the nation. CEO Ewing's standard: "Would I want my family to use the facilities."

It is ironic, then, that he has engineered the construction of one of the U.S.' largest ship repair and conversion consortiums, which is a business that is not often associated with high profit margins, or for that matter, in many cases, any profit margins at all.

But Mr. Ewing's plan for United States Marine Repair is grounded not in ship repair and conversion, per se, rather the cyclical nature of business itself. When he entered the business nearly three years ago in San Diego with Southwest Marine, he saw that several market conditions were converging to make the ship repair and conversion business an attractive investment. The industry — particularly the naval and government work, or "gray side" — was spending far less money per year in the maintenance of its vast fleet. At the same time, new build funds were slashed even further, whittling the U.S. Navy fleet precariously close to 300 ships.

While naval suppliers and builders saw the sinking of the 600 ship navy more than a decade ago, common thought is that a minimum fleet of 300 ships is needed to adequately fulfill the country's defense needs. Hence, fewer new ships plus reduced maintenance dollars spent on the existing fleet equaled an upside potential for ship repair and conversion yards, reasoning that more intensive repair would come later in the effort to keep an older fleet running longer and stronger, until the next wave of newbuildings comes down the line.

The majority of navy repair and maintenance work still finds its way into the hands of public shipyards, and Mr. Ewing maintains a fight to ensure that private facilities get an increasing share of the budget pie.

## Back to Basics

Market timing notwithstanding, Mr. Ewing plans to use plain business sense to make his new collection of shipyards profitable. He admits that there is

nothing particularly complicated or intimidating about his program, rather it is a straight forward and simple concept.

There are several core beliefs that define Mr. Ewing's management style, with the first and perhaps most prominent being that "People are Important." More than just a catchy phrase found on cafeteria walls, he truly believes the critical element to a successful business is



B. Edward Ewing

providing workers on all levels with a healthy amount of honesty, information and respect. Those who witnessed the immediate lay-off of hundreds of workers at Norshipco immediately following the takeover might argue that Mr. Ewing does not practice what he preaches; but they would be wrong.

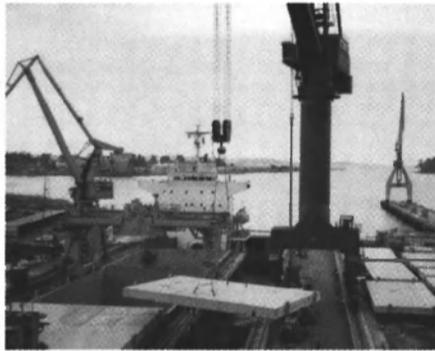
Ed Ewing was raised in a working class family on modest means in Jasper, Ind., and he knows the sting first-hand of layoffs and job loss. He was truly unhappy when forced to pare the Norshipco workforce to its current mid-800 level, but he knew it was necessary to keep the business alive. "I'm in the manpower business. We will only be successful if we have 2,000 more workers."

"We're trying to demonstrate that the management process we're using has the ability to turn around long-standing companies, which have historically not been profitable," he said. "We have shown that we can successfully implement this process that literally improves every aspect of the ship repair business, i.e. treatment of our people, profitability, safety practices, environmental protection programs, Worker's Compensation, housekeeping and community relations and involvement.

When we put our people first and they are convinced that we are the best in the business, quality, productivity and pride in workmanship and attention to detail improve dramatically. It then becomes inevitable that our customers will also say that we're the number one ship repair firm in the country."

Another plank in the Ewing business philosophy is a neat and tidy appearance of the business, an item not high on many ship repair and conversion facilities' agenda list. He has ensured that Southwest Marine in San Diego is well organized, laid-out and maintained, and he intends the same tonic for Norshipco, which has not maintained its appearance over the last few years. Current plans (due to be fully implemented in late Spring '99) include pavement in parking lots and new pavement throughout the shipyard, as well as new trees and

## Astilleros Astander Makes Repair Inroads



Astilleros Astander, which has built a solid reputation of providing quality service in a timely manner, significantly upgraded its facilities last year with the purchase and commissioning of a 200-ton tower crane, purchased from the ex Boelwerf yard in Temse. The 200-ton crane has considerably reinforced the lifting capacity of the yard's biggest drydock, drydock No. 2 which measures 230 x 33 m.

In fact, Drydock No. 2 is now served by four cranes of 200, 40, 15 and 10 tons, which helps to markedly enhance the drydock's operations and further increase the yard's productivity ratios. A variety of lifting operations, from removing/refitting heavy hatch covers,

shrubs lining the street to the entrance of Norshipco. "This facility will be restored to the standard where somebody cares. If you look at pictures of the yard when it was built, it was pristine."

The new attitude seems to be yielding great dividends, in that Mr. Ewing claims that the yard — in just its first five days under new management, helped to obliterate an estimated 4Q 1998 loss of \$14 million, while raising efficiency 15 to 20 percent within the first 90 days. "If we demonstrate the ability to turn around some of the biggest private ship repair firms in the country, maybe we will be afforded the opportunity to partner with our Navy customers to help them realize the same achievements in the public yards. Together, we can set a new standard for the ship repair industry."

## Southern Arrives At Norshipco

Norshipco announced the LNG Southern arrived for its reactivation and upgrade. The contract — reported to be the largest commercial contract ever awarded — is for re-activation and upgrade of the vessel to re-enter the commercial market. The ship will be chartered to Shell Marine U.K., and the current schedule calls for the ship to be delivered by October 1999.

for example, now take much less time, allowing the remaining three cranes' lifting capacities to be devoted to other simultaneous activities.

Astilleros Astander has received ISO 9002 accreditation by Lloyd's Register Quality Assurance Ltd.

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**SHIP REPAIR**

# Cascade General Upgrades AMHS Ferries

The first oceangoing passenger vessel built in the U.S. in more than 20 years, the 382-ft. (116 m) M/V Kennicott is the pride of the Alaska Marine Highway

System (AMHS). Halter Marine designed and built the new ferry, delivering it in the summer of 1998. Halter Marine chose Cascade General in



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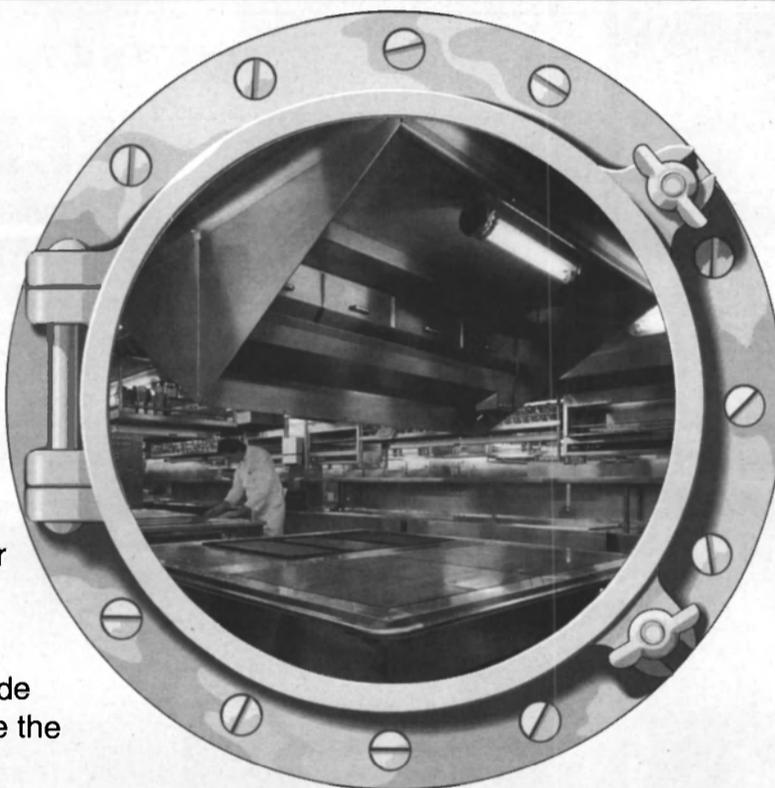
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Circle 232 on Reader Service Card



Portland to carry out warranty work at the end of the first summer season.

Alaska ferries have made their way to the Portland Shipyard for general maintenance for decades. Still, the yard took a particular interest in the ultra modern Kennicott, which is equipped to cross the stormy Gulf of Alaska and to act as a mobile command center during oil spills or natural emergencies. Once convinced of Cascade General's expertise, Halter Marine's list of work expanded to include drydocking the ship for hull inspection; repairs to the Sperry Gyro Fin Stabilizers, and repairs to both tailshafts.

After a five week visit in September/October, the Kennicott returned to service and another AMHS ferry, the 408-ft. (124 m) M/V Matanuska, came to Cascade General over the winter for an extensive SOLAS overhaul.

The 35-year old ship was re-fitted with deck gear needed for carrying four small craft; two lifeboats, one rescue/lifeboat and a fast response boat. Additionally, pairs of sponson guards fitted at the waterline will ensure smooth launches for all systems. The complete upgrade brought the ship into compliance with all international, USCG and SOLAS safety regulations.

Mechanical upgrades to Matanuska included converting the refrigeration equipment and installing a new oily water separator, complete with tank modifications.

Engineering and design was accomplished by Guido Perla and Associates.

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M/V Kennicott ©1998, J. Schiffhauer

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Rustibus 200 Low  
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Circle 219 on Reader Service Card

# LR Report Tackles Fatigue Cracks On Bulk Carriers

A recent technical report from Lloyd's Register dubbed "Shell and bottom longitudinal fatigue induced cracks on Capesize and Panamax bulk carriers" investigates extensive fatigue cracking at web and floor stiffener and tripping bracket connections to the longitudinals in the hopper tank and double bottom spaces.

LR notes in the report that the cracking has occurred at connections of both side and bottom shell longitudinals. At these locations, cracking has occurred at the weld toe in a way of the return weld at the heel scallop, with crack indications extensively evident throughout the

double bottom and hopper spaces.

In making recommendation for repair, LR notes that, based on the experience gained from these cases, a "best practice" repair and reinforcement recommendation has been prepared and this is shown in Figures 2 and 3. The recommendation proposes:

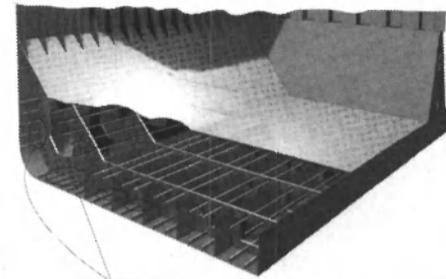
- partial renewal of web and floor stiffener, and tripping bracket, with shaped insert piece incorporating soft toe and

heel.

- Fitting of soft toe backing brackets.
- Adoption of soft heel to ensure that, where weld repair of longitudinal crackings is adopted, the landing of the heel and return are positioned away from any world repair.

- An optimum nose height at toe and heel of bracket and stiffener of not more than 10mm.

Circle 100 on Reader Service Card



LR recently commented on the problems and solutions of shell and bottom longitudinal fatigue induced cracks on Capesize and Panamax bulk carriers in its Marine Bulletin.

## Marine Accommodation Snarcs RCI Job

Marine Accommodation was contacted by Royal Caribbean Cruise Lines to supply BIP Accommodation system for the refurbishment work onboard Monarch of the Seas being carried out at Atlantic Marine, Mobile, Ala. The total quantity supplied was 1,300 wall panels, 900 sq. m. of continuous ceiling panel, cabin doors and A-60 doors. While the delivery was not an unusual one for Marine Accommodation, it was a unique job in that it entailed a delivery time of just four days.

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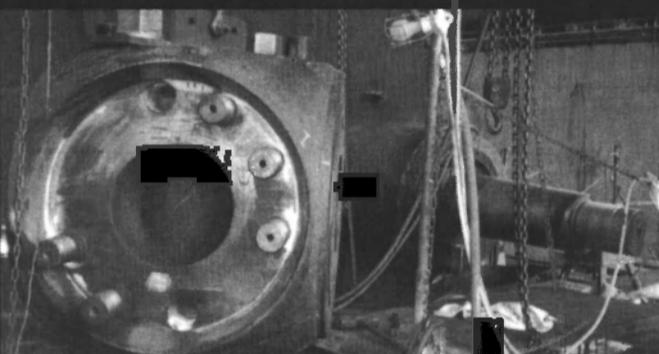
## Blohm + Voss Turns FSO Into FPSO

Hamburg-based Blohm + Voss Repair GmbH has historically had much success in the offshore sector, and this reputation was enhanced and extended recently with the conversion of the 138,680 dwt Knock Taggart from an FSO into an FPSO. Working under strict deadline pressure from owners Red Band AS and Fred Olsen Production AS, Blohm + Voss Repair completed the job in just 57 days, three days earlier than the contract stipulated. The deadline pressure was enhanced by the fact that Knock Taggart arrived in the yard only 22 days after the signing of the contract, a fact which required the shipyard to quickly procure and make available all necessary materials. The job was extensive, and included considerable amounts of work on the vessel's propulsion system. Also, the starboard boiler was converted to gas firing to utilize some of the associated gas for ship operation.

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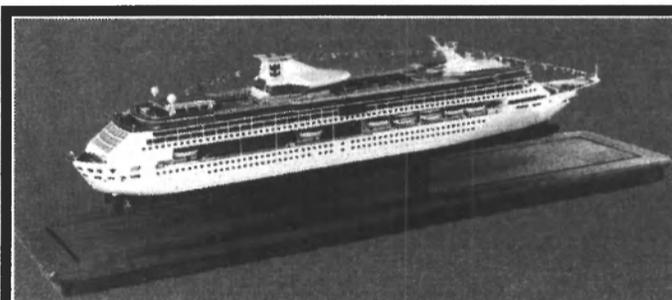
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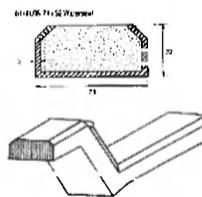
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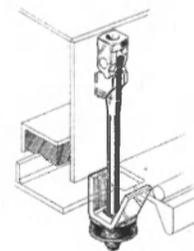
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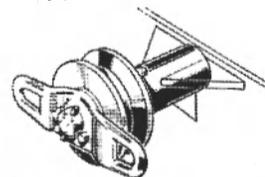


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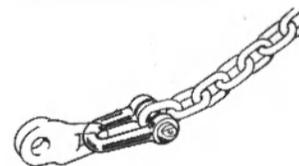
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# A&P Tapped For Oriana Refit

By Alan Thorpe, international editor

P&O Cruises' flagship, the 69,153-grt Oriana, is to be refitted at A&P Group's Southampton shiprepair facility. The

contract for the 21-day refit, rumored to be worth in excess of \$1.5 million, has been signed by P&O Cruises and A&P Group, and will begin on April 14 and be completed by May 6. The companies

involved in the hotel work include Mivan Marine, Harris Pye (outfitters), Trimline, CLC Marine, and Durastic.

This is the second refit for the Oriana, which was built for P&O Cruises by

Germany's Meyer Werft, Papenburg, entering service in April 1995. At the time of her first refit, A&P Southampton was unable to bid for the contract because the yard was occupied with other pre-existing contracts. Competition for this contract came from a number of other Northern European ship repair yards, including Lloyd Werft (Germany), Arno Dunkerque (France) and Cammell Laird (Tyneside).

The scope of work includes a standard drydocking program, which encompasses sea valve removal and maintenance, anchors and thrusters inspection and overhaul where necessary, main and auxiliary engine inspection and maintenance, and hull inspection and maintenance where necessary. A&P will also be applying a full below the water line paint system, supplied by International Paint, and a repaint job on the ship's superstructure.

A&P Southampton has recently completed a two-ship refit order from Norway's Fred Olsen Cruise Lines, involving the Black Watch and Black Prince.

Following the recent decision by Shell to use Singapore's Sembawang Shipyard as a base for repairs in the foreseeable future, there has been another such deal. This time Singapore-based Neptune Orient Lines (NOL) has signed an alliance agreement with Singapore's Jurong Shipyard Ltd. (JSL), covering all repairs, conversions, upgrading and maintenance of ships managed by NOL subsidiary Neptune Shipmanagement Ltd.

Egypt's Port Said Shipyard (PSS) has recently taken delivery of a 17,000-ton lifting capacity floating dock, which is currently undergoing refurbishment operations and is expected to be ready for operations during the middle part of this year. There are currently two other floating docks at the yard suitable for the repair of ships up to 20,000 dwt. PSS' main market is Suez Canal Authority (SCA) ships, 52 of which were docked/repared last year. There were also 11 commercial ships repaired last year.

Varna-based shiprepair specialist, Odessos Shiprepair Yard, Bulgaria, has now received approval for the sale of a 25 percent holding to a management buy-out, named KRZ Invest, for \$3.26 million, from the Bulgarian privatization agency. With the deal being delayed for several months, the agency has now changed its mind over adjoining wharves, which the agency thought was nothing to do with the capital of the yard. Under Bulgaria's mass sell-off privatization, just over two-thirds of the yard's total capital was sold against privatization vouchers two years ago.

Facilities at the yard include a 787 ft. x 89 ft. (240 m x 27 m) graving dock, capable of dockings ships up to 35,000



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Singapore's Jurong Shipyard Ltd. (JSL), with which NOL has signed a block booking agreement.

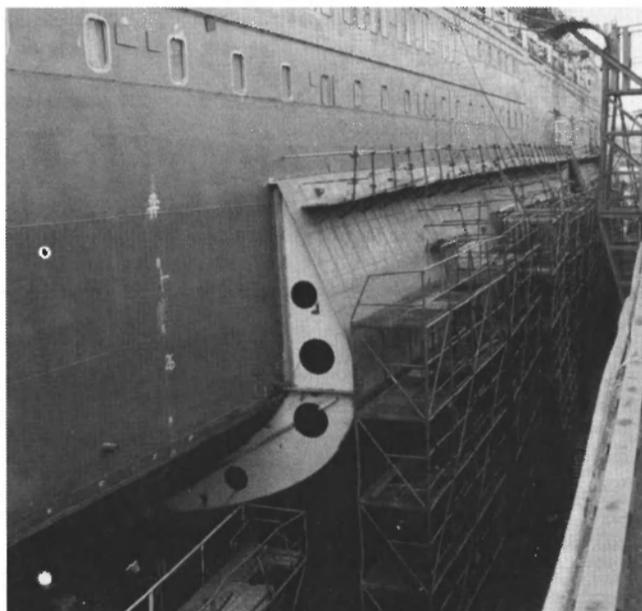
dwt; two floating docks, one 525 ft. x 39 ft. (160 m x 12m) at 4,100 tons lifting capacity (l/c) and the other 525 ft. x 89 ft. (160 x 27 m) at 12,000 tons l/c; and approximately 4,000 ft. (1,200 m) of repair quays.

South Africa's Dorbyl Marine has recently confirmed that as the company enters the final quarter of its financial year, the expectation for the full-year remains bullish despite difficult market conditions. From this basis, the shiprepairer has in operation a strategic plan to expand its business in both the shiprepair and other marine-related market sectors. By combining the substantial resources of the Dorbyl Engineering Division with Dorbyl Marine, several ventures are anticipated for this year and the distant future.

Repair facilities in South Africa are currently well positioned to secure substantial projects from the West African coast offshore oilfields: the re-vitalization of the Mossagas Project, the forthcoming armaments approved budget and the proposed upgrading by Portnet, the state-owned port authority, of the shiprepair facilities in Durban, Cape Town and East London.

This overall potential has made the business attractive to some international and local companies as an investment. The Dorbyl Group is very optimistic at present about the future of this business, citing Dorbyl Marine Ltd. as one of its blue-chip divisions.

Ships recently at the yard undergoing repair work include Noordkap's 49,730-dwt containership Heemskerck (which is being undertaken in a joint venture with Elgin, Brown & Hamer), Novoship's 16,940-dwt RoRo vessel Sochi, and



Sponsons being fitted to the Admiral of Scandinavia in Gdansk.

March, 1999

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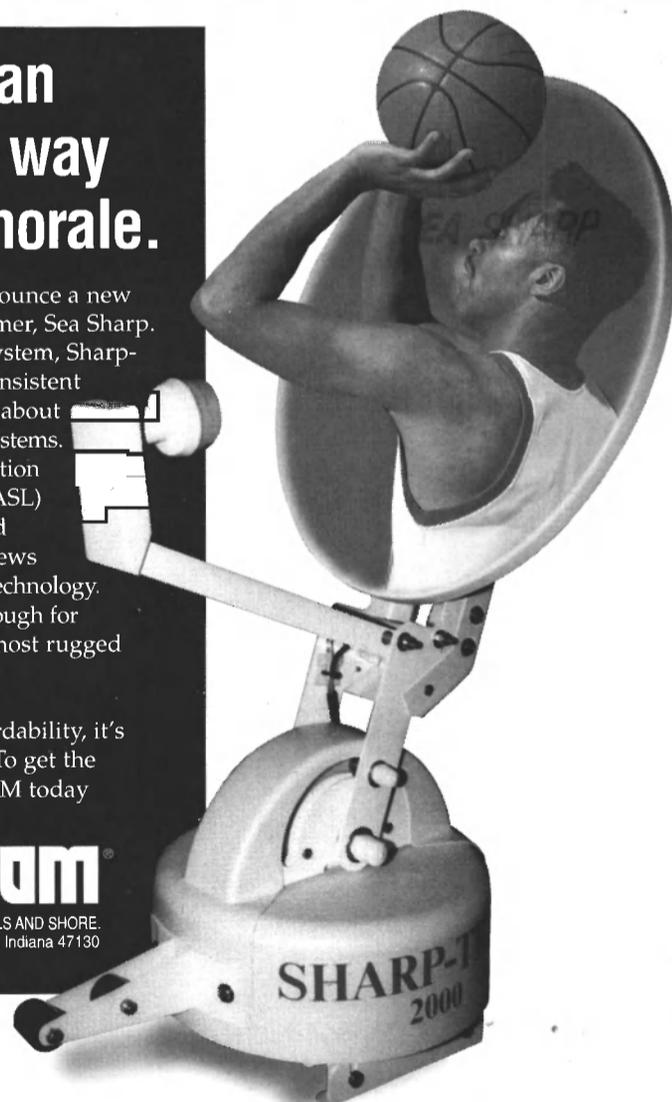
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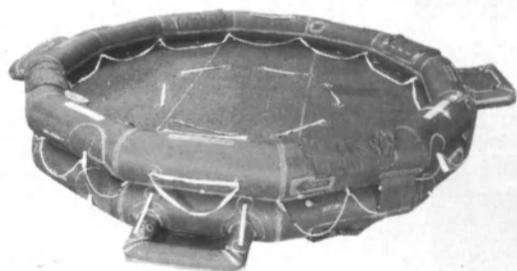
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Maramaras' 37,636-dwt bulk carrier Panormos.

Elsewhere in South Africa, Elgin, Brown & Hamer (EBH), with ship repair facilities in the port of Durban, has taken delivery of an 8,500-ton lifting capacity floating dock, which is the first privately-owned shiprepair facility in South Africa.

Keppel Corp. has decided to pull out of the Keppel Cairncross Shipyard Ltd. in Australia after sustaining continuous losses. A company statement said that the group has appointed a voluntary administrator to assess and decide the yard's future, whether it be sold or closed. The repair yard, which was crippled by a bitter industrial dispute during last year, has failed to deliver the Singapore conglomerate a profit since Keppel Corp. acquired a majority stake in 1994.

Facilities at the Brisbane-based yard include a 864 ft. x 107 ft. (263.2 m x 32.5 m) graving dock, capable of docking ships up to 85,000 dwt, and 1,006 ft. (306.7 m) of repair quays, with a maximum draft of 29.8 ft. (9.1 m).

Following a 10-month conversion project at Fredrikshavn's Orskov Staalskibsvaerft, where the Kommander 3000 was converted from a RoRo vessel to an ROV support vessel recently, the vessel is once again to undergo the chop, with Viktor Lenac, Croatia winning the contract to convert her into a sophisticated pipelaying vessel. The vessel, which has been contracted by Oslo's DSND Sondenfjedske ASA, is to carry out a contract DSND secured from Brazilian oil major Petrobras for laying flexible pipeline in Brazil.

Work onboard the vessel will include lengthening the hull by 69 ft. (21 m) and widening it by 5 ft. (1.5 m), upgrading the bowthrusters (with the addition of an Ulstein 1,300 kW azimuth thruster), and installing an extensive pipelaying system. A Cegelec duplex dynamic positioning system will also be fitted, as well as two moonpools for ROV work. She is expected to be at the yard until the end of June.

Gdansk Shiprepair Yard (GSY-Remontowa), has had a good start to the year with another conversion project. GSY-Remontowa is to convert DFDS' 18,888-grt passenger RoRo vessel Admiral of



The Black Watch in A&P Southampton.

Scandinavia, with work including the construction and installation of two 5 ft. (1.5 m) wide sponsons, each weighing 270 tons. The project also includes port and side ports (bunkering and pilot) installation, replacement of all fire doors between car deck and lower deck compartments, strengthening of main trunk, installation of MES and upgrading accommodation blocks. The vessel is expected to be at the yard for a total of four weeks.

GSY-Remontowa is also involved in the hull conversion of the sea-going yacht Polarex. The vessel is being converted into a research and training vessel for up to 75 passengers (including 40 students). Work includes lengthening the hull via the insertion of an 26 ft. (8 m) steel section, re-engining, renewal of tailshaft and propeller, construction of superstructure, outfitting and installation of ships' systems. The contract was awarded by Poland's

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Gdynia Maritime Academy (GMC).

Lisbon-based Lisnave International, which has the same shareholder as major shiprepairer Lisnave, is set to acquire shiprepair interests in Senegal, currently negotiating to play a leading role at the Dakar-based yard. Apart from this acquisition, Lisnave International already has activities in Mozambique (Beira) and Angola (Luanda and Lobito). Management at Lisnave International hoped to sign an agreement in January for a 25-year concession to operate the shipyard formerly run by state-owned Dakar Marine, now in liquidation.

Following the award of a tender against French competition, Dakarnave, a company created for this purpose, was

## Portable Hydraulic Pumps Help To Save Time

Golten's portable hydraulic G-Pump has reportedly received a tremendous amount of attention, given the unit's ability to supply and maintain pressure up to 21,300 psi (1,500 kp/cm<sup>2</sup>) with high accuracy.

Modern loading and unloading equipment has helped to minimize the lay days in port for modern ships, a situation which creates a shortage of time for important repairs. However, to ensure long-term performance and profitability, some items must be maintained regularly.

For example, main engine pistons should be drawn or exhaust valve housings lifted. With Goltens' G-Pump, one person can reportedly do the job, a feat which traditionally requires three or four workers. Another routine maintenance task, removing and mounting a cylinder cover is accomplished quickly and easily with the G-Pump. It is connected to a common high-pressure pipe by means of a quick coupling. All of the hydraulic nuts on each cylinder are connected in parallel.

As soon as the G-Pump starts, all of the bolts are stretched and the nuts will be loosened and removed by hand.

The hydraulic jack for each nut with pipe is fastened to the cylinder cover. The quick coupling is the only thing which has to be released.

In an effort to enhance its service even further for all of its products and services, Goltens has created a website at [www.goltens.com](http://www.goltens.com).

Circle 60 on Reader Service Card

selected to enter talks with public company SIRN, the capital of which is owned by the Senegal state. The state is to supply the infrastructure, and Dakarnave the management and majority of the equipment, and would pay a basic annual rent, supplemented by commissions in work awarded.

The facility has one floating dock, capable of docking ships up to 60,000 dwt, and a single lift with five pontoons

mainly for locally-owned fishing vessels and small craft.

By the end of the first quarter of 1999, Manila-based Subsea Services Inc., is hoping to have expanded its operations in Cebu, central Philippines, by establishing a service station and equipment center. Due to problems with land transportation in the Philippines, Subsea Services' Capt. **Raymond Dodkin**, part-founder of the company in 1997,

said: "Having a base in Cebu will cut out response time for ships and marine installations requiring our services in central and southern Philippines."

Recent work carried out includes survey work to one of Keppel Cebu Shipyards drydocks, underwater repairs to one of K Line's ships, pre-sale surveys for a Greek and Italian buyer, and post-typhoon pipeline surveys for a local oil company.

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1999 SHIP  
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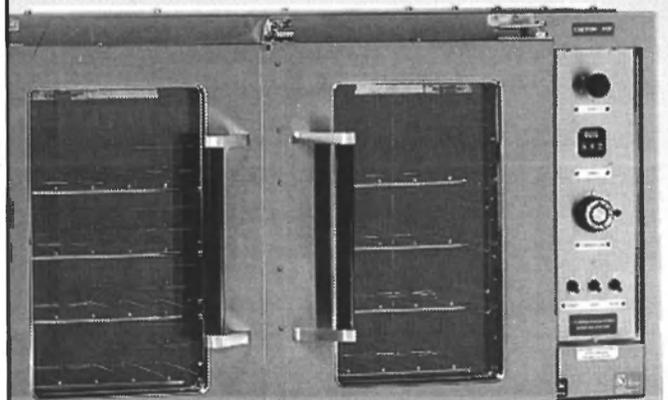
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# This Barge Is Fairest Of Them All

The 198-passenger R/B River Explorer is a vessel perhaps like no other, designed and "built" to offer passengers from all walks of life the unforgettable experience of "barging" through America's vast inland waterways.

The vessel's tale is as unique as its itinerary, as the River Explorer is actually built upon two 295-ft. barges — LaSalle and DeSoto — and powered by the powerful towboat Miss Nari, which is reported to be the only towboat in the U.S. with Z-Peller 360-degree propulsion units.

Bauer Interiors spearheaded the mission of incorporating cameos of river history into the interior retro design of the River Explorer.

When the project was started, it was evident that "convertibility" was the prime directive of the project, to arrange the vessel a multitude of uses within a single space.



R/B River Explorer

"We were faced with the challenge of providing all the modern amenities of a first-class hotel and incorporating them into the two barges' casual theme and emphasis on river history," said **Grace Bauer**, president of Bauer Interiors.

Among interesting design themes onboard are the Pilot House Lounge and the DeSoto Patio.

The former duplicates most of the electronic outfitting found in the real pilothouse, as passengers watch radar screens, hear ship-to-shore and ship-to-ship radio conversations and review maps and charts of the river. The latter recreates the air of an ante-bellum New Orleans courtyard with foliage and fountain.

The aft barge, LaSalle, carries two floors of two-person, all-outside staterooms furnished in birds-eye maple and mahogany.

Each 200-sq.-ft. room is equipped with satellite and closed circuit TV and VCR, refrigerator, phone with computer port, and bathroom with tub and shower.

Circle 63 on Reader Service Card



R/B River Explorer - The Rio Vista Lobby

## New Shipyard Opens

Shipping Investment of Puerto Rico, Inc. is a new ship repair organization established to provide diversified ship repair activities in the Caribbean. The company's repair yard is located in the San Juan Bay area of Puerto Rico, just a few minutes from the entrance to San Juan Harbor. It operates a 30,000 GRT drydock certified by the American Bureau of Shipping and Lloyd's Register, as well as a large and well-equipped machine shop. Repairs above the water line are performed at one of several piers. Main services include hull conservation, welding services, tank cleaning, propeller repair, mechanical and electrical works.

Circle 31 on Reader Service Card

### Facility Particulars

Graving dock	
max. cap. ....	30,000 GRT
Graving dock	
length, o.a. ....	691 ft. (210 m)
Docking length, o.a. ....	632 ft. (192.6 m)
Maximum	
docking draft ....	24 ft. (7.3 m)
Width, o.a. top ....	100 ft. (30 m)
Width, o.a. top for 4	
ft. blocks ....	83 ft. (25 m)
Ballast ....	.1 hour
Deballast ....	.2 hours

## Portable Analyzer Boosts Combustion Efficiency

ER & S Eurotron of Plantersville, Tex. has developed a portable gas analyzer which is designed to improve the performance of main propulsion systems and auxiliary equipment by accurately measuring the black smoke of unburned particulates and analyzing all parameters that affect combustion efficiencies. The Y2K-approved microprocessor-based analyzer can store up to 250 complete analyses, which can be downloaded directly into a PC or displayed on a built-in LCD display. Self-diagnostic software and an autocalibration system help eliminate potential human errors.

Circle 2 on Reader Service Card

## ASRY Records Good Year

ASRY reported that it recorded the highest ever man hours and steel renewals in 1998. Repairs, ranging from quick seven day docking to major overhauls were routinely undertaken in 1998. According to company statistics, the average stay in the yard rose by 12 percent to 21.9 days.

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## Shipboard Plasma Cutting System Increases Efficiency



Drew Marine's new welding catalog.

A new plasma cutting system from Ashland Chemical Co.'s Drew Marine is designed to ease onboard maintenance and repair. The Amerarc XL series features technological and design advances which are incorporated for operating efficiency, ease of use and safeguards. There are three models available — the Amerarc P50XL, the Amerarc P75 XL and the Amerarc P100XL — each of which can be used to cut any metal, including stainless steel, aluminum and other alloys.

The systems are rated for cutting 15, 20 and 25 mm thick material under all conditions, and 20, 25 and 30 mm thick

material under specific, lower-speed conditions. Advanced inverter technology is designed to give the units compact size and portability along with good power, reliability and durability. Universal input power requirements ensure compatibility with virtually any shipboard availability. Each system can



Amerarc P75XL plasma cutting system.

be operated from any primary input from 208 to 460 volt (+ 10 percent), sin-

gle or three phase, 50/60 Hz.

In order to ensure that Drew Marine's welding and cutting products are used better and more efficiently onboard ships, the company recently released a new products catalog which details the company's products and support.

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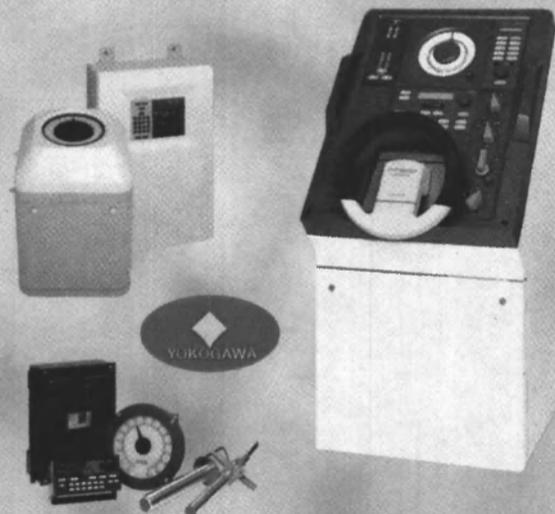
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## New Drydock Helps Heddle Marine Win Unique Work

Heddle Marine Service Inc., established in 1987, is a ship and barge repair company based in Port of Hamilton, Ontario. Services provided include dry-docking; air control and hydraulic mechanics; piping, plumbing and electrical repairs; sandblasting and painting; tank cleaning and gas freeing; and welding. In the beginning of 1998, the company completed a new drydock with 6,000 dwt capacity. The drydock can handle vessels up to 450 ft. (137 m) in length and is 94 ft. (28.6 m) between the wingwalls. The building of this new drydock led to a contract with Upper Lakes

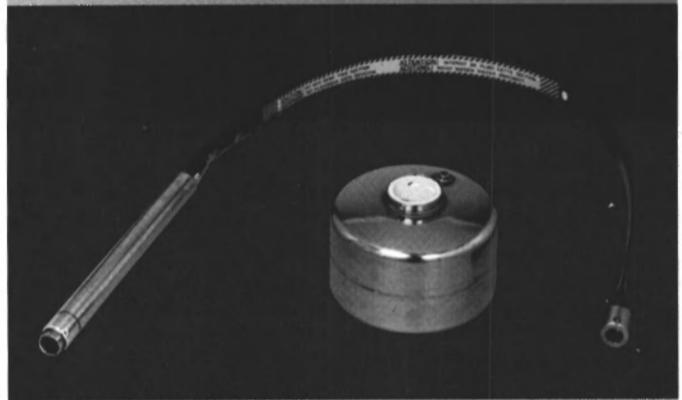


Heddle's new drydock helped it secure a technically challenging contract for work on the MV Hamilton Transfer.

Group, Inc. for assisting in the conversion of the MV Hamilton Transfer. In April, Hamilton Transfer docked at Heddle Marine to have its stern cut off, and receive sandblasting and painting to its bow and cargo section. Heddle Marine is currently engaged in building a third dock which will accommodate vessels up to 730 ft. (222.5 m) in length and 78 ft. (23.8 m) in beam. The dock is scheduled to be completed this fall.

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## SHIP REPAIR

# A Stitch In Time ...

## Metal Stitching Technology Helps To Cut Costs, Keeps Vessels Sailing

Up in the bridge the first mate is in charge as the container ship Archangel is setting a course towards Seattle. The gauges indicate that the engine is losing pressure. A call goes down to the captain who is catching up on sleep and the drill begins. The inspection confirms the fears of the ship's engineer - the Archangel has thrown a conrod in one of its engines.

After the captain radios the owners, they conclude the ship will be in for hundreds of thousands of dollars of repairs and months in dry dock as the Archangel limps towards port at half speed. An hour later, the office radios in they have contacted an outside vendor and have possible good news, "from what we know about the damage, we think we can get the casting stitched."

Metal surgery, not a widely known repair approach, is practiced by just a few companies across the country. It is intended to save time and money, as a part that may need to be replaced with weeks or months of down time can be repaired in just hours to days.

The process allows broken cast iron or dissimilar metals to be repaired either on-site or in-house.

For example, if the conrod housing on the Archangel had been remedied with a replacement part, the ship would have faced many months in the repair berth. Instead, a technician was flown in to

meet the ship at its home port in Vladivostok to engineer the repair process.

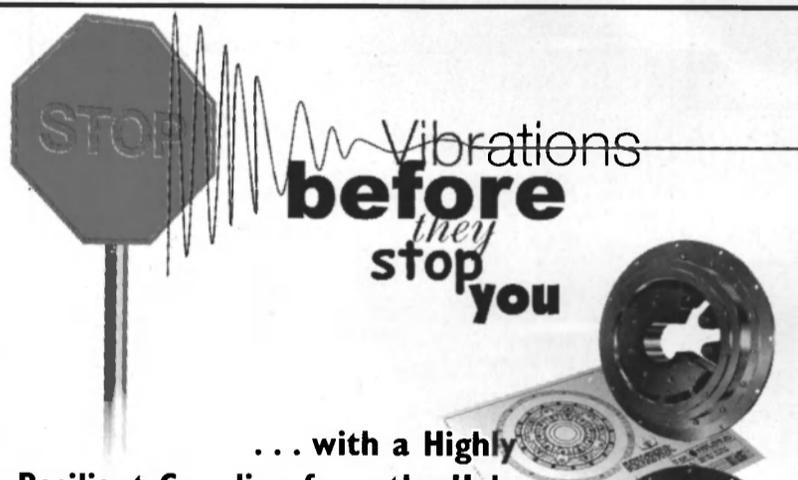
### Repaired at a Fraction of the Cost

The ship took on a load and headed back across the Pacific under half speed to its destination. An insert was machined at the Metal Surgery facility in Milwaukee for the lower bore liner and the cracks in the housing were stitched back to the original surface alignment. The repair took place in a very difficult to access portion of the engine. In 76 days the housing was back in shape with the engine providing full power to the Archangel. Cost of the repair was roughly \$120,000 - significantly less than the estimated six million dollars to disassemble and totally repair the engine. Upon inspection, ABS concluded that the operation was an excellent repair.

For castings that suffer cracks or breaks, stitching can restore part casting strength to equal or better than their original shock load capabilities by creating an even stronger structure along the course of the pattern. High-strength locks in the stitched and repaired areas absorb shock loads up to or greater than the original design is able to sustain.

### Adding Vital Years

Metal stitching recently was able to



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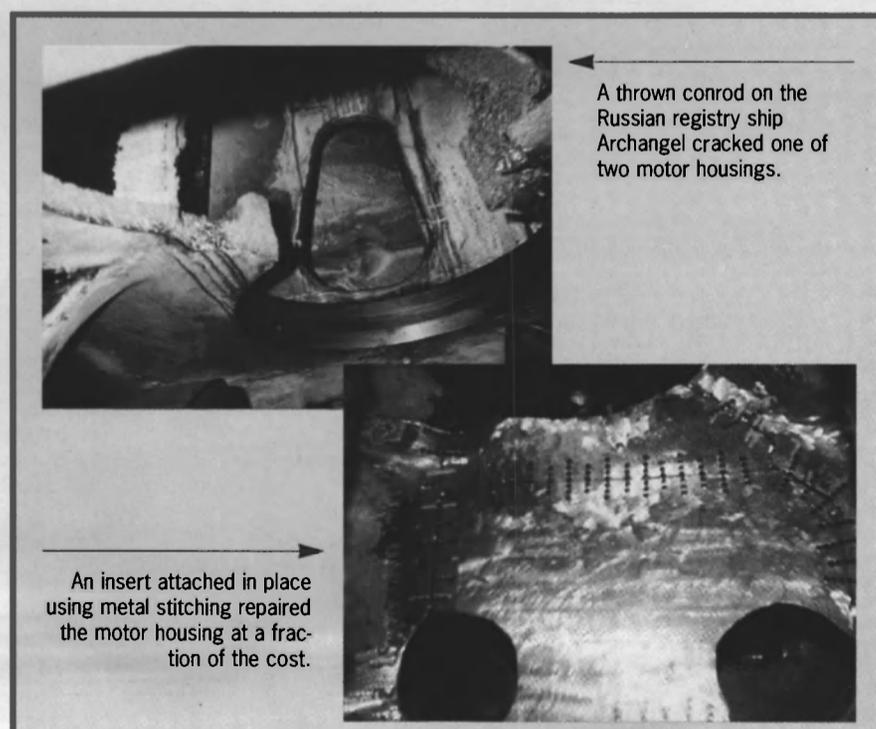
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A thrown conrod on the Russian registry ship Archangel cracked one of two motor housings.

An insert attached in place using metal stitching repaired the motor housing at a fraction of the cost.

Maritime Reporter/Engineering News



The Great Lakes ore carrier Herbert C. Jackson suffered severe damage — four ft. cracks — to its propeller hub. The hub was restored to original specifications using metal stitching.

rejuvenate a more than 90 year old Great Lakes cement carrier. The ship is powered by a 3,000 hp Skinner Uniflow steam engine, one of just two Great Lakes vessels still operating with this type of power plant. On a return trip from Chicago, the Medusa Challenger developed cracks in the lower heads.

Back in its homeport of Milwaukee, the owners chose to weld the damaged areas. This weld would be no easy task due to the depth of the cracks. Prior to welding, the repairmen ground out the cracks in the shape of a "V", and then filled in the area with weld. The day and night repairs took place on board over 13 days. While welding took place below deck, the entire crew remained busy with painting and general maintenance.

The hard work failed to pay off. Once the ship left port, the welds proved unable to hold up to the stresses of operation. Having heard of metal stitching, the owners decided to try the process.

The additional work consisted of drilling a series of holes at right angles to the cracks and then filling the cracks with rods made of a special alloy. In just six days the repairs were completed and the Challenger departed.

Unlike standard welding procedures, the metal stitches held up to the demands of the ship.

Another benefit of the process is the stitch distributes torsional loads away from fatigue points. Precision dimensions on the repair parts are tightly held as they are cold repaired — no heat is required. Stitching is permanent, as the repair is stronger than the original metal.

#### Hub No Match for Crushing Ice

For the Herbert C. Jackson, a Great Lakes ore carrier, battling the severe shocks of ice-bound water had resulted in 80 in. cracks into the 4-sq. ft. propeller blade hub.

Five days of metal stitching and \$25,000 brought the hub back into ser-

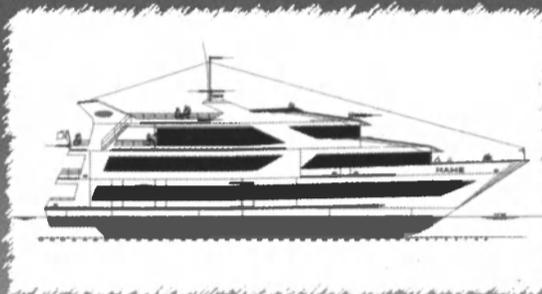
vice. This type of repair for a hub securing 7 ft. blades had reportedly never been attempted before. Estimates for replacing the heat-fitted hub ran to \$250,000 and nearly six months of work.

As proof of the strength of the repair, the Herbert C. Jackson set out to

Cleveland in early spring two years after the repair. This time the ice sheared off the propeller blades. After ballasting the tanks to start the repairs, an inspection revealed the hub was as good as new. Metal Surgery went on to replace the blades.

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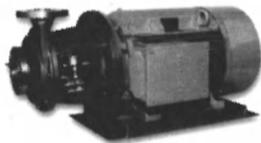
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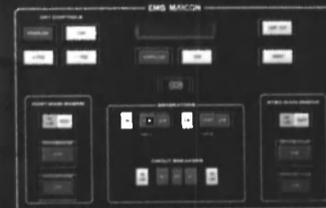
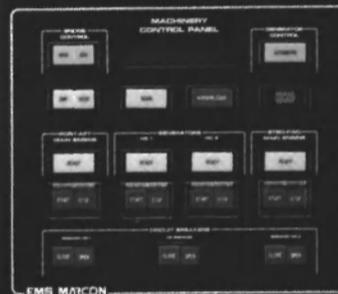
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Circle 225 on Reader Service Card

# Caveat Emptor

Boat buyers in the current depressed market need to be aware of shady operators that might not be able to deliver all they claim. One recent victim of this sit-

uation was well-known Alaska excursion vessel operator **Brad Phillips**.

At the start of 1997, Phillips contracted for a new \$4.2 million all-aluminum

catamaran, hoping to have the boat ready by the Alaska summer season. The man Phillips approached to build the boat, **Dan Johnston**, appeared to have the right qualifications and a new trick for aluminum welding that might save some money. In the end, Phillips lost his money and saw his boat cut up for scrap because the welding failed.

According to Phillips, Dan Johnston headed up a company called Falcon Marine at Port Townsend, Wash. Johnston claimed to have a "patented high-speed welding process" that could be used to build aluminum vessels "faster, better, and cheaper than any other boatbuilder."

The boast seemed plausible. Johnston had already turned out a 52-ft. aluminum speedboat for Florida owners and had a large building hall available for new construction. Caught up by Johnston's claims, Phillips signed on the dotted line and in early 1997, construction began on what was to be called Klondike Express, a 420-passenger, 38-knot catamaran.

Johnston told Phillips the boat would be in the water by May — a remarkably short construction time. The vessel started to come together quickly, with the twin hulls fabricated in an upside down position, but even in the early stages of construction it suffered from welding problems.

**One USCG inspector noted in his log that "every weld defect known was commonplace and rampant"**

Buckled deck plating was easily noticeable by visitors, and Johnston's "patented welding process" never seemed to come together. Most of the welding — in fact — was being performed by unqualified and uncertified welders, said Phillips.

Later, it was even disclosed the foreman of Falcon's fabrication department had little to no knowledge of either welding or boatbuilding. When U.S. Coast Guard (USCG) teams began certification inspections, they were shocked by the boat's condition and the manner in which it was being assembled.

There were no approved plans on site and construction apparently started without even minimal plan approval. One USCG inspector noted in his log that "every weld defect known was commonplace and rampant; longitudinal and crater cracks, inadequate penetration, undercuts, incorrect weld size and shape, poor fit-up, and generally sloppy workmanship."

As time progressed, the USCG found inspection of the project increasingly difficult because there was never a set of approved construction plans available, nor had Johnston established a quality



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control program. No one seemed in charge of the project, or at best, a different person was in charge during each USCG visit. Inspectors found themselves looking at every individual weld - and condemning most of them.

By April they were issuing "Letters of Concern" to Johnston, but to little avail. The man appeared more interested in expanding his holdings at Port Townsend through dealings with the local port commission than in completing Klondike Express.

As the May launch date rolled around the USCG was getting upset with Johnston. On May 13, 1997, it sent the following note: "This is intended to reemphasize our concerns regarding construction of Klondike Express. To date no plans have been approved by the USCG for this vessel, yet most of the vessel's twin hull and bridging structure

have been assembled."

Nevertheless, the boat still was not ready for the water, nor would it ever be.

By September, the USCG noticed correction marks made by its inspectors were being removed as soon as they left the shop. In a Sept. 10, 1997 "Letter of Concern" it wrote: "We are writing this letter to express our continued concern

regarding the construction and certification of Klondike Express. We have repeatedly identified excessive welding/fabrication defects in those areas presented for inspection. The markups made by several marine inspectors during structural inspections have been removed prior to their completion of the inspection. Such markings are to remain

in place until the structure/welding has been fully approved by the attending marine inspector."

While Johnston paid little attention to USCG law he couldn't get by the Law of Gravity. As the double hull had been started upside down it eventually had to

*(Continued on page 47)*



Every bad weld exposed itself by popping, and once the hull was reset on blocks, it began to sag.



Promise of an "advanced aluminum welding technique" resulted in the \$4.2-million Klondike Express being sold for \$24,000 in scrap.

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# CIMAC Studies Medium Speed Lubrication Issues

The Conseil International des Machines a Combustion, better known as CIMAC, has tackled the issue of lubrication in its recent writings, specif-

ically releasing two reports on the matter: Guidelines for the lubrication of medium speed diesel engines and Guidelines for the lubrication of two-

stroke cross-head diesel engines. The following will address consumption of medium speed engines.

Usually, medium speed diesel engines

are lubricated through a so-called "dry sump" system. This dry sump means that the oil charge, typically 1 to 1.3 kg/kW, is set in a tank external to the engine. With such an installation, the oil flow is so that the whole charge of oil is passing the engine every five to six minutes. Usually, the specific lube oil consumption is about 1 g/kWh. In fact, in today's diesel industry, there is a tendency to reduce both the quantity of oil in services as well as lube oil consumption.

Today, it is not unusual to see oil charge at 0+3 kg/kW and a specific lube on consumption as low as 0.2 g/kWh. In such a condition, the whole charge is going through the engine every 1.5 to 2 minutes, and the replenishment by topping up may not be sufficient to maintain proper condition of the oil.

The CIMAC Lubricant Working Groups have studied this subject in depth by examining parameters impacting oil consumption, and they have found these to be: engine design and conditions; oil quality; fuel quality; oil system quality; operating conditions; service effect on BN depletion; system losses; system maintenance.

Under the above-mentioned eight conditions, it was found that the oil is subject to degradation with the following key factors: oxidative and thermal stresses of the oil; product of combustion; metallic particles as a result of controlled wear at ring/liner interface; scraps left in the engine during maintenance; water; and corrosion.

The Working Group issued recommendations to carefully follow oil conditions by particular monitoring of the oil quality.

CIMAC Lubricant Working Group is working closely with another international body, the CEC European Council of Coordination. This body is dealing with engines including lubricants and fuels. Within this organization, there is the Working Group CEC 1L047 on "Lubrication of large diesel industrial engines." At CIMAC's request they are studying particular problems.

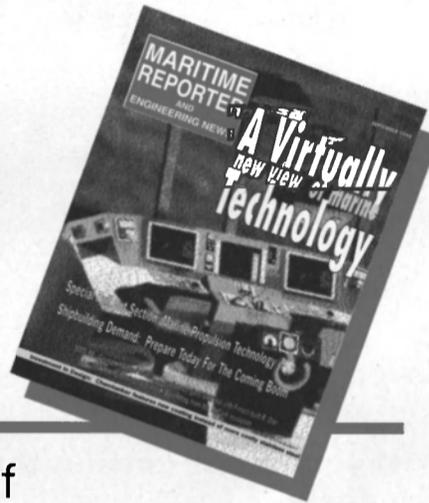
Some of CIMAC's main concerns in this field deal with alkalinity reserve, viscosity and insolubles. The purpose of the alkalinity reserve is to protect the engine from attacks caused by the sulfur contents of the fuel. In service, this alkalinity reserve is depleting and comes theoretically to a stabilized level. This document studies this phenomenon, and gives guidance about initial BN, lube oil consumption, renewal rate if needed. The group's concerns sur-

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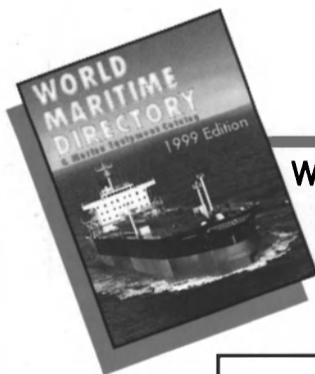


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rounding viscosity stem from the fact that due to higher thermal stresses induced by these new trends on lube circuits — as well as raw fuel dilution — viscosity is increasing. Finally, CIMAC notes that due to the combustion of low grade heavy oils and the lower quantity of oil in service, the level of insoluble may rise quickly and must be carefully checked.

CIMAC's Lubricants Working Group is reviewing the consequences of trends such as lowering oil charge and specific lube oil consumption in engines. The Working Group gives general recommendation on technical levels, keeping in mind the economical aspects of lubrication on a life cycle cost basis. This study will soon be available from CIMAC.

*Jean-Francois Chapuis of S.E.M.T. Peilstick is the chairman of CIMAC's Working Group on Lubricants.*

### Moran Management Changes

General manager of Moran Towing of Miami, **Matthew R. Walton**, will be relocating to White Stack Maritime in Charleston, S.C. as general manager. White Stack became part of the Moran Towing Corp. group of companies as a

result of the recent Moran/Turecamo merger.

The position of GM at Moran Towing of Miami will be filled by **Thomas Craighead**.

### Mobil To Accept Ship's Bunker Samples

Mobil International Marine Fuels has become the first bunker supplier to accept custody transfer sampling. "From now on Mobil will accept a single umpire sample of bunker fuel taken at the ship's manifold," said **Iain White**, Mobil manager for marine fuels and trading. "This will apply to ships bunkering in Singapore and using DNV approved sampling equipment and meeting Port of Singapore bunkering standards. It is part of our campaign to give peace of mind to owners who buy fuel from Mobil."

Mobil will write into its supply agreement for Singapore that custody transfer sampling will be accepted, provided that the vessel's receiving manifold is fixed to a shipboard sampling device conforming to the Port of Singapore's Standards CP 60 and that the sampler is in good order and has been regularly serviced.

"Multiple samples of fuel, which may come from a number of different locations, including refinery tanks, the barge or tanks on board the receiving ship, can cause confusion over quality," says Mr. White.

"Mobil is confident of its fuel quality and confident that by agreeing to accept a standard sample taken at the point of custody transfer we will not only make life simpler for shipowners, but also encourage good practice in the bunker industry."

### Detroit Diesel, Volvo Penta Collaboration Concludes

Detroit Diesel Corporation (DDC) and Volvo Penta of the Americas (VPA) have announced a mutual agreement to conclude their successful four-year collaboration which provided Detroit Diesel distribution rights for Compact and 6-16 liter inboard diesel engines and parts in North America. Effective February 1, 1999, Compact diesel inboard engines from 10-102 horsepower as well as 6-16 liter diesel inboard engines from 318-770 horsepower were transitioned back to VPA for engine, parts, sales, distribution, service and warranty.

*(Continued from page 45)*

be flipped to add the superstructure. Such were the stresses imposed during this procedure that every bad weld exposed itself by popping, and once the hull was reset on blocks, it began to sag.

This condition was noted by the USCG on October 28, 1997. Two days later, Johnston sold the boat to Phillips in an unfinished state. Although Phillips attempted to salvage the situation by bringing in outside naval architects, it was too little and too late.

By February 1998, Falcon Marine was broke. Dan Johnston left town leaving 85 employees with unpaid wages and a multitude of suppliers with worthless checks. Klondike Express was condemned, its structural problems incapable of being resolved.

On September 16, 1998, it was auctioned off for \$24,000 and cut up for scrap, its propulsion gear returned to suppliers. Phillips, older and wiser, hopes to have a replacement 340-passenger, 35-knot catamaran completed by Nichols Brothers this year. And he's learned a valuable lesson about boat-building: If it sounds too good to be true, it probably isn't true.

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# Marine Electronics Product Finder

The following is a comprehensive listing of the world's marine electronics equipment, system and service providers. Publisher is not responsible for errors or omissions.

## ANTENNAS

DeHart Marine Electronics — Memphis, Tenn.  
Frank L Beier Radio Inc — Harvey, La.  
ICG Satellite Services — Miami, Fla.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
KVH Industries Inc — Middletown, R.I.  
LaBarge — St. Louis, Mo.  
Landsea Systems, Inc. — Virginia Beach, Va.  
Mackay Communications, Inc. — Raleigh, N.C.  
Marine Electronics Solutions — Jacksonville, Fla.  
Mobile Telesystems, Inc. — Gaithersburg, Md.  
Naval Electronics Inc — Tampa, Fla.  
Racal-Decca Marine — New Malden, Surrey United Kingdom  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
S.P. Radio AS — Aalborg Denmark  
Sea-Trac Offshore Services — Harahan, La.  
Semco Marine Inc — Fort Lauderdale, Fla.  
Thrane & Throne — Soborg Denmark

## AUTOPILOT SYSTEMS

Bayou Marine Electronics — Chalmette, La.  
Benmar Marine Electronics — Santa Ana, Calif.  
ComNav Marine — Vancouver, B.C. Canada  
Coretec Inc. — St. Johns, Nfld Canada  
DeHart Marine Electronics — Memphis, Tenn.  
Frank L Beier Radio Inc — Harvey, La.  
Fratronics Inc — Houston, Texas  
Furuno U.S.A. — Camas, Wash.  
Kongsberg Norcontrol AS — Horten Norway  
Mackay Communications, Inc. — Raleigh, N.C.  
Marine Electronics Solutions — Jacksonville, Fla.  
Matrix Technologies — St. Johns, Nfld Canada  
Metal Marine Pilot, Inc. — Fircrest, Wash.  
Moody Marine Electronics — Sabine Pass, Texas  
Norcontrol Seacraft AS — Horten Norway  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
Sea-Trac Offshore Services — Harahan, La.  
Seacoast Electronics — Jacksonville, Fla.  
Simrad North America Inc — Lynnwood, Wash.

## COMMUNICATION AUTOMATION

Frank L Beier Radio Inc — Harvey, La.  
International Communications — Newport News, Va.  
Kongsberg Norcontrol AS — Horten Norway  
Radio Holland USA BV — Houston, Texas  
S.P. Radio AS — Aalborg Denmark  
Scientific Maritime Services — Escondido, Calif.  
Scientific Maritime Services — Houston, Texas  
Sea-Trac Offshore Services — Harahan, La.  
Stratos — Ft. Lauderdale, Fl.

## COMMUNICATION SECURITY

Landsea Systems, Inc. — Virginia Beach, Va.  
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Stratos — Ft. Lauderdale, Fl.  
Stratos Mobile Networks — St. Johns, Nfld. Canada

## COMMUNICATIONS SERVICE

ASCOM Teteo AB — Hamburg Germany  
AT&T Mobile Satellite Services — Morristown, N.J.  
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ICG Satellite Services — Miami, Fla.  
Icom America Inc. — Bellevue, Wash.  
Mackay Communications, Inc. — Raleigh, N.C.  
Marine & Industrial Electronics — Houma, La.  
Maritime Telecommunications — Miami, Fla.  
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O'Garra Satellite Systems — Deer Park, N.Y.  
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Stratos — Ft. Lauderdale, Fl.  
Stratos Mobile Networks — St. Johns, Nfld. Canada

TradeWinds Call Center — Kenville, N.S. Canada  
Waterway Communications System Inc — Jeffersonville, Ind.

## COMMUNICATIONS SYSTEMS

Coastal Communications — Lafayette, La.  
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Earmark — Hamden, Conn.  
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Hose-McCann — Deerfield Beach, Fla.  
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IPS Marine — Bremerton, Wash.  
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LaBarge — St. Louis, Mo.  
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Marine Electronics Solutions — Jacksonville, Fla.  
OSL - Offshore Systems Ltd — North Vancouver, B.C. Canada  
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S.P. Radio AS — Aalborg Denmark  
Sea-Trac Offshore Services — Harahan, La.  
Semco Marine Inc — Fort Lauderdale, Fla.  
Stratos — Ft. Lauderdale, Fl.  
Stratos Mobile Networks — St. Johns, Nfld. Canada  
Thrane & Throne — Soborg Denmark  
Trimble Navigation Ltd — The Woodlands, Texas  
Watercom — Jeffersonville, Ind.  
Waterway Communications System Inc — Jeffersonville, Ind.

## COMPASSES

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International Industries — Annapolis, Md.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
KVH Industries Inc — Middletown, R.I.  
Marine Electronics Solutions — Jacksonville, Fla.  
Radio Holland USA BV — Houston, Texas  
Radio Zeeland Group — AB Terneuzen Netherlands  
Raytheon Marine Co — Hudson, N.H.  
Sea-Trac Offshore Services — Harahan, La.  
Telcar Instruments — Irvine, Calif.

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Radio Holland USA BV — Houston, Texas  
Sea Inc — Mountlake Terrace, Wash.  
Sea-Trac Offshore Services — Harahan, La.  
Si-Tex Marine Electronics Inc — St. Petersburg, Fla.  
Standard Communications — Los Angeles, Calif.  
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## DIGITAL SINGLE HANDED RADIO

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## DISPLAYS (COMPUTER)

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Intercolor — Duluth, Ga.  
Intercol — Duluth, Ga.  
PinPoint Systems International — N.Y.  
Scandinavian Micro Systems — Ft. Lauderdale, Fla.  
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## ELECTRONIC EQUIPMENT

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Hose-McCann — Deerfield Beach, Fla.  
Interstate Electronics — Anaheim, Calif.  
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Semco Marine Inc — Fort Lauderdale, Fla.  
Si-Tex Marine Electronics Inc — St. Petersburg, Fla.  
SKY Computers — Chelmsford, Mass.  
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Thrane & Throne — Soborg Denmark  
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Mackay Communications, Inc. — Raleigh, N.C.  
Marine Electronics Solutions — Jacksonville, Fla.  
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Sea Inc — Mountlake Terrace, Wash.  
Sea-Trac Offshore Services — Harahan, La.

## FLAT PANEL DISPLAYS

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Barco International — Duluth, Ga.  
Frank L Beier Radio Inc — Harvey, La.  
Intercolor — Duluth, Ga.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Landsea Systems, Inc. — Virginia Beach, Va.  
Marine Electronics Solutions — Jacksonville, Fla.  
PinPoint Systems International — Westhampton Beach, N.Y.  
Radio Holland USA BV — Houston, Texas  
Scandinavian Micro Systems — Ft. Lauderdale, Fla.  
Sea-Trac Offshore Services — Harahan, La.

## GMDSS

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International Communications — Newport News, Va.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Kongsberg Norcontrol AS — Horten Norway  
Landsea Systems, Inc. — Virginia Beach, Va.  
Marine Electronics Solutions — Jacksonville, Fla.  
Morsviazspunik — Moscow Russia  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
S.P. Radio AS — Aalborg Denmark  
Sea Inc — Mountlake Terrace, Wash.  
Sea-Trac Offshore Services — Harahan, La.  
Semco Marine Inc — Fort Lauderdale, Fla.  
Thrane & Throne — Soborg Denmark

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KVH Industries Inc — Middletown, R.I.  
Landsea Systems, Inc. — Virginia Beach, Va.  
Mackay Communications, Inc. — Raleigh, N.C.  
Marine Electronics Solutions — Jacksonville, Fla.  
Moody Marine Electronics — Sabine Pass, Texas  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
Sea-Trac Offshore Services — Harahan, La.

## INMARSAT - C

Frank L Beier Radio Inc — Harvey, La.  
Fratronics Inc — Houston, Texas  
Furuno U.S.A. — Camas, Wash.  
ICG Satellite Services — Miami, Fla.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Kongsberg Norcontrol AS — Horten Norway  
Landsea Systems, Inc. — Virginia Beach, Va.  
Maganovox Advanced Products & Systems Co — Torrance, Calif.  
Marine Electronics Solutions — Jacksonville, Fla.  
Mobile Telesystems, Inc. — Gaithersburg, Md.  
Morsviazspunik — Moscow Russia  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
S.P. Radio AS — Aalborg Denmark  
Sea Inc — Mountlake Terrace, Wash.  
Sea-Trac Offshore Services — Harahan, La.  
Stratos — Ft. Lauderdale, Fl.  
Stratos Mobile Networks — St. Johns, Nfld. Canada  
Thrane & Throne — Soborg Denmark  
World Communication Systems — Newport News, Va.

## INTEGRATED NAVIGATION SYSTEMS

Advanced Marine Technology — Seattle, Wash.  
Frank L Beier Radio Inc — Harvey, La.  
Furuno U.S.A. — Camas, Wash.  
Hose-McCann — Deerfield Beach, Fla.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom

Kongsberg Norcontrol AS — Horten Norway  
KVH Industries Inc — Middletown, R.I.  
Marine Electronics Solutions — Jacksonville, Fla.  
Marine Electronics Solutions — Jacksonville, Fla.  
Morsviazspunik — Moscow Russia  
Nautilus — Houston, Texas  
OSL - Offshore Systems Ltd — North Vancouver, B.C. Canada  
PinPoint Systems International — Westhampton Beach, N.Y.  
Radio Holland USA BV — Houston, Texas  
Sea Inc — Mountlake Terrace, Wash.  
Sea-Trac Offshore Services — Harahan, La.  
Waterway Communications System Inc — Jeffersonville, Ind.

## NAVIGATION & COMMUNICATIONS EQUIPMENT

Advanced Marine Technology — Seattle, Wash.  
Barco International — Duluth, Ga.  
Coretec Inc. — St. Johns, Nfld Canada  
DeHart Marine Electronics — Memphis, Tenn.  
Electronic Marine Systems Inc — Rohway, N.J.  
Frank L Beier Radio Inc — Harvey, La.  
Furuno U.S.A. — Camas, Wash.  
Hose-McCann — Deerfield Beach, Fla.  
ICS Electronics — Ford, Arundel, West Essex United Kingdom  
Island Control — Charlottetown, P.E. Canada  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Kongsberg Norcontrol AS — Horten Norway  
KVH Industries Inc — Middletown, R.I.  
Leica Inc — Torrance, Calif.  
Litton Marine Systems — Charlottesville, Va.  
Mackay Communications, Inc. — Raleigh, N.C.  
Magellan Systems Corp — San Dimas, Calif.  
MapTech — Andover, Mass.  
Marine Electronics Solutions — Jacksonville, Fla.  
Morsviazspunik — Moscow Russia  
Negrin Marine Consultants — Elizabeth, N.J.  
Northern Airborne Technology — Marlborough, Mass.  
Northstar Technologies — Chelmsford, Mass.  
O'Garra Satellite Systems — Deer Park, N.Y.  
OSL - Offshore Systems International Inc — Fife, Wash.  
OSL - Offshore Systems Ltd — North Vancouver, B.C. Canada  
Pilot Marine Products — Tallahassee, Fla.  
PinPoint Systems International — Westhampton Beach, N.Y.  
Q-Mor, Inc. — Montreal, Que. Canada  
Radio Holland USA BV — Houston, Texas  
RGM Information Systems — Titusville, Fla.  
S.P. Radio AS — Aalborg Denmark  
Scandinavian Micro Systems — Ft. Lauderdale, Fla.  
Scientific Maritime Services — Escondido, Calif.  
Scientific Maritime Services — Houston, Texas  
Sea Inc — Mountlake Terrace, Wash.  
Sea Tel Inc — Concord, Calif.  
Sea-Trac Offshore Services — Harahan, La.  
Seacoast Electronics — Jacksonville, Fla.  
Si-Tex Marine Electronics Inc — St. Petersburg, Fla.  
Simrad North America Inc — Lynnwood, Wash.  
Simrad Robertson Inc — Houston, Texas  
Standard Communications — Los Angeles, Calif.  
Starlink — Austin, Texas  
Trimble Navigation Ltd. — Sunnyvale, Calif.  
Trimble Navigation Ltd — The Woodlands, Texas  
Waterway Communications System Inc — Jeffersonville, Ind.

## NAVTEX RECEIVERS

Frank L Beier Radio Inc — Harvey, La.  
Furuno U.S.A. — Camas, Wash.  
Kongsberg Norcontrol AS — Horten Norway  
Lokata Ltd. — Hainault, Ilford, Essex United Kingdom  
Marine Electronics Solutions — Jacksonville, Fla.  
Radio Holland USA BV — Houston, Texas  
Sea-Trac Offshore Services — Harahan, La.

## RADAR

Advanced Navigation Systems, Inc. — North Vancouver, B.C. Canada  
Alaska Diesel Electric — Seattle, Wash.  
Anritsu Corp — Minato-ku Japan  
Atlas Elektronik of America — Cranford, N.J.  
Bayou Marine Electronics — Chalmette, La.  
DeHart Marine Electronics — Memphis, Tenn.  
Frank L Beier Radio Inc — Harvey, La.  
Fratronics Inc — Houston, Texas  
Furuno U.S.A. — Camas, Wash.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Koden Electronics Co. — Clearwater, Fla.  
Kongsberg Norcontrol AS — Horten Norway  
Mackay Communications, Inc. — Raleigh, N.C.  
Marine Electronics Solutions — Jacksonville, Fla.  
Marine & Industrial Electronics — Houma, La.  
Moody Marine Electronics — Sabine Pass, Texas  
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PinPoint Systems International — Westhampton Beach, N.Y.  
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C-Mop/Commercial — Mashpee, Mass.  
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Frank L Beier Radio Inc — Harvey, La.  
Kongsberg Norcontrol AS — Horten Norway

Marine Electronics Solutions — Jacksonville, Fla.  
Matrix Technologies — St. Johns, Newfoundland Canada  
OSL - Offshore Systems Ltd — North Vancouver, B.C. Canada  
Radio Holland USA BV — Houston, Texas  
Scandinavian Micro Systems — Ft. Lauderdale, Fla.  
Sea-Trac Offshore Services — Harahan, La.  
Starlink — Austin, Texas

## NAVIGATIONAL CHARTS

Advanced Marine Technology — Seattle, Wash.  
Anritsu Corp — Minato-ku Japan  
Barco International — Duluth, Ga.  
Frank L Beier Radio Inc — Harvey, La.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Magellan Systems Corp — San Dimas, Calif.  
Marine Electronics Solutions — Jacksonville, Fla.  
Matrix Technologies — St. Johns, Newfoundland Canada  
Negrin Marine Consultants — Elizabeth, N.J.  
Norcontrol Seacraft AS — Horten Norway  
OSL - Offshore Systems Ltd — North Vancouver, B.C. Canada  
PinPoint Systems International — Westhampton Beach, N.Y.  
Racal-Decca Marine — New Malden, Surrey United Kingdom  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
Sea-Trac Offshore Services — Harahan, La.

## NAVTEX RECEIVERS

Frank L Beier Radio Inc — Harvey, La.  
Furuno U.S.A. — Camas, Wash.  
Kongsberg Norcontrol AS — Horten Norway  
Lokata Ltd. — Hainault, Ilford, Essex United Kingdom  
Marine Electronics Solutions — Jacksonville, Fla.  
Radio Holland USA BV — Houston, Texas  
Sea-Trac Offshore Services — Harahan, La.

## RADAR

Advanced Navigation Systems, Inc. — North Vancouver, B.C. Canada  
Alaska Diesel Electric — Seattle, Wash.  
Anritsu Corp — Minato-ku Japan  
Atlas Elektronik of America — Cranford, N.J.  
Bayou Marine Electronics — Chalmette, La.  
DeHart Marine Electronics — Memphis, Tenn.  
Frank L Beier Radio Inc — Harvey, La.  
Fratronics Inc — Houston, Texas  
Furuno U.S.A. — Camas, Wash.  
Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
Koden Electronics Co. — Clearwater, Fla.  
Kongsberg Norcontrol AS — Horten Norway  
Mackay Communications, Inc. — Raleigh, N.C.  
Marine Electronics Solutions — Jacksonville, Fla.  
Marine & Industrial Electronics — Houma, La.  
Moody Marine Electronics — Sabine Pass, Texas  
Norcontrol Seacraft AS — Horten Norway  
PinPoint Systems International — Westhampton Beach, N.Y.  
Racal-Decca Marine — New Malden, Surrey United Kingdom  
Recorder — Monteagle, Tenn.  
Radio Holland USA BV — Houston, Texas  
Raytheon Marine Co — Hudson, N.H.  
Sea-Trac Offshore Services — Harahan, La.  
Si-Tex Marine Electronics Inc — St. Petersburg, Fla.  
Simrad North America Inc — Lynnwood, Wash.  
Tribar Industries — Downsview, Ont. Canada  
Waterway Communications System Inc — Jeffersonville, Ind.

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Furuno U.S.A. — Camas, Wash.

Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
 Kongsberg Norcontrol AS — Horten Norway  
 Marine Electronics Solutions — Jacksonville, Fla.  
 Radio Holland USA BV — Houston, Texas  
 Sea-Trac Offshore Services — Harahan, La.

**RADIO EQUIPMENT**

American Radio Corp. — Mill Creek, Wash.  
 DeHart Marine Electronics — Memphis, Tenn.  
 Frank L. Beier Radio Inc. — Harvey, La.  
 Furuno U.S.A. — Camas, Wash.  
 Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
 Kodan Electronics Co. — Clearwater, Fla.  
 Kongsberg Norcontrol AS — Horten Norway  
 Mackoy Communications, Inc. — Raleigh, N.C.  
 Marine Electronics Solutions — Jacksonville, Fla.  
 Mobile Telesystems, Inc. — Gaithersburg, Md.  
 Radio Holland USA BV — Houston, Texas  
 Raytheon Marine Co. — Hudson, N.H.  
 S.P. Radio AS — Aalborg Denmark  
 Sea-Trac Offshore Services — Harahan, La.  
 SGC — Bellevue, Wash.  
 Si-Tex Marine Electronics Inc. — St. Petersburg, Fla.  
 Standard Communications — Los Angeles, Calif.  
 Techsonic Industries — Eufaula, Ala.  
 Waterway Communications System Inc. — Jeffersonville, Ind.

**RADIO TELEPHONES**

DeHart Marine Electronics — Memphis, Tenn.  
 Furuno U.S.A. — Camas, Wash.  
 Hose-McCann — Deerfield Beach, Fla.  
 Marine Electronics Solutions — Jacksonville, Fla.  
 Moody Marine Electronics — Sabine Pass, Texas  
 Radio Holland USA BV — Houston, Texas  
 S.P. Radio AS — Aalborg Denmark  
 Sea Inc. — Mountlake Terrace, Wash.  
 Sea-Trac Offshore Services — Harahan, La.  
 Waterway Communications System Inc. — Jeffersonville, Ind.

**RADIO TRAFFIC ACCOUNTING**

Globe Wireless — Foster City, Calif.  
 Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
 Mackoy Communications, Inc. — Raleigh, N.C.  
 Morsviazputnik — Moscow Russia  
 Radio Holland USA BV — Houston, Texas  
 Sea-Trac Offshore Services — Harahan, La.

**SATCOMS AND SATNAVS**

American Mobile Satellite Group — Reston, Va.  
 AT&T Mobile Satellite Services — Morristown, N.J.  
 Beijing Marine Communications and Navigation Company — Beijing China  
 Boatrac Inc. — San Diego, Calif.  
 BT Inmarsat — London United Kingdom  
 Cellnet Corp. — Stamford, Conn.  
 Coastal Communications — Lafayette, La.  
 Commercial Satellite Systems — Fairport, NY  
 Comsat Maritime Services — Clarksburg, Md.  
 Comsat Mobile Communications — Bethesda, Md.  
 DeHart Marine Electronics — Memphis, Tenn.  
 France Telecom — Paris, Cedex 12 France  
 Frank L. Beier Radio Inc. — Harvey, La.  
 Furuno U.S.A. — Camas, Wash.  
 ICO Global Communications Services — Washington, D.C.  
 Inmarsat — London United Kingdom  
 Iridium N.A. — Tempe, Ariz.  
 Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
 KVH Industries Inc. — Middletown, R.I.  
 Landsea Systems, Inc. — Virginia Beach, Va.  
 Mackoy Communications, Inc. — Raleigh, N.C.  
 Maritel — Gulfport, Miss.  
 Morsviazputnik — Moscow Russia  
 Nera Satcom — Billingstad Norway  
 Norwegian Cable Systems — St. Olavs Plass, Oslo 1 Norway  
 O'Gara Satellite Systems — Deer Park, N.Y.  
 OTE SA — Maroussi Greece  
 PTT Telecom — The Hague Netherlands  
 Radio Holland USA BV — Houston, Texas  
 S.P. Radio AS — Aalborg Denmark  
 Sea Inc. — Mountlake Terrace, Wash.  
 Sea Tel Inc. — Concord, Calif.  
 Sea-Trac Offshore Services — Harahan, La.  
 Seacoast Electronics — Jacksonville, Fla.  
 Singapore Telecom USA — Westport, Conn.  
 Singapore Telecommunications Ltd Intl Mobile Service — Singapore  
 Skandinavisk Teleindustri SKANTI AS — Vaerloese Denmark  
 Station 12 — The Hague Netherlands  
 Stratos — Ft. Lauderdale, Fl.  
 Stratos Mobile Networks — St. Johns, Nfld. Canada  
 T-Mobil — Bonn Germany  
 Telekom Malaysia Berhad — Petaling Jaya Malaysia  
 Telenor Satellite Services AS — Oslo Norway  
 Telestra Mobile Satellite — Auburn Nsw, Australia  
 Telstra Mobile Satellite & Radio Services — Auburn Australia  
 Thrane & Thrane — Soborg Denmark

Trimble Navigation Ltd — The Woodlands, Texas  
 Videsh Sanchar Nigam — Bombay India  
 Waterway Communications System Inc. — Jeffersonville, Ind.  
 Westinghouse Wireless Solutions — Linthicum, Md.

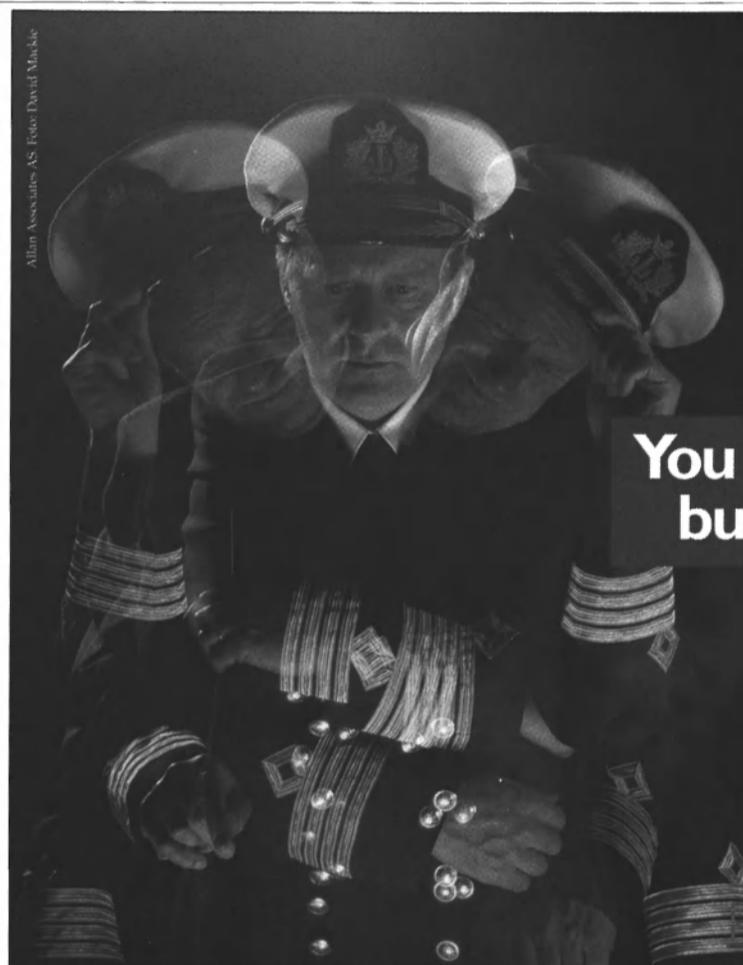
**SONAR**

Frank L. Beier Radio Inc. — Harvey, La.  
 Furuno U.S.A. — Camas, Wash.  
 PinPoint Systems International — Westhampton Beach, N.Y.  
 Radio Holland USA BV — Houston, Texas  
 Raytheon Marine Co. — Hudson, N.H.  
 Sea-Trac Offshore Services — Harahan, La.  
 Techsonic Industries — Eufaula, Ala.

**TELECOMMUNICATIONS**

Alden Electronics — Westborough, Mass.  
 Atlas Elektronik of America — Cranford, N.J.  
 Comsat Maritime Services — Clarksburg, Md.  
 Frank L. Beier Radio Inc. — Harvey, La.  
 Globe Wireless — Foster City, Calif.  
 Henschel — Newburyport, Mass.  
 Hose-McCann — Deerfield Beach, Fla.  
 ICG Satellite Services — Miami, Fla.  
 Kelvin Hughes Ltd. — Hainault, Ilford, Essex United Kingdom  
 KVH Industries Inc. — Middletown, R.I.  
 Mackoy Communications, Inc. — Raleigh, N.C.  
 Marine Electronics Solutions — Jacksonville, Fla.  
 Mobile Telesystems, Inc. — Gaithersburg, Md.

Radio Holland USA BV — Houston, Texas  
 S.P. Radio AS — Aalborg Denmark  
 Sea Inc. — Mountlake Terrace, Wash.  
 Stratos — Ft. Lauderdale, Fl.  
 Stratos Mobile Networks — St. Johns, Nfld. Canada  
 Thrane & Thrane — Soborg Denmark  
 TradeWinds Call Center — Kenosha, N.S. Canada  
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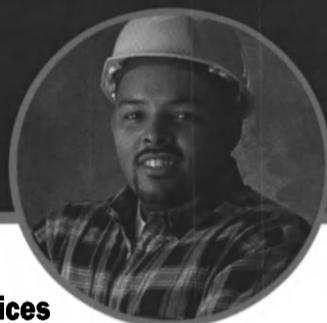
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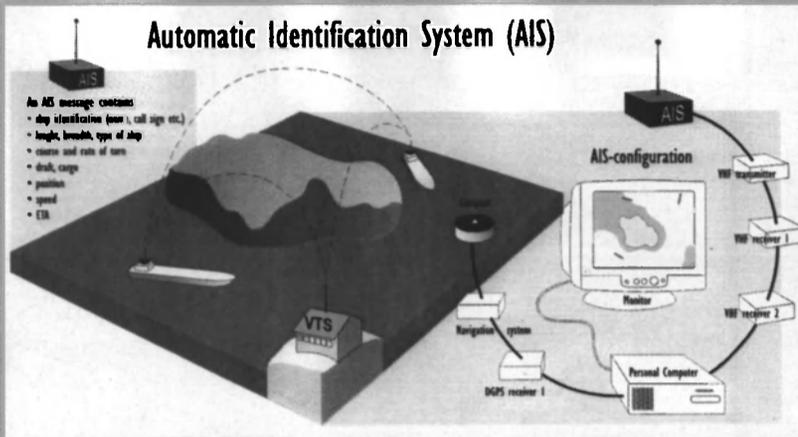
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# Vessel I.D. System Aids Vessel Safety

Sweden and Finland — traditional developers of advanced maritime industry technological solutions — have scored again with advanced development and implementation of a new automatic identification system for vessels, dubbed the Universal AIS (Automatic Identification System).

The AIS system allows data to be exchanged between two AIS sets using VHF. A radio link can be used to transmit, for example, identification data or information on location from one AIS device to another. Adding to the system's quality and value is that the connection is made



automatically, without the user having to intercept.

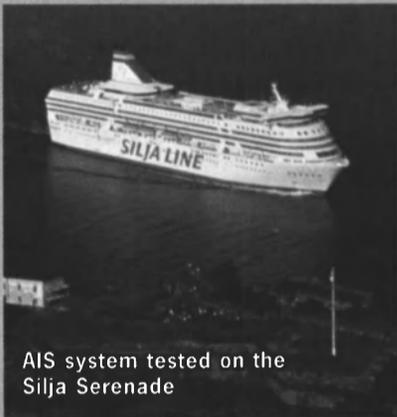
AIS technology has a myriad of uses throughout the maritime realm, but it should prove especially beneficial in times of bad weather, particularly on vessels sailing through dangerous waterways. Here, the AIS will have a significant advantage in delivering high quality traffic control.

## Government & Industry Working Together

Perhaps a large reason for the continued success of Scandinavian

countries in developing and marketing effective technological tools for the maritime market is the unparalleled level of support and cooperation enjoyed among industry and government. In this case, Finland has successfully completed a Poseidon project funded by the EU. VTT Technologies and the Finnish Maritime Administration have made in-depth studies regarding the use of AIS together with VTS. Meanwhile, Sweden has successfully commenced the installation of a network of base stations for AIS

(Continued on page 71)



AIS system tested on the Silja Serenade

## A to Z Listing of Marine Electronics Manufacturers

### ACR Electronics Inc.

5757 Ravenswood Road  
Fort Lauderdale, Fla. 33312  
Tel: 954-981-3333  
Fax: 954-983-5087  
Email: info@acrelectronics.com

### Adroit Systems Inc.

209 Madison St., 5th Floor  
Alexandria, Va. 22314-1764  
Tel: 703-684-2900  
Fax: 703-836-7411

### Advanced Marine

#### Technology

2003 Western Avenue, Suite 725  
Seattle, Wash. 98121  
Tel: 206-443-5663  
Fax: 206-443-5661  
Email: omt@advmarine.com

### Advanced Navigation

#### Systems, Inc.

913-1327 E. Keith Rd.  
North Vancouver, B.C. V70 3T5 Canada  
Tel: 604-990-1168  
Fax: 604-990-1316

### Alaska Diesel Electric

4420 14th Ave NW, P.O. Box 70543  
Seattle, Wash. 98107  
Tel: 206-789-3880  
Fax: 206-782-5455  
Email: ade@northern-lights.com

Website: <http://www.northern-lights.com/>

### Alden Electronics

P.O. Box 500, 40 Washington St.  
Westborough, Mass. 01581-0500  
Tel: 508-366-8851  
Fax: 508-303-6763

### American Mobile

#### Satellite Group

10802 Parkridge Blvd.  
Reston, Va. 22091  
Tel: 703-717-6522  
Fax: 703-758-6190

### American Radio Corp.

914 164th St., S.E. B1698  
Mill Creek, Wash. 98012  
Tel: 206-745-8424  
Fax: 206-745-8424

### Anritsu Corp.

10-27 Minamiazabu, 5-chome  
Minato-ku Tokyo 106 Japan  
Tel: 011-81-3-3446-1111  
Fax: 011-81-3-3440-235

### ASCOM Tateco AB

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Tel: 908-276-9400  
Fax: 908-276-3822

**Azonix Corporation**

900 Middlesex Tpke., Bldg. 6  
Billerica, Mass. 01821  
Tel: 800-365-1663  
Fax: 978-670-8855  
Email: [market@azonix.com](mailto:market@azonix.com)  
Website: <http://www.azonix.com>

**Barco International**

3059 Premier Parkway  
Duluth, Ga. 30097  
Tel: 678-475-8000  
Fax: 678-475-8100  
Website: <http://www.barco.com/display>

**Bayou Marine Electronics**

5125 Paris Rd.  
Chalmette, La. 70044  
Tel: 504-279-0967  
Fax: 504-277-4218

**Beijing Marine Communications and Navigation Company**

1 Waighan Houshen  
Beijing 100011 China  
Tel: 011-86-10-6429-3665  
Fax: 011-86-10-6421-3509

**Benmar Marine Electronics**

3629 W. MacArthur Blvd., Ste. 208  
Santa Ann, Calif. 92704  
Tel: 714-540-5120  
Fax: 714-641-2614  
Email: [benmar@aol.com](mailto:benmar@aol.com)

**Boatrac Inc.**

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San Diego, Calif. 92121  
Tel: 619-657-0100  
Fax: 619-657-0101

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London EC1A 7HP United Kingdom  
Tel: 011-44-171-492-4996  
Fax: 011-44-171-492-4996

**C-Map/Commercial**

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Mashpee, Mass. 02649  
Tel: 508-477-7537  
Fax: 508-477-7549

**Carlisle & Finch**

4562 West Mitchell Ave.  
Cincinnati, OH 45232  
Tel: 513-681-6080  
Fax: 513-681-6226

**Cellnet Corp.**

400 Main Street  
Stamford, Conn. 06901  
Tel: 203-359-6333  
Fax: 203-359-6826

**Coastal Communications**

4549 Johnson St.  
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Tel: 318-989-0444  
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**Cole Hersee Co.**

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Fax: 617-268-9490  
Website: <http://www.colehersee.com>

**Commerical Satellite Systems**

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Fairport, NY 14450  
Tel: 16-425-0760  
Fax: 716-425-0762

**ComNav Marine**

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Vancouver, B.C. Canada  
Fax: 604-255-3523

**Comsat Maritime Services**

22300 Comsat Drive  
Clarksburg, Md. 20871

Tel: 800-424-4297  
Fax: 301-601-5953

**Comsat Mobile Communications**

6560 Rock Spring Drive  
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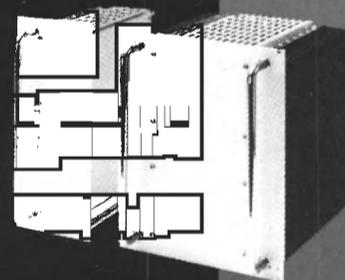
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# Crew Training Critical To New System Success

Mariners today are confronted with a burgeoning array of new electronic equipment on the bridges of commercial ships, and confusion and questions regarding the exact functions are a common occurrence. With the advances in digital radar, fancy DGPS receivers, new autopilots, complex GMDSS and the advent of Electronic Chart Display and Information Systems (ECDIS), crews are faced with the challenge of mastering a suite of equipment that was absent a decade ago. True enough, much of this equipment does aid navigation efficiency and safety but, without a solid knowledge of the technology, the equipment's purpose can be easily diminished.

Offshore Systems Ltd., a pioneer in the field of Electronic Chart Systems (ECS), considers training to be as integral as the new technology itself.

For a shipping company, training helps

to ensure that its crews are proficient with new equipment and to demonstrate the company's professionalism. OSL benefits from its training service by developing a relationship with the end-user and by presenting its full product and service line.

Usually, the impetus for installing such equipment comes from a shipping company's operations manager. Old equipment requires replacement, new technologies arrive and new regulations come into force. Whatever the reason, becoming familiar with these devices is the responsibility of the captain and the mates. Left to their own devices and maybe a little help from a printed manual, navigators will invariably figure out some, but not all, of a system's features. The primary aim of any training is to make the end-user knowledgeable about the equipment. This knowledge not only

involves knowing which buttons do what but also helps explain the fundamentals of the technology. With respect to Electronic Chart Systems, the mates may know how to 'zoom-in' or 'zoom-out' but they will have no understanding of the limitations of the equipment. Why, for example, does the ship's symbol appear where the ship really isn't? The answer could be problems with the DGPS or inaccuracies in the electronic chart or the selection of a poorly detailed, small scale chart.

Conversely, a good trainer will emphasize the wider range of benefits available to the mariner. For example, what is the quickest way to initiate an anchor watch alarm of exactly 400 yds around the ship and have it centered on the forward anchor? That's well and fine, but when will the alarm go off? Is it when a portion of the ship touches the circle or is it when the entire ship drags outside of the watch circle? It may be highly frustrating or even impossible for the navigator to find these answers themselves. A relatively brief training course, however, would end such frustration and diminish the mate's stress, especially when the captain demands quick answers from the electronic equipment.

Often, without training, mates will make certain assumptions about the equipment. These assumptions invariably make their way to other crew members who accept their shipmates' opin-

ion and spread the conjecture further afield. If training doesn't occur soon after the equipment is installed on board, the instructor's task will invariably include dispelling all of these assumptions as well.

While many shipping companies provide Bridge Resource Management training, they often neglect any specific instruction on ECS. An assumption is frequently made that an ECS is much like a radar - if you can operate one then you can operate them both. Also, Ops. Managers underestimate the importance of an ECS or ECDIS. Without a SOLAS carriage requirement, these systems take a back seat to most other bridge electronics. However, a crew's reliance on Electronic Chart Systems for navigation becomes quite remarkable over time. Unfortunately, this fact is often overlooked by Ops. Managers

Training captains and mates provides certain benefits to OSL, specifically in the form of using comments and suggestions into new product features or functions.

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*Gwil Roberts is the Customer Training Representative for Offshore Systems Ltd. in North Vancouver, B.C. Mr. Roberts has trained crews from over 30 ships in the use of ECPINS.*

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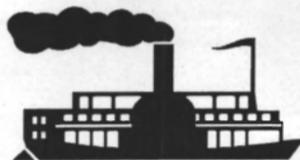
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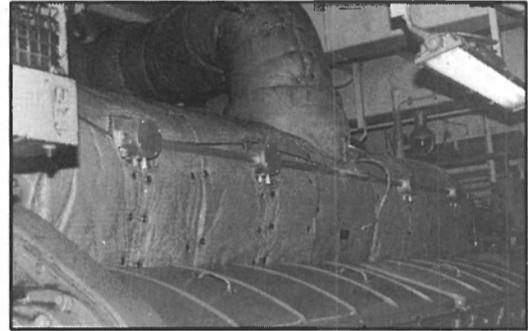
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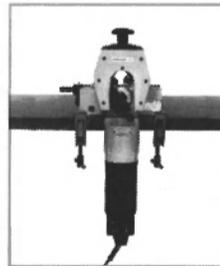
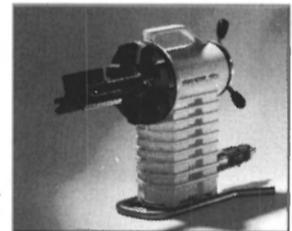
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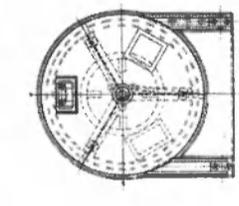
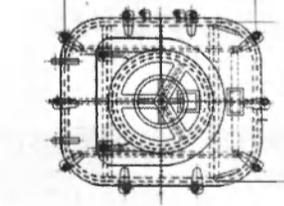
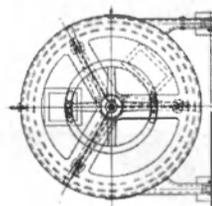
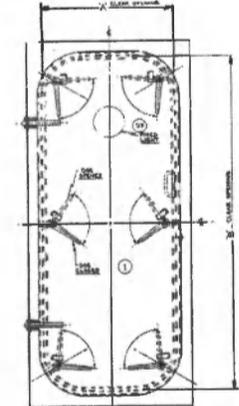
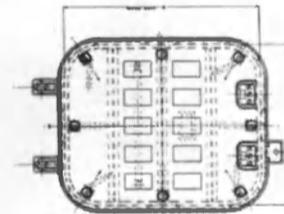
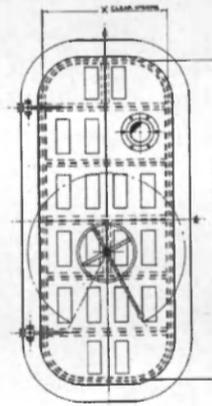
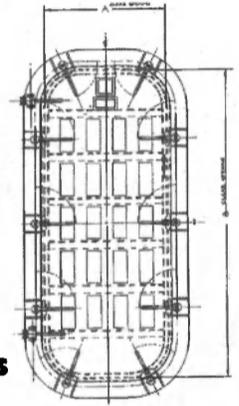
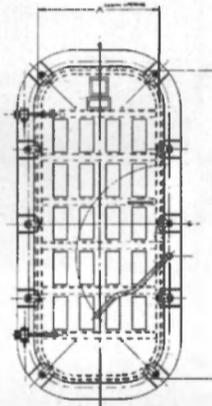
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### Anti-Fouling, Hull Efficiency Combined

HySpeedKote from Marine Polymer Group, Inc. is a hydrophilic hull coating material that has been shown to increase

the efficiency of a displacement hull by as much as 15 percent. An independent test on a new 33 ft. (10 m) twin engine boat showed a 15.45 percent increase at idling speed of 650 rpm. At 1,500 rpm, the boat's speed was increased by more than 27 percent. HySpeedKote is designed to increase speed, extend range, reduce fuel consumption and reduce engine maintenance expense. The company plans to introduce HySpeedShield, a coating with the same speed increasing and fuel saving qualities of HySpeedKote, plus anti-fouling.

**Circle 26 on Reader Service Card**

### Delta T Spray-On Thermal Insulation

Delta T Marine from Mascoat Products is a spray-on insulating coating designed to replace or enhance thermal conventional insulating materials found on shipboard construction. With a 40 mm layer, Delta T insulating coating can be as effective as 3 in. of conventional insulation on substrate bulkheads, sidewalls, stiffeners, and overheads. The coating is extremely lightweight and bonds to almost any surface. Additional benefits include providing an excellent surface barrier protection and a vapor barrier all in one coat. Delta T is normally applied with airless spray equipment. This reduces total application time and greatly reduces total insulation costs. Typically, a 200 ft. (61 m) OSV can be thermally insulated in two days. The coating contains no solvents, no harmful VOC's, and is UL and USCG approved. Currently the coating has been applied to more than 60 vessels.

**Circle 24 on Reader Service Card**

### Fighting The Power Of Soluble Salts

Chlor\*Rid International Inc. has introduced a new version of its patented liquid soluble salt remover Chlor\*Rid, called Chlor\*Rid DTS (Direct-To-Surface). The formula is the same, but comes pre-mixed to eliminate the need for field mixing and diluting. The product is biodegradable, non-flammable, contains no volatile organic compounds and does not interfere with coating adhesion. It strips chlorides and sulfates from industrial surfaces using ionization energy. The company also offers Chlor\*Test, a three-step, easy to use field kit for testing surface chloride contamination.

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### Fiber-Filled Epoxies Prevent Flash Rusting

Progressive Epoxy Polymers distributes the BIO-GARD and BIO-DUR line



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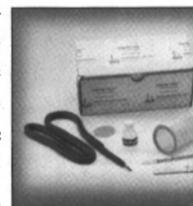
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of epoxy coatings, sealers and adhesives manufactured by Thin Film Technology, Inc. (TFT). These epoxies are solvent-free and 100 percent solids containing Kevlar microfibers to provide internal strength and chip/crack resistance. TFT epoxies can be applied to wet or damp surfaces (even underwater), such as those recently waterjetted clean. By coating before the surface is completely dry, flash rusting can be prevented.

BIO-STEP 185 is a ladder rung and stair coating which provides an anti-slip surface and minimizes heat transference. The epoxy coating does not transfer heat as effectively as metal rungs, resulting in a surface which is much cooler to touch — an important safety factor for crew escaping a fire.

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#### Marine-Friendly Bottom Paint Product Of Asian Cooperation

A new bottom paint which does not cause marine pollution has been developed by Ishikawajima-Harima Heavy Industries Co. Ltd., Toyobo Co. Ltd, and Nippon Paint Marine Coatings Co. Ltd. through financing from the Ship & Ocean Foundation and The Nippon Foundation. Natural substances such as a derivative of allium, lactic acid and malic acid take the place of conventional components in antifouling agents and resins. The natural ingredients do not cause marine pollution as in time they decompose into CO<sub>2</sub> and H<sub>2</sub>O with the help of marine microorganisms. Tests are being performed to assess the effectiveness of the new paint.

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#### Rust Converting Primer

Corroseal from Corroseal, Inc. works by converting rust to magnetite — priming metal for top coating without the need for extra maintenance to clean rust to white metal or sandblasting. Preparation time for Corroseal using machine tools takes about one third as many labor hours as conventional metal primers. To solve the problem of visible rust and to stop loss of metal, Corroseal may be used for spot coating along with a normal top coat. The product is non-flammable, non-toxic, biodegradable and low in VOCs. Corroseal etch primes still-good old paint and can serve as an etch primer for most types of aluminum.

Circle 67 on Reader Service Card

#### Flexible Coating Stops Corrosion

Eureka Chemical Company produces Fluid Film, a line of non-solvent base corrosion preventive coatings and lubricants that are applied to steel structure and parts. These products are used world-wide by commercial ships, mili-

tary ships, drillrigs and shipyards. Common areas of use include topside maintenance, ballast tanks, interior of rudders and wire rope. Fluid Film systems penetrate existing rust, displace water and form a durable film which does not harden or crack.

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#### Non-Toxic Hull Coating

Sound Specialty Coatings Corp. offers Aquaply M, a non-toxic hull coating for boats and ships. The product contains no solvents, therefore wet mil. thickness is equal to its dry mil. thickness. The system will cure on wet or damp substrates and even under water. Aquaply M can

last for up to five years, and can be applied on wood, metal and FRP substrates. It is available in both standard and custom colors. The company has also developed Prop\*Coat, a two-part epoxy coating for propellers and running gear.

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Hempel Coatings (USA) Inc. manufactures Hempadur 1763, a high-build, light-colored, modified epoxy paint for the application of cost-effective systems in new ships. It does not contain tar or isocyanate,

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and has a low content VOC. Hempadur 17630 is specified as a two-coat system in accordance with widely accepted guidelines for ballast tank coating systems. It contains higher molecular weight epoxy resins to give tough films with resistance to seawater and special polyamide adducts as curing agents, designed to give high corrosion resistance and good flexibility. The system cures down to 0°C/32°F, making it an all-year-round product in most locations.

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### Whirling Steel Blades

Aurand's M and K tools, with their whirling steel blades, shape up any surface prior to recoating or repainting. The M tool is slightly heavier, and more aggressive than the K tool, and is typically used on horizontal surfaces. Adjustable depth settings protect the underlying surface, and prevent overloading, stalling and excessive cutter wear. Both are available in many widths, and in pneumatic or electric models. A dust collector is also available for each model.

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### One-Day CeRam-Kote Barnacle/Mussel Repellant System

CeRam-Kote's Ceramic Barnacle/Zebra Mussel Repellant System is applied in two passes of CeRam-Kote 54, followed by a wet-on-wet application of CeRam-Kote CuBR, which translates into substantial labor savings. CeRam-Kote 54's insulating barrier is applied directly to the properly prepared substrate, followed by a top-coat of the CeRam-Kote CuBR barnacle/zebra mussel repellant. The system is environmentally friendly, self-priming and has low VOCs.

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### International's Intersleek

Intersleek is a revolutionary coating technology which controls fouling on fast craft, says International. Unlike the traditional solution – antifouling – Intersleek does not contain any added biocides.

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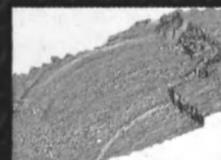
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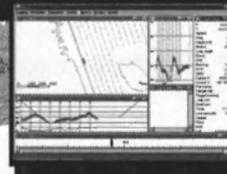
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face to give weak bonding between the fouling organism and the surface. Intersleek works by providing a smooth, low friction, hydrophobic surface on which fouling organisms have difficulty settling. Any that do settle, adhere only weakly, and can be easily removed from the slippery, easy clean surface.

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#### Zero VOCs

Jotun Valspar Marine Coatings offers WB-14 Pre-Construction primers, featuring zero VOCs. Fast weld formulas (40 in. per min) and high speed welding are also benefits to the product, says the company. With a 61-64 percent volume of solids, there is a high coverage rate per gallon. The product is an ABS certified weld through primer.

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#### New Coating Thickness Measurement Gauge



A new CTM 20 coating thickness gauge, that uses innovative ultrasonic technology, is available by Krautkramer Branson. The new instrument enables measurements to

be made even on coatings and multilayers covering nonmetallic materials. It is possible to measure the total thickness as well as the thicknesses of the individual layers, with the CTM 20. There is also a wall thickness function that enables through-coating measurement of the test part. It is a compact, portable, battery-powered instrument.

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#### Rohm and Haas Offers New Literature

Chemicals manufacturer Rohm and Haas Company has published a new bulletin on the use of Sea-Nine 211 marine antifoulant. Sea-Nine employs isothiazolone chemistry as a more environmentally acceptable ingredient in marine plants. The bulletin examines the environmental chemistry and aquatic toxicology of Sea-Nine, and presents a number of data tables to illustrate comparisons between Sea-Nine and tributyltin.

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#### Full Line from Sigma Coatings

Sigma Coatings offers a wide range of coating products for the marine industry, designed specifically for each task –

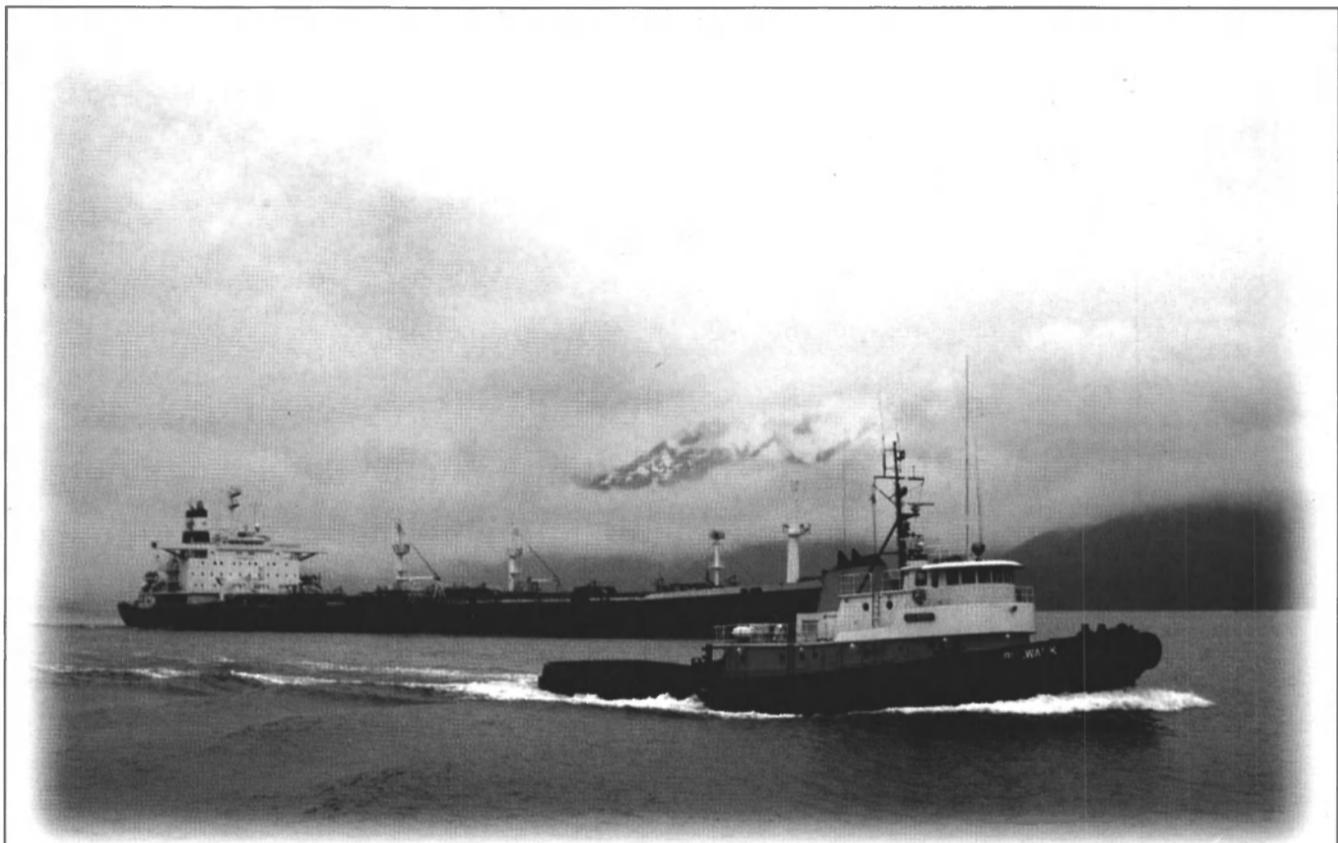
whether it be below the waterline anti-corrosive coatings and anti-fouling to protect the hull, or cargo tank coatings to provide protection from corrosive chemicals and solvents. The 491,120-dwt ULCC Sea World, owned by Norway's Seatankers Inc., recently completed a five-year special survey in Dubai Drydocks where Sigma Coatings

products were reapplied. The hull was spot repaired to bring the anti-corrosive up to top condition and then a Sigmaplane HB five-year system was applied. Sigmaplane HB is a universal, high-build self-polishing anti-fouling suitable for use at newbuilding or maintenance stages which can last up to 60 months (five years).



During the Dubai dry-docking, Sea World's 30 cargo tanks were coated with Sigmaguard CSF, a coating specifically designed to protect cargo tank bottoms.

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## The Safeguards you don't see...

Tug escorts and double bottoms help safeguard the environment but the best safeguards you don't see - they are trained people.

Competent mariners who have been afforded the opportunity to practice operating procedures and react to emergencies can and do prevent mistakes before they happen.

This is why ARCO, BP, Crowley and other responsible carriers, have worked with MSI San Diego to develop an interactive simulator training program for tanker escort operations where tanker, escort tug and emergency response vessel operators interact with Port, Coast Guard and VTS stations.

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For the past year, MSI has been conducting joint, monthly courses for tug and tanker operators who must train together as a team.

Whether aboard a tanker, an escort tug, a response vessel or ashore at a terminal or VTS station, it takes coordinated skills to assure a safe passage. When quick reaction counts, each participant must know his job and understand that of the others.

A full program of joint courses is scheduled for 1999. Even now, MSI is preparing a simulator response model for ARCO's new Millennium Tanker for use in future training.

# Marine Safety

international

## GULF COAST REPORT

### New Generation Drillship Goes to Work

Conoco and R&B Falcon Corp. announced Deepwater Pathfinder - a first-of-its-kind, ultra-deepwater drillship - began a five-year work program in the Gulf of Mexico.

The ship, the first new build capable of

drilling in 10,000 ft. of water, will fulfill a \$400 million drilling program for Conoco. The vessel is expected to drill three or four wells in its first year of operation, with the first exploratory well being drilled at Garden Banks Block 783. Conoco has interests in 295 deepwater leases in the Gulf.

The technological highlight of the ship

is its dynamic positioning systems, wherein a specialized combination of seabed and satellite systems send signals to onboard computers. Six high-powered thrusters counter the force of currents, wind and waves to keep the vessel exactly on target without an anchor, even in weather conditions as severe as a ten-year Gulf of Mexico

storm. Furthermore, Deepwater Pathfinder is the only drillship worldwide incorporating triple-redundant power and operating functions, which qualify for the ABS' DP3 classification - the shipping society's highest standard of safety, redundancy and reliability for dynamically positioned vessels.

Deepwater Pathfinder has numerous innovative features that combine to make it a new generation of drillships. No other ultra-deepwater drillship designed to date meets such stringent standards for safety, redundancy and reliability.

In one of the first applications of its kind, the vessel features computerized rig floor operations, with conventional manual backup capabilities. This automation virtually eliminates the human element from operating much of the traditional drilling equipment, thereby reducing the risk of injury and increasing efficiency.

Conoco and R&B Falcon are building a second deepwater drillship with the same specifications, expected to be delivered in early 1999 - about two months ahead of schedule. It will operate on Conoco's deepwater tracts in other parts of the world, such as the Atlantic Margin, Norway, New Zealand and Nigeria. Conoco holds more than 35 million acres of deepwater leases throughout the world.

Conoco will contract the second ship for 2.5 years out of the first five years of its operation, with renewal options.

### Schlumberger Completes First Coiled Tubing Horizontal Well

Schlumberger Oilfield Services successfully drilled and completed the first horizontal well in the Gulf of Mexico with CoilDRILL coiled drilling technology. Working in conjunction with the Spirit Energy 76 drilling team, Schlumberger Integrated Project Management (IPM) designed, drilled and completed the well.

An exit window was milled through two strings of pipe, 1,390 ft. of 4.75 in. open hole was drilled with 750 ft. of this hole above 80 degrees.

The well was then completed by conveying a horizontal completion assembly consisting of sand control screens, an inflatable packer for zonal isolation, and Dowell's QUANTUM gravel packer open hole isolation assembly on coiled tubing to 8,100 ft.

### Halter Begins Construction Of Three Second Generation Hvide SDM

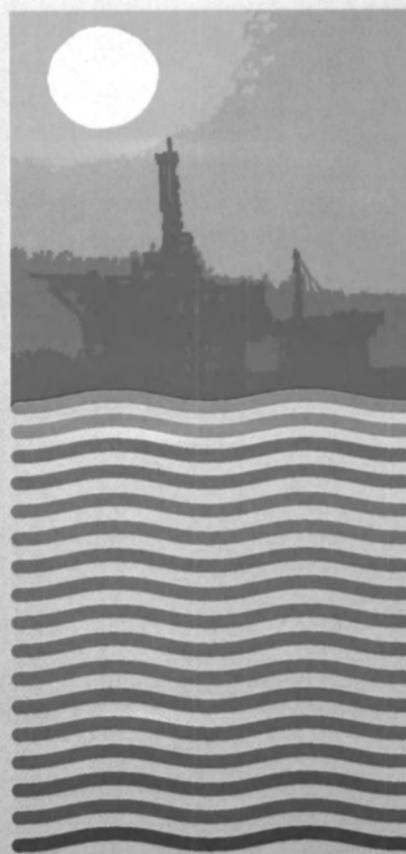
Halter Marine, Inc. has begun construction of three second generation



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Halter starts work on third SDM.

Ship Docking Modules (SDM) at its Lockport, La. shipyard for Hvide Marine, Inc. The new tugs, designated SDM Mark II, follow the three original Halter-built SDMs, New River, St. Johns and Escambia. Two of the new vessels, Suwanee River and Peace River, are scheduled for delivery in 1999, and Kissimmee River, the third Mark II, will be delivered in 2000.

The patented, double-ended 90 ft. x 50 ft. (27.4 m x 15 m) SDM design, which requires only two crew members to operate, was conceived by Erik Hvide, chairman and president of Hvide Marine and refined by the Elliot Bay Design Group, Seattle, Wash. The design is critical to maneuvering large ships in and out of narrow ports and harbors.

The revolutionary harbor tugs have skegs mounted on centerline at each end, and Z-Drives mounted diagonally offset 6.5 ft. from the center to provide 100 percent of their bollard pull in any direction. The immediate success of the first innovative "flying saucer shaped" vessels and the experience gained from their operations led to the new order and a few design and propulsion changes which include: An expected increase in bollard pull from 110,000 pounds to 125,000 pounds by using two Wartsila 9L20, 2,000 HP diesel engines driving two Ulstein Z-Drives turning 94.5 in. diameter Nibral propellers in nozzles. The first generation SDMs are powered by Caterpillar 3516BTA diesels driving two Ulstein Z-Drives turning 86 inch diameter propellers in nozzles. An Aquapilot engine control system will monitor the main engines. Ship's service power will be provided by two 65 kW Caterpillar 3306 generator sets. Fendering on the first three vessels is a single-loop Schuyler Rubber design and the Mark II's will be equipped with Schuyler's multi-loop design.

### Halter To Convert Bouchard Barge, Tug To ITB Unit

Halter Marine, Inc., has signed a contract with Bouchard Transportation Co., Inc. of Hicksville, N.Y. to convert a 446-ft. single hulled, ocean-going petroleum tank barge (B. No. 155) to a double hull to meet the requirements of the Oil Pollution Act of 1990 (OPA 90). The contract also includes options for similar conversions of two additional pairs

of sister vessels, all of which were constructed at Halter shipyards.

The barge's conversion will be accomplished through the addition of an outside hull. As a result, the barge's dimensions of 446 ft. x 74 ft. x 32.5 ft. (136 m x 22.5 m x 10 m) will be increased to 468 ft. x 85.5 ft. x 38 ft. (142.6 m x 26

m x 11.6 m) and ocean load line capacity will increase from 125,000 barrels of residual fuel oil to 158,000 barrels with segregated ballast. Halter will also install an Intercon connection system on the barge and the 127-ft. tug "M/V Buster Bouchard" to convert both vessels into an integrated tug/barge config-

uration. The system eliminates tow wires between the tug and barge as the tug is firmly connected to the barge by a pair of 50-in. diameter rams projecting from both sides of the tug which lock into receptacles on each side of a "notch" at the stern of the barge.

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# Spanish Maritime Report

A focus on higher value, specialized vessel types has been the cornerstone of strategy in Spanish shipbuilding for some years. While state-owned Astilleros Españoles (AESA) has successfully developed a number of niche markets, the private sector has nurtured business across a broad platform, and continued to build on long-standing skills in meeting the comprehensive requirements of the fisheries industry. The intensification of competition from the Far East, however, is a major concern to AESA in particular, writes technical editor David Tinsley.

## Independent Boosts Fleet

Spain's largest private shipowner, the Fernandez-Tapias group, has initiated a new stage in the development of the country's deepsea fleet by ordering Suezmax-class tonnage in South Korea. Its Madrid-based shipping arm, Naviera F Tapias, recently entrusted a second 158,000-dwt tanker to Daewoo Heavy Industries, the opening deal having been awarded last July.

Group head **Fernando Fernandez-Tapias** oversees an organization with broad-based interests, including food, plastics and travel agency, and has fostered the expansion of shipping activities since entering the market in 1991.

The purchase of the Spanish subsidiary of pre-eminent Danish operator A.P. Moller, together with its ships, had provided the original platform on which to build. One year later, in mid 1992, Tapias took over Servicios Auxiliares de Puertos (Sertos) and its extensive tug operations. Subsequent investment has been such that Tapias is now reckoned to account for around one-third of the Spanish mercantile fleet.

The company had displayed a forward-looking approach through an early

involvement in the European shipbuilding industry's technologically-advanced, E3 'green tanker' program. Astilleros Espanoles (AESA) had played a central role in the project, which was subsequently overtaken by market events.

Fernando Fernandez-Tapias is a strong advocate of Spanish industry at large, in his role as president of the Confederacion Empresarial Independiente de Madrid, and observes that more than 80 percent of the country's overseas trade is carried in foreign-owned ships. "Spain's merchant marine has a very low capacity compared to Spain's transport requirements," he confirms.

However, he is of the view that the country's remaining owners have a more solid base than they had 10 years ago. "The shipowners who have survived are much more competitive now," Fernandez-Tapias told BV World, the house magazine of classification society Bureau Veritas. "And although there is no consistent government policy on shipping, the special register in the Canary Islands has helped us a lot to regain our competitive position."



Spain's Naval Gijon Shipyard.

Naviera F Tapias has particular strengths in the Suezmax category, as represented primarily in its ownership of tankers of 135,000-147,000 dwt dating from the end of the 1980s and beginning of the 1990s.

The two 158,000-dwt vessels under construction at Daewoo's Okpo yard are scheduled for completion during the second-half of 2000, and will have main dimensions of 899 ft. (274 m) length overall, 157.4 ft. (48 m) molded breadth and 76 ft. (23.2 m) depth. The propulsion plant will be a six-cylinder model of the MAN B&W low-speed S70MC type.

## ISM

Many Spanish shipowners, not least the leading independent tanker operator Fernando Fernandez-Tapias, regard class as an aid to implementing and maintaining ISM Code requirements. Classification societies have not been authorized to handle ISM certification in Spain, which has been kept within the state domain through the maritime authorities. Nonetheless, class is perceived within the industry as having an important role to play in assisting owners to prepare for the code.

## Investing Products

Maintaining a dynamic approach to fleet development, the Valencia-based Boluda Group is a classic example of a family-run business which has continually reinvested profits in its core activities while fostering diversification in other marine-related areas. Its \$24.5 million expenditure in 1998 on eight new tugs for deployment at ports in Spain, the Canary Islands and Mexico

underscored its particular strengths in ship towage, complemented by its anchor-handling and offshore supply services. Tugs and support ships together account for the highest proportion of a fleet of more than 150 vessels.

But testament to the group's widening portfolio of shipping interests was provided by last year's addition of three secondhand containerships of around 900-TEU capacity, following on from the acquisition of domestic boxship operator Naviera Pinillos. In fact, over the past five years alone, Boluda has purchased five companies in the marine field.

Alert to new opportunities for providing specialized shipping solutions, it is currently investigating a number of projects, including one which could give rise to a requirement for the construction of two 20,000-dwt self-unloading cement carriers to be deployed in South American waters.

A series of five, Lloyd's Register-classed azimuthing tractor tugs ordered by the Boluda Group is nearing completion at the Santurce premises of Astilleros Zamakona, one of Europe's most prolific constructors of tugs.

Three of the vessels were completed last year, for ship-handling operations in Valencia and at Las Palmas, in the Canaries, and the two remaining tractors are scheduled to be handed over in mid 1999. A stern-drive tug of 1,520-kW propulsive power has also recently been delivered by Zamakona to Boluda for deployment at the Mexican port of Coatzacoalcos. The family-owned yard, which had been heavily reliant on the fisheries industry until its break into the tug newbuild market at the start of the 1990s, gave fresh expression to its



Atunsa's 180-m Doniene was the first tuna seiner to receive Reintjes' gear.

## Efficient Design Tools

One of Germany's most accomplished and resilient shipbuilders, J.J. Sietas, has endorsed the latest advance in computer-based design and production technology from Spanish engineering firm Sener by opting for the versatile, Foran V40 system. The integrated CAD/CAM/CIM system, tailored to the ship design and construction environment,

breaks new ground as it can be run in its entirety on commercially-available PCs under



the Windows-NT operating system. The culmination of more than three years' product enhancement drawing on feedback from users of previous Foran systems, V40 is thereby fully portable across multiple hardware platforms and operating systems, including UNIX and OpenVMS, with the additional Windows-NT capability.

Enshrined in the latest development is Sener's central philosophy of providing efficient tools to meet the client market's unerring drive for improved productivity. Key features of the latest version of Foran include a new graphical user interface, automatic generation of complex drawings and welding information, easier CIM implementation, improved integration with product data and material management, and enhanced 'walk-through' capability.

Sietas' selection of the system is pertinent to the yard's extensive workload and to the increased market reach conferred by infrastructural investments which enable the company to deliver bigger ships than hitherto from its Neuenfelde premises. Productivity is an absolutely key ingredient in its competitiveness. Other companies which have selected Foran V40 include fast ferry specialist builder Kvaerner Fjellstrand and Clydeside's Kvaerner Govan among well over 40 yards and design offices to date.

V40 forms a constituent part of the computerized, naval design and management system (NDMS) which Sener has been contracted to design, supply and install for the Brazilian Navy. The network will include the Navy's ship design center (Centro de Projecto de Navios), shipyard (Arsenal de Marinha do Rio de Janeiro), naval engineering directorate and weapons system directorate.

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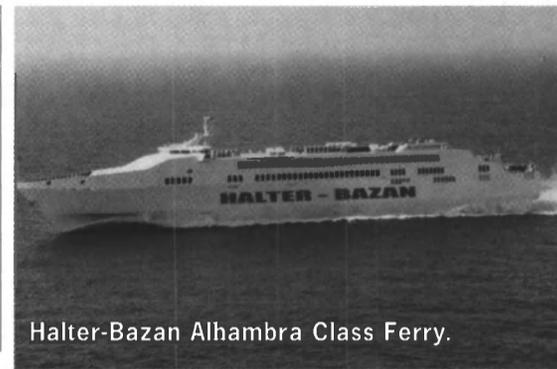
international standing last year with the completion of a powerful tractor tug for a German operator. Its production versatility was also implicit in its delivery of a double-ended ferry for service in the west Norwegian fjords with More og Romsdal Fylkesbaatar (MRF).

Located within the port of Bilbao, Zamakona has formulated a development program for its shipyard in keeping with its perception of market demand.

Key elements of the \$4.7 million program foreseen for execution in 1999 and 2000 include a 361 ft. (110 m) slipway and five cranes offering the capability to lift 100-ton hull blocks.

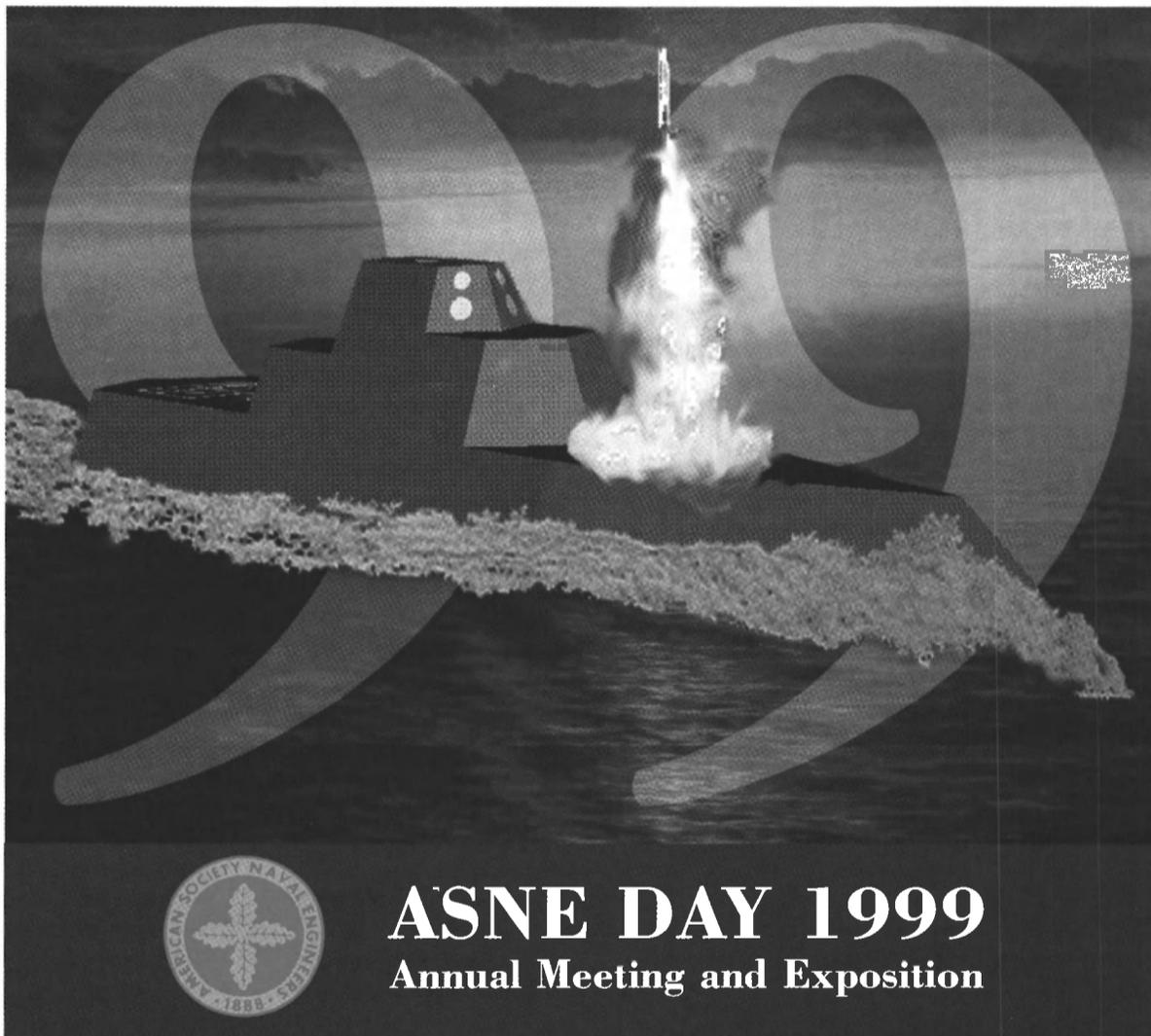
## Niche Business

Astilleros Espanoles (AESAs) reaffirmed its pre-eminent European standing in shuttle tanker build and conver-



Halter-Bazan Alhambra Class Ferry.

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# Spanish Maritime Report

sion technology with the recent re-delivery of a crude carrier adapted for a North Sea offshore role as the 150,000-dwt Catherine Knutsen.

Undertaken on behalf of Haugesund-based Knutsen OAS Shipping, a prominent customer of Spanish yards in the 1990s, the project entailed the extensive rebuild of the former deepsea oil tanker Tanana for a new role lifting crude from offshore fields to terminals on the North Sea rim under charter to Norwegian energy group Statoil.

The work undertaken at AESA's Cadiz conversion and repair yard included the installation of a bow loading system, remodeling of the shaft line and fitting of a new, controllable pitch propeller. So as to meet the standards set by Dynpos Class 1 requirements, the tanker has been equipped with station-keeping

capabilities encompassing a dynamic positioning system (DPS) enhanced with a hydroacoustic positioning radar (HPR) system, and including two bow and two stern thrusters and two dedicated gensets.

Also entailing the fitting of an Artemis system on the bridge and some 550 tons of new steel, the contract was the third shuttle tanker conversion carried out for the Norwegian owner at Cadiz. The earlier jobs had entailed the Tove Knutsen in 1992 and the Dicto Knutsen in 1994, the latter having been the first tanker worldwide to be installed with a submerged turret loading (STL) system.

Significantly, both AESA and Knutsen have provided an input to ARCO Marine in connection with the U.S. company's bold program for a mold-breaking series of tankers to serve continuous-cycle

shipments of Alaskan North Slope crude to west coast refineries. Certain parallels were perceived between the demands of the long-term North American coastwise shipping requirement and the intensive nature of North Sea shuttle tanker operations, since the latter demands the closest attention to factors of ship maneuverability, system redundancy and environmental protection.

## Return To Private Sector

After forming part of state-controlled AESA for nearly a quarter of a century, Astilleros Barreras returned to the private domain in June 1998 with the completion of the sale to a group of Spanish businessmen in conjunction with the yard's management. The move has put added momentum behind the commercial endeavors of the Vigo yard, which has a solid reputation in the field of specialized tonnage.

Production through 1998 has confirmed both the versatility and contractual performance of the company, located in the magnificent natural harbor of Vigo, in Galicia, the country's northwest region. Output during that milestone year has comprised three widely differing newbuilds, in the shape of a 977-TEU containership for a Madrid shipowner, an 8,300-dwt chemtanker to French account, and a 12,300-gt train ferry for New Zealand.

The 13,300-dwt boxship Fernando M. Perez, commissioned during the six-month spell between government approval being granted for the sale of the yard and the legal change of ownership, was phased into service with Naviera del Odriel, one of the new shareholders in the Barreras enterprise. Another longstanding client of the shipbuilder, the Albacora Group, is one of the participants in the new owning consortium, along with locally-based industrial firm Garofa Costas.

The participation of the existing shipyard management in the ownership structure has better ensured continuity and motivation, as demonstrated by positive results to date against a backcloth of a difficult shipbuilding market. The reconstitution within the private sector was also made with the organization in good shape in terms of its operating procedures as well as workload, since the hand-over of the Fernando M Perez had been accompanied by the award to the yard of ISO 14001 certification, issued through Lloyd's Register Quality Assurance (LRQA).

The second completion in 1998 was the 9,800-cu m oil and chemical tanker Alexander, built to meet the trading requirements of Marseilles-based

Fouquet-Sacop Maritime. Strengthened to Ice Class C stipulations laid down by Bureau Veritas, and equipped for IMO Class 2 chemical cargoes, Alexander has been design for rapid and efficient turnarounds through the adoption of a 290-cu m per hour cargo pump in each of the 10 main cargo spaces.

The subsequent delivery of an innovative train/RoRo ferry for New Zealand's Tranz Rail provided a first-rate example of the shipbuilding skills available in the Galicia region. In the face of an increasingly wide-ranging competition from yards in the Far East, it also confirmed the capacity of Western Europe's maritime sector to design, engineer and produce newbuild solutions tailored to specific needs.

The 1999 delivery program re-emphasizes the propensity of the Vigo yard for higher-value vessel types and for a diversified production output, since it encompasses another tuna fishing newbuild of record-breaking size and capacity, a pair of 18,800-gt vehicle carriers for Lineas Suardiaz, and the conversion of a RoRo for subsea work. Ordered by the Albacora Group, the tuna catcher approaching completion at the time of writing is the latest symbol of the yard's prowess in a highly specialized category, in which it has broken new bounds through the 1990s with fast, sleek new ships over 328 ft. (100 m) length overall. The latest vessel is 380.5 ft. (116 m) long, and her 5,850-kW main engine of Wartsila 8R46 type offers a speed of 19 knots.

Given several export orders, 'super seiners' from Barreras in recent years have bolstered French as well as Spanish catching capacity. The yard is understood to have contracts in hand for a further three tuna catchers, to Spanish account. The private sectors' far-reaching expertise in fishing vessels is also demonstrated by a project at another Vigo yard for a 466 ft. (142 m) freezer stern trawler, one of the largest in the world. The "supertrawler" ordered by a Dutch shipowner from Construcciones Navales P Freire is of 9,000-dwt, and has been designed to catch and load the equivalent of 5,200 pallets of pelagic species of fish.

## Chemical Tanker Production

As a contributor to Spanish success in niche shipbuilding markets, Naval Gijon's distinctly export-based workload takes its chemical tanker construction program through 2000. The Gijon company holds great store by its organization, processes and carefully honed

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yard skills in attracting and retaining specialist clients from among the North European shipowning communities.

For instance, it can offer a 17-month contract build period for a 19,000-dwt chemical carrier embodying 34 tanks in stainless steel, and attributes one factor in its delivery competitiveness to the extent to which it has developed pre-outfitting practice. In terms of medium-sized shipbuilding firms, Naval Gijon's building dock rates as one of the largest in Europe, with main dimensions of 613.5 ft. x 115 ft. (187 m x 35 m) conferring the scope for ships up to 45,000-dwt. Equipment includes, notably, portable workshops for stainless steel sections and orbital welding facilities, plus a twin-headed plasma cutting machine and plate, pipe and bar benders. It has 120 welders certified for stainless as well as carbon steel welding, and holds ISO 9001 certification for the quality of its production processes.

More recent deliveries such as the 19,000-dwt chemtankers Kristin Knutsen and Stolt Kent for Norwegian and British owners, respectively, and the current 35,000-dwt coated chemical/products carrier newbuilds for Knutsen OAS Shipping testify to the standing it has attained in the specialized tanker market. But the adaptability of its systems and its track record in a host of other areas including RoRos, car carriers, containerships, reefer vessels, fish factory ships and fishing vessels, are pointers to the areas it will pursue in accordance with market needs and conditions.

Naval Gijon was created in 1985 through the coupling of two private yards, Maritima del Musel and Duro Felguera, both of which had a long industrial tradition within the Asturias region. The company is owned by Grupo Orejas through its 100 percent subsidiary Maritima del Musel.

The 35,000-dwt tanker class in hand at Gijon has been designed for IMO Class 2 chemical cargoes and oil products in 12 coated tanks, for an overall shipment capability of 42,400-cu m. Each of the cargo spaces will be served by a 600-cu m/hr deepwell pump, and the double-shell spaces bounding the revenue section together with the peaks will provide a water ballast capacity of around 18,000-cu m.

Two-stroke MAN B&W machinery of the 6S50MC type, yielding 11,640 bhp, has been specified against a service speed expectation of 15 knots, in a project which entails Germanischer Lloyd class participation. In addition, Naval Gijon's program includes a 22,000-dwt, all-stainless steel chemtanker offering a 4,000-cu m cargo intake in a highly compartmentalized configuration comprising 24 tanks.

## Trans Atlantic Alliances

Having earlier entered into a co-operation agreement involving its engine building division Bazan Motores and Caterpillar of the U.S., Empresa Nacional Bazan has fostered a further transatlantic alliance through the collaboration deal with Halter Marine in the fast ferry domain.

The link-up with Halter Marine, one

of the rising stars among the world constellation of small to medium-size vessel building specialists, promises continuity for the Spanish company in commercial high-speed vessel technology, drawing on the experience accumulated by its San Fernando yard in particular.

The venture puts added momentum behind Halter's drive to develop its activities and increase its market reach in the fast ferry sector. Already, the

Halter-led joint venture is ready to lay down a 410-ft aluminum, monohull RoRo ferry for a European operator, based on the 40-knot Alhambra type conceived and built by Bazan. The Spanish company will provide design drawings, production planning and experience, complementing Halter's supply of management, production labor and a dedicated facility at Gulfport.

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- 13218 Martha's Vineyard to Block Island
- 400 The West Indies
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# Advanced Aluminum Extrusions Offered

Williamsburg Fabricators has recently made available Friction Stir Welded aluminum in the U.S. By joining forces with one of the world's leading producers of Friction Stir Welded products — Marine Aluminum of Haugesund, Norway — the company is able to offer this technology in America. Production is currently scheduled to begin later this year.

Marine Aluminum has supplied Friction Stir Welded material since 1997 for applications such as high speed ferry boats, rail transportation, offshore drilling platforms, helicopter decks and other industrial products. The product offers some unique properties and advantages, including no distortion or deflection, high productivity, reliable and uniform high weld quality, little pre- or post-production work, plus the higher strength of the weld.

According to the company, these advantages conspire to make it possible to reduce material thickness, and therefore the weight of the final prod-

uct by up to 10 to 20 percent. For marine applications, the advantages of lower weight with similar strength are obvious, as less weight equals more favorable fuel consumption, and can also lead to a more cost effective powering solution.

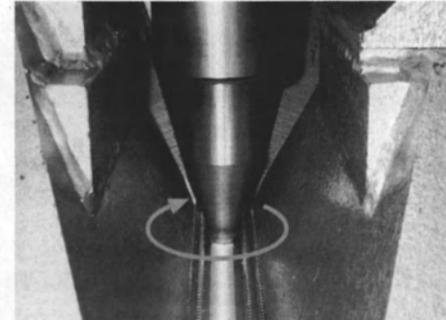
Williamsburg Fabricators will target the high speed ferry boat market, as well as the markets for railroad cars, truck trailers, shipping containers and other products that would benefit from lower weight with no sacrifice in strength. Although the company's primary capability is providing aluminum welding services of components for manufacturers of equipment using Friction Stir Welding, they will also offer design assistance for aluminum extrusions, anodizing, coating and modular assembly.

The project also includes the vast technical expertise and experience of ESAB. Aluminum is normally welded using MIG, TIG, plasma or manual welding with coated electrodes, and ESAB is a big manufacturer of

machines and consumables for these processes. ESAB has now enlarged the product program with machines for the new welding method, Friction Stir Welding, which was developed and patented by the U.K.'s TWI.

The FSW method is based on the principle of obtaining sufficiently high temperature to forge two aluminum components, using a rotating tool which moves along the joint. Using the FSW method, components are joined together without increasing the temperature above the melting point. It is reportedly ideal for joining straight profiles from 1.6 mm to 30 mm thick. When welding materials of more than 15 mm thickness, the welding is carried out from both sides. Maximum thickness is approximately 30 mm with 100 percent penetration. The FSW-method has been approved by DNV, and Marine Aluminum has been issued the corresponding certificate covering the welding machine and the use of the welding method.

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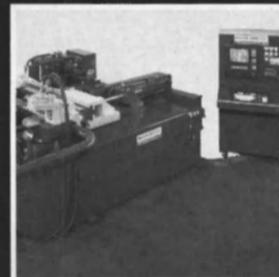
### Advantages of FSW Process

- High consistency in weld quality.
- Shield gas not required.
- Welding consumables not required.
- Better strength in the heat affected zone, which can make it possible to reduce material dimensions and consequently the weight of the final product.
- Plane and smooth surface free of distortion. Post treatment and straightening of panels is not needed.
- Higher tolerance requirements satisfied than with other methods.

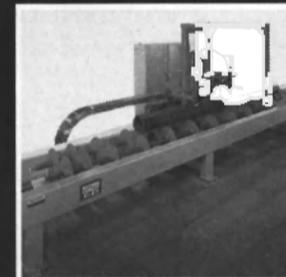
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# Vessel I.D. System Aids Vessel Safety

(Continued from page 50)

along its coast. Finland will follow with its own network of base stations before the end of 2001. Similarly, the Maritime Administrations of Finland and Sweden have encouraged the largest shipowners to invest in AIS equipment.

As the results are so successful today, the two countries are working to have the International Telecommunication Union (ITU) standard accepted by IMO as a compulsory requirement within the SOLAS convention. It should take effect in 2002 for cargo vessels and passenger vessels over 300 grt.

Interest in and work in AIS has intensified just in the past eight months, as ITU announced the new standards for AIS. The AIS technology used in this project is based originally on the work of a Swedish manufacturer, GP&C, which worked with VTT in Finland.

## The System

The system requires a VHF channel of its own to operate, and ITU has already decided to allocate two VHF channels worldwide to AIS applications. As a supplement, some countries evidently plan to use Inmarsat for data transmission.

Although an AIS set can be configured specially as a base station or a mobile station, data communication is totally independent of an onshore base station network. A data link is set up immediately between two or more AIS devices once they are within radio range of each other, whether ship-to-ship or ship-to-shore. This facilitates identification on the open ocean reportedly as easily as within range of an onshore base station. The technology that permits this self-organizing network is known as SOTDMA, or Self-Organized Time Division

## Multiple Access.

Three companies currently manufacture AIS equipment. The project underway in Finland uses the R3 AIS by Swedish manufacturer GP&C. The instrument consists of a GPS receiver, processor components and a VHF radio.

The Finnish Maritime Administration, together with VTT Manufacturing Technology, has taken part in the EU-funded Poseidon project, within the

framework of which a number of AIS sets have been installed and type of services based on the system have been developed.

The system was tested onboard the passenger ferries Viking Mariella and Silja Serenade, as well as onboard some FMA service ferries.

Until final international standards are agreed, it is impossible to accurately list all possibilities for the system.

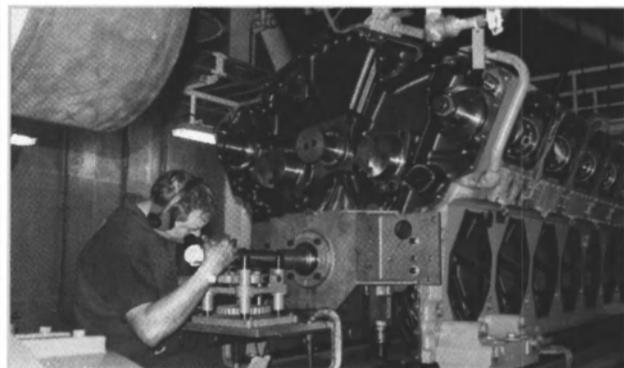
## Thrane & Thrane Offers New Local GMDSS Printer

The new TT-3042D Remote Alarm/Printer from Thrane & Thrane is approved for use as a local printer in a GMDSS system. Using the compact unit as a local printer offers the ability to reduce space used by similar equipment. Also, up to eight remote alarms can be connected to the same transceiver, one configured as local printer, the remainder as remote.



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## Weeks and T.L. James Join Forces In Gulf

In September 1998, Weeks Marine, Inc. added the Gulf Coast operations of T.L. James to its dredging division. The Gulf Coast operations will continue to be managed by the former T.L. James staff operating out of its Kenner, La. office. The combination of Weeks Marine's East Coast experience with

T.L. James' experience in the maintenance dredging market in the Gulf Coast aims to form a more complete organization in terms of experience, flexibility and service.

## ICCL Appoints Technical Operations Director

**Stanford W. Deno** has been named the new director of technical operations

for the International Council of Cruise Lines (ICCL), the trade organization representing the North American cruise industry. Mr. Deno will assist in the coordination of ICCL Technical Committee matters, including interface with U.S. regulatory agencies and implementation of industry objectives regarding the International Maritime Organization (IMO) and other safety-related matters.

## Jered Industries Named Exclusive Representatives

Jered Industries and ACH Engineering have concluded an exclusive representation agreement under which Jered Industries will provide marketing, manufacturing and logistic support for ACH Engineering products for the U.S., Canada, Mexico and the Caribbean. These products include various vessel stabilization systems, undersea energy and telecommunication cable handling equipment, radar cross section masks, and special handling equipment for mine sweeping and sonar systems. Jered Industries is an international manufacturer of marine and naval deck machinery and systems.

Circle 1 on Reader Service Card

## SEA Inc. Appoints Sales Manager

SEA Inc. has appointed **Tom Thorsvig** as Marine International Sales Manager. He will provide support to existing SEA and Datamarine international dealers, and work to develop new markets worldwide. Most recently, Mr. Thorsvig was involved with commercial and recreational applications of marine communications and navigation equipment at Northern Marine Electronics in Seattle, Wash.

Circle 4 on Reader Service Card

## Bath Iron Works Signs Agreement With Battelle

Bath Iron Works (BIW) and Battelle signed a memorandum of understanding (MOU) in January which established a partnership to pursue innovative technologies for ongoing and future U.S. Navy programs. The MOU focuses on combining BIW's ship design and construction expertise with the extensive research, development and testing resources of Battelle. The result aims to be the introduction of innovative technologies into the fleet to improve operational readiness and sustainment well into the future while reducing the total ownership costs of fleet assets and supporting infrastructure.

Circle 5 on Reader Service Card

## Major Fleet Expansion For Columbia Coastal

The first of four new container barges was added to Columbia Coastal Transport's fleet in late January. Columbia New York (formerly Columbia Trader) was refurbished at Detyens Shipyard and configured to allow transport of both 20 ft. and 40 ft. containers with a capacity of 590 TEU or 295 FEU. The barge will call on a weekly basis on the ports of Charleston, Savannah and Miami. Columbia New



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### Coating Success Depends on Salt Removal

CHLOR\*RID is a liquid, available in a concentrate or ready to use DTS (Direct To Surface) formulation, that is commonly mixed with water to remove chlorides left from marine atmospheres. CHLOR\*RID is all organic, non-hazardous, biodegradable and has no VOC's.

Testing by the Oregon DOT has shown that a water wash alone removes about 20-25% of the chlorides from surfaces, while adding CHLOR\*RID to the same water wash removes 90 to 95%, thereby reducing corrosion.

The product is typically used as part of surface preparation during painting/recoating operations. CHLOR\*RID DTS is a ready-to-use version of the product. Simply wet the surface to be cleaned thoroughly with DTS and rinse it off with water.

Also from CHLOR\*RID Int., Inc. is CHLOR\*TEST, the latest state-of-the-art method of testing for chloride levels that is extremely user friendly and more accurate.

## CHLOR\*RID®

will not interfere with the adhesion of protective coatings.

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US Navy specifications require chlorides to be 3 micrograms/cm<sup>2</sup> or less for immersion service. Chlorides in excess of that level have caused premature coating failure.

### OCEAN CITY RESEARCH Avg. 6 Panels Each

	Results µg/cm <sup>2</sup>
Hand Wash	
Control	45
Water Wash	11
<b>CHLOR*RID</b>	<b>6</b>

### KTA-TATOR 30 Test Panels

	Results µg/cm <sup>2</sup>
3,000 PSI Pressure Wash	
Control	Discarded
Water Wash	7 ± 3
<b>CHLOR*RID</b>	<b>2.6 ± .06</b>

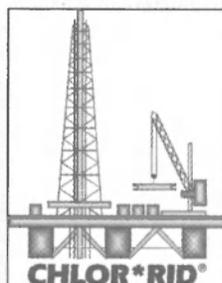
### JET PROPULSION LAB\* Avg. 6 Panels

	Results µg/cm <sup>2</sup>
3,000 PSI Pressure Wash	
Control	4.60
Water Wash	4.38
<b>CHLOR*RID</b>	<b>2.82</b>

### CAL TRANS Field Test Results

3,000+ PSI with 15° Flat Fan Nozzle	Before µg/cm <sup>2</sup>	After µg/cm <sup>2</sup>	Reduction Percent
Water Wash	100-110	80	20%
Water Wash	5-6	5	0%
<b>CHLOR*RID 1:100</b>	<b>150</b>	<b>6</b>	<b>97%</b>

Reduce costly coating failures and corrosion rates. For cleaner surfaces and increased coating adhesion, use CHLOR\*RID®.



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York will be followed by Columbia Newark (670 TEU), Columbia Philadelphia (480 TEU) and Columbia Wilmington (480 TEU). The four new barges will bring the company's fleet total up to 10 barges, and represent a 75 percent increase in total container capacity.

### Willms Awarded Honor

In a presentation during the January

christening of the tug Leader, **Maynard Willms**, vice president of the Crowley subsidiary Vessel Management Services (VMS) was awarded Crowley Maritime Corporation's highest honor, the



**Tom Crowley Jr.** (left) presents **Maynard Willms** with the Thomas Crowley Trophy.

Thomas Crowley Trophy, by **Tom Crowley Jr.**, chairman, president and CEO of Crowley Maritime Corp.

Mr. Willms was selected for his outstanding work in developing vessels in the Crowley fleet, including the newest cycloidal propulsion tractor tugs. He began his 38 year career with Crowley as an engineer aboard Crowley tugs, rising through the ranks to his present position as VP of VMS. The Thomas

Crowley Trophy is awarded annually to an employee who displays outstanding performance.

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### Electronic Marine Systems Acquires SMC Assets

Electronic Marine Systems, Inc. (EMS) of Rahway, N.J. has acquired the assets of Sarasota Measurements and Controls (SMC) of Sarasota, Fla., a leading manufacturer of land-based liquid storage tank gauging systems. SMC has more than 6,000 tanks installed worldwide. The new division of EMS will be known as EMS.SARASOTA. **Rolland Piccone**, president of SMC, will assume the position of general manager and will be responsible for all land-based application engineering and sales.

Circle 102 on Reader Service Card

### International Frigate Market Subject Of MOU

Bath Iron Works (BIW), Espresa Nacional Bazan (E.N. Bazan) of Spain, and Lockheed Martin Government Electronic Systems have signed a memorandum of understanding to pursue opportunities for the construction and integration of frigate-sized ships worldwide. The MOU provides the foundation for the three companies to work together to analyze the suitability of E.N. Bazan's frigate design for the international marketplace and to jointly pursue ship construction opportunities. E.N. Bazan's frigate design is represented by the Spanish Navy's newest class of surface combatant, the F-100 AEGIS Frigate.

The F-100 incorporates Government Electric Systems' combat system and SPY ID radar. BIW has also signed an agreement with E.N. Bazan to provide technical support to the F-100 frigate program.

### Q-Mar Partners With Socomar

Q-Mar, specialist in the development of ECDIS for the naval and hydrographic sectors, has formed a partnership with Socomar Intl. to integrate their industrial and commercial activities.

The management of both firms is under the direction of president and CEO, **J.L. Paul Dionne**. Socomar Intl. is a Canadian provider of turnkey management information and navigation systems for the marine geomatics and environment sectors. The company specializes in sensors and integrated systems, vessel traffic systems, geo-spatial data infrastructure (GSDI) systems. Q-Mar has also signed a dealer license agreement with Nautical Data International (NDI) to license and distribute electronic charts from the Canadian Hydrographic Service.

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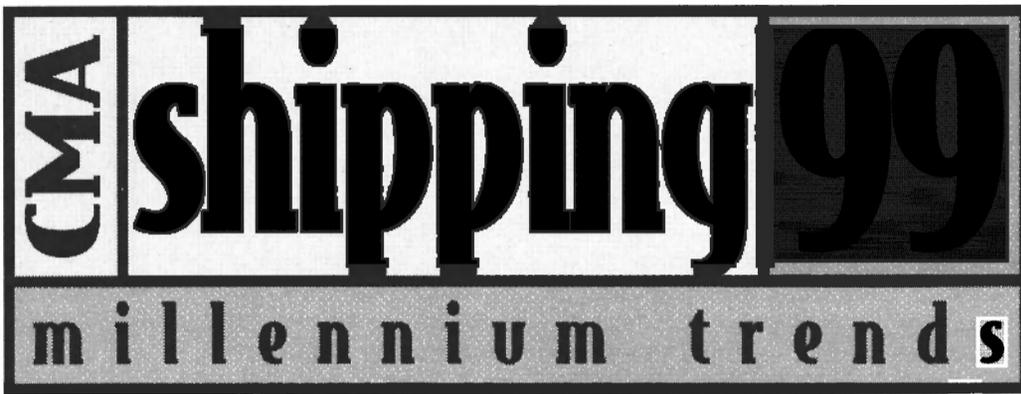
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# Training in the Virtual World

(Continued from page 30)

exactly the functional adequacy which is in question, as when modeling, say, the functions (features) of the hydrodynamic environment we are using facilities absolutely different from those in nature.

The description of a virtual world in the terms of a function (feature) is sufficient for rendering credibility to this world, as the operational world image of a human being consists primarily of a set of features and functions of this world's objects.

What is the difference between bad and good training tools? Only that the simulation environment created

with bad tools does not contain a full set of features and functions required for the formation of professionally essential skills. For example, a trainee may have perfect skills of controlling the vessel which supports spatial evolutions on 3DOF level. Would this be sufficient to allow him to stand at the real ship's helm? No. And for one reason only: the virtual mediator represented by the model forms a false image of the world, a false operational structure of behavior in this world, and, as a consequence, inadequate professional skills.

Another example follows of how seemingly insignificant details may have a considerable effect on the quality of professional decision making. The modern bridge simulators are known to contain a dynamic visualization of the environment which the navigator

can observe from the bridge of the ship. In situations connected with maneuvers in congested waters or mooring, the navigator receives a considerable amount of information not only from navigation aids, but also by taking record of the characteristic features and changes of the surroundings.

Simplified visualization patterns draw no difference between the seasonal changes in the same environment, so, for example, the ship is always berthed in a certain abstract season. But in the northern latitudes these operations are quite often performed in floating ice conditions, which is a vital factor for a smaller vessel.

For the navigator to form a decision making structure adequate to the situation, in the case in question the ice floes are required to be shown as dynamic objects with certain dynamic features, while their visual image should generate navigator's associations with a potential danger.

One could give quite a few examples of when the simulation's expressive features are significant in training, and there will hardly be any disputes about the thesis that the level of losses should be minimized in the actual world - virtual world- ideal world information transmission channel.

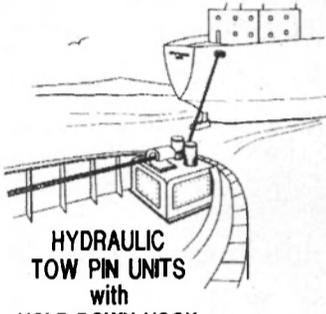
Another matter is how to achieve this. Which technical and software facilities can be offered by modern technology for generating an illusion of reality within man? It is clear that one can believe in practically everything, and the history of religion provides a good proof for it. But it is rather difficult to plant a belief in a rational human being armed with the logic of professional activity and with a considerable empirical experience of assimilating to the actual world. Man is inherently a carrier of reasonable criticism which is one of the principal mechanisms for retaining internal stability. This is a filter which does not allow false signals to pass through. This barrier cannot be overcome by anything which is not recognizable and which is not accepted by a rational human being as a fact which has a right to exist in the actual world. The simulator developers are, therefore, faced with an extremely complicated problem of designing, on the one hand, a world whose objects are endowed with the same behavioral properties as real world objects, performing the same functions as the actual objects, and, on the other hand, a world which would actuate in a human being the same psychological structures of behavior (including motivational), which a normal person displays in actual life.

To date, the problem of technological facilities for the development and building of simulators can be considered to be close to its solution. Any computer catalogue will offer long lists of various graphic boards and accelerators, acoustic support facilities, sensors and systems for processing the tactile and vasomotor information. Generations of software developers have accumulated gigabytes of code in the form of different libraries.

While formerly the availability of these facilities was rather limited due to their extremely high price, today this kind of technology can be afforded even by organizations with a modest budget. And what becomes the determining factor, indeed, is something on the verge of technology and art, something, which via the technological design makes man live several hours of his life on the navigation bridge of a virtual ship and never be sorry about it.

by Alex Koukharenko, Transas Vice-president

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

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12310 Northwinder Row, Bayonet Point, Fla. 34667
- COMPOUNDS**  
ITW Philadelphia Resins, 130 Commerce Dr, Montgomeryville, PA 18936
- COMPRESSOR PARTS**  
CMP Corporation, P.O. Box 15199, Oklahoma City, OK 73155
- COMPUTER LOFTING**  
Barataria Lofting Co., Inc., 1616 Barataria Blvd., Ste. 4, Marrero, LA 70072
- COMPUTER / COMPUTER SOFTWARE**  
Autoshop Systems Corp., #403, 611 Alexander St., Vancouver, BC, CANADA V6A1E  
Chand Corporation, 157 Hwy 654, Mathews, LA 70375  
Coastal Oceanographics, Inc., 11-G Old Indian Trail, Middlefield, CT 06455  
Sener, C/Severo Ochoa, 4 Parque Tecnologico de Madrid, 28760 Tres Cantos - Madrid SPAIN  
Intecolor Corp., 2150 Boggs Rd., Deluth GA 30096  
Lloyd's Register, 100 Leadenhall St., London, England EC3A 3BP  
Ship Motion Associates, 10 Danforth St., Portland, ME 04101  
Azonix Corp., 900 Middlesex Tpke., Billerica, MA 01821  
Proteus Engineering, 301 Pier One Rd., Stevensville, MD 21666
- CONDENSERS/SEPARATORS**  
Beard Industries Inc., P.O. Box 31115, Shreveport LA 71130
- CONSTRUCTION MATERIALS**  
Plastic Piling Inc., 1485 South Willow Ave., Rialto, CA 92376
- CONSULTANTS**  
Hornblower Marine, Pier 3 Ferryboat Santa Rosa, San Francisco, CA 64111
- CONSOLE - QMDSS**  
Mackay Communications, 2721 Discovery Dr., Raleigh, N.C. 27616-1851
- CONTROL SYSTEM - Monitoring/Steering**  
Engine Monitor, Inc., 179 Hickory Ave. Harahan, LA 70123  
GEC ALSTHOM Diesels Inc., 10801 Kempwood Drive, Suite 1 Houston, TX 77043-1412  
Ian-Conrad Bergan, 3409 Gulf Breeze Pkwy, Gulf Breeze, FL 32561  
MMC International, 60 Inip Dr, Inwood NY 11096  
Robertson Marine Systems, 3000 Kingman St., Suite 207, Metairie, LA 70006  
Scientific Marine Services, Inc., 101 State Pl., Suite F, Escondido, CA 92029
- Kobelt Mfg Co., Ltd., 8238-129 St, Surrey, B.C. V3W0A6  
Stork-Kwant BV, P.O.B. 23, 8600 AA Sneek, Netherlands  
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
- CONVERSIONS & REPAIRS**  
Vancouver Shipyards, 50 Pemberton Ave., N. Vancouver, B.C. CANADA V7P 2R2
- COOLERS/FREEZERS**  
Western Engineers, 2112 SE 8th Ave., Portland, OR 97214
- COUPLINGS**  
Mapeco Products, 91 Willenbrock Rd. Unit B, Oxford, CT 06478  
Centa Corp., 8185 Cass Ave., Darien, IL 60561  
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 Int'l, 60 Inip Drive, Inwood, NY 11096  
Renold Hi-Tec, 512 W. Crescentville Rd, Cincinnati, OH 45246
- CRANE-HOIST-DERRICK-WHIRLIES**  
Bisso Marine Co. P.O. Box 4113, New Orleans, LA 70178  
Holly Hoist Corp., P.O. Box 86, St. Clair Shores, MI 48080-0086  
Edgewater Machine & Fabricators, P.O. Box 358, Edgewater, FL 32132-0358  
Marine Travelift, Inc., 49 E. Yew St., Sturgeon Bay, WI 54235  
McElroy Machine & Mfg Co., Inc., P.O. Box 4454, Biloxi MS 39535-4454  
New England Trawler Equipment Co., 291 Eastern Avenue, Chelsea, MA 02150  
Liebherr-Werk Nenzing GMBH, A-6710 Nenzing/Austria, Tschalenga 3, P.O. Box 10  
Xtek, Inc., 11451 Reading Road, Cincinnati, OH 45241
- CRANKSHAFT DEFLECTION ANALYZER**  
FCS, Inc., 22 Main St., Centerbrook, CT 06409
- CRANKSHAFT REPAIR**  
In-Place Machining, 1929 North Buffum St., Milwaukee, WI 53212
- CUSTOM CLOSURES**  
Waltz & Krenzer, 91 Willenbrock Rd., Oxford, CT 06478
- CYLINDER LINERS**  
Silsan A.S., P.O. Box 127, TR-01210 Adana, Turkey
- DAVIT SYSTEMS**  
Holly Hoist Corp., P.O. Box 86, St. Clair Shores, MI 48080-0086  
Wein Lambie N.A. Inc., 18 Ridgecrest Drive, Bridgewater Nova Scotia, Canada B4V 3 V8
- DECK MACHINERY - Cargo Handling Equipment**  
Lake Shore Inc., P.O. Box 809, Iron Mountain, MI 49801, 1150 Markey Machinery Co., Inc., P.O. Box 24788, Seattle, WA 98124-0788  
McElroy Machine & Mfg Co., Inc., P.O. Box 4454, Biloxi, MS 39535-4454  
Skookum, Inc., P.O. Box 280, Hubbard, OR 97032  
Leenstra Machine, P.O. Box 9, Drachten, Netherlands, 9200AA Intercontinental Engineering, P.O. Box 9055, Kansas City, MO 64168  
Edgewater Machine & Fabricators, P.O. Box 358, Edgewater, FL 32132-0358  
New England Trawler Equipment Co., 291 Eastern Avenue, Chelsea, MA 02150  
Pusnes, PO Box 102, N-4818, Faerвик, NORWAY  
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
- DEHUMIDIFIERS**  
Dry Air Technologies, 313 N. Oak St., Burlington, WA 98233  
Munters Corp., 79 Monroe St., Amesbury, MA 01913
- DESALINATION - REVERSE OSMOSIS**  
Lifestream Watersystems, Inc., P.O. Box 634, Huntington Beach, CA 92647  
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**  
FCS, Inc., 22 Main Street, Centerbrook, CT 06409  
Icon Research, 8 Market Street, Ellesmere, Shropshire SY12 0AN, England  
Hermont Marine Inc., 3528 Griffith St. Laurent, Quebec Canada  
**DIESEL ENGINE - Spare Parts & Repair**  
Scardana Americas Bkg., 502 Empire St., Greefield 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  
Castoldi S.p.A., Viale Mazzini, 161, 20081, Abbiategrasso, ITALY  
Cummins Engine Co., 4500 Leeds Ave., Ste. 301, Charleston, SC 29405-8521  
Cummins Mid-South, Inc., 110 E. Airline Highway, Kenner, LA 70062  
John Deere, John Deere Rd., Moline, IL 61265  
Deutz Canada Inc., 4420 Garand St., Montreal, Que. H4R 2A3  
GEC ALSTHOM Diesels Inc., 10801 Kempwood Drive, Suite 1, Houston TX 77043-1412  
MAN B&W Diesel AG, Stadtbachstrasse 1, D-86153 Augsburg 1, GERMANY  
Centofanti Marine Systems, Inc., P.O. Box 660, West Elizabeth, PA 15088-0660  
MAN B&W Diesel A/S, Tegholmsgade 41, DK-2450 Copenhagen SV, DENMARK  
MAN B&W Diesel, 17 State St., New York, NY 10004  
Motor-Service AB, Box 2115, S-144 04 Ronninge, SWEDEN  
Motor Service-Hugo Stamp, 3190 S.W. 4th Ave., Ft. Lauderdale, FL 33315  
Fluid Mechanics Inc., 4521 W. 160th St., Cleveland OH 44135  
Paxman Diesels, P.O. Box 8, Paxman Works, Colchester, Essex, CO1 2HW, ENGLAND  
Ustefin Bergen AS, PO Box 924, N5002 Bergen, NORWAY  
Wartsila Diesel, 201 Defense Highway, Annapolis, MD 21401  
Goltens, 160 Van Brunt St., Brooklyn, NY 11231
- CMB Cummins Engine Co., 500 Jackson St., Comunbus, IN 47202  
FM / Alco 701 Lawton Ave., Beloit, WI 53511  
Goltens, 160 Van Brunt St., Brooklyn, NY 11231  
Kiene Diesel, 325 South Fairbanks, Addison, IL 60101  
Deutz Canada Inc., 4420 Garand St., Montreal, Que. H4R 2A3  
H.P. International, Inc., 3812 W. Linebaugh Ave., Tampa, FL 33624  
Powerhouse Diesel, 5505 Broadway, American Canyon, CA 94589
- DIESEL FUEL DECONTAMINATION**  
Fuel Dynamics, 707 Mullet Dr. #110, Cape Canaveral, FL 32920
- DIGITAL TORQUE METER SYSTEM**  
Instruments Computers & Controls, 70 South Bow Rd, Hooksett, N.H. 03106
- DIVING & SALVAGE**  
Coast Diving Services, Inc. 793 B Mira Flores, San Pedro CA 90733  
Bisso Marine Co. P.O. Box 4113, New Orleans, LA 70178  
H.J. Merrhue, P.O. Box 23123, New Orleans LA 70183  
JW Fishers, 65 Anthony St., Berkley, MA 02779  
South Texas Underwater Divers, 2921 16th Ave. North, Texas City, Texas 77590  
Muldoon Marine Services, Inc., P.O. Box 3221, Terminal Island, CA 90731
- DOCK BOXES**  
Betterway Products, 70891 County Rd. 23, New Paris, IN 46553
- DOCK FENDERING SYSTEMS**  
Seaward Int'l, P.O. Box 98, Clear Brook, VA 22624  
Plastic Piling Inc., 1485 South Willow Ave., Rialto, CA 92376  
Urethane Products Corp., 17007 South Broadway, Gardena, CA 90248
- DOORS - MARINE & INDUSTRIAL**  
Branton Ind., 1101 Edwards Ave., Jefferson, LA 70181  
Mapeco, Inc., 90 Forest Ave., Locust Valley, NY 11560  
Walz & Krenzer, 91 Willenbrock Rd., Unit B4, Oxford CT 06478  
Marine Accommodations, Inc., 3830 Williamsburg Park Blvd., Building 7, Jacksonville FL 32257  
Railway Specialties Corp., 2979 State Rd., P.O. Box 29, Bristol, PA 19007  
Beclawat Mfg. Inc., 130 Adam St., Belleville, Ontario, Canada K8N 2X9
- DRY DOCKS-Design**  
Conrad Industries, 1501 Front Street, P.O. Box 790, Morgan City, LA 70381  
Crandall Dry Dock Engineers Inc., P.O. Box 505804, Chelsea, MA 02150  
Heger Dry Dock Engineers, Inc., P.O.B. 6605, Holliston, MA 01746
- DOUBLE HULL TECHNOLOGY**  
Maritrans, 1818 Market St., Philadelphia, PA 19103
- EDUCTORS**  
Vita Motivator, 566 Parker St., Newark, NJ 07104
- ELECTRICAL EQUIPMENT**  
Baylor Co., 500 Industrial Blvd., Sugarland, TX 77478  
L. F. Gaubert & Co., Inc., P. O. Box 50500, New Orleans LA 70150  
MMC International, 60 Inip Dr, Inwood NY 11096  
Air Marine Systems, 2701 Sonic Dr., Virginia Beach, VA 23456  
Semco Marine Inc., 3721 SW 47th Ave., Ste 309, Ft. Lauderdale, FL 33314
- ELECTRICAL MOTOR DRIVES**  
Tech Power Controls, 10850 S. Wilcrest, Houston, TX 77099
- ELECTRONIC INFORMATION SUPPORT**  
Scandinavian Micro Systems, P.O. Box 155, N-1411, Kolbotn, NORWAY
- ELECTRONICS**  
Azonix Corp., 900 Middlesex Tpke, Billerica, MA 01821
- ELEVATORS**  
McElroy Machine, 1101 Lorraine Rd., Biloxi, MI 39535-4454
- EMPLOYMENT**  
Boat Crews, 1 Seine Court, Suite 309, New Orleans, LA 70114  
Marine Jobs, Inc., 800 Downtowner Blvd. Ste. 111, Mobile, AL 36609
- ENGINEERING SERVICES / MARINE ENQS**  
NKF Engineering, Inc., 4200 Wilson Blvd., Arlington, VA 22203  
Elliot Bay Design Group 5301 Shilshole Ave. N.W. Ste. 200, Seattle, WA 98107  
Scientific Marine Services, Inc., 101 State Pl., Suite F, Escondido, CA 92029
- ENGINE LUBRICATION SYSTEMS**  
Dow Corning Corp., P.O. Box 994, Midland, MI 48686-0994  
Engine Lubrication Systems, 64 State Rd., Paoli, PA 19301
- ENGINE ROOM LIGHTING/MONITORING & CONTROL SYSTEMS**  
Pauluhn Electric Mfg. Co., Inc. 1616 N. Main, P.O. Box 53, Pearlant, TX 77581  
Mackay Communications, 2721 Discovery Dr., Raleigh, N.C. 27616-1851  
Radio-Holland USA, 8943 Gulf Freeway, Houston, TX 77017
- EVACUATION SYSTEMS**  
DBC, 12351 Bridgeport Rd., Richmond, BC Canada
- EVAPORATORS**  
Alfa-Laval Separation, Inc., 955 Mearns 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
- EXPLOSIVELY BONDED METALS**  
Northwest Technical Industries, 2249 Diamond Point Rd., Sequim, WA 98382
- FAIRING COMPOUND**  
Philadelphia Resins, P.O.B. 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.B. 683, Carnegie, PA 15106
- FENDERING SYSTEMS/BOYS - Dock & Vessel**  
Plastic Piling Inc., 1485 South Willow Ave., Rialto, CA 92376  
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241  
Seaward International, Inc., Clearbrook Industrial Park, P.O. Box 98, Clearbrook, VA 22624  
Urethane Products, 17007 South Broadway, Gardena, CA 90248  
Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH 44062-0067

Viking Fender Co., 1160 State St., Perth Amboy, NJ 08861  
Ultra Poly, Inc., 2926 South Steele St., Tacoma, WA 98409  
Promar, 115 Industrial Blvd., Keameysville, W. VA 25430  
Schuyler Rubber Co., 16901 Woodred Rd., Woodinville, WA 98072  
Urethane Products Corp., 17007 South Broadway, Gardena, CA 90248

#### FIBERS

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

#### FILTERS/FILTER SYSTEMS

Kraissl Co., 299 Williams Avenue, Hackensack, NJ 07061  
Luber-Finer, Inc., 200 South 4th St., Albion, FL 62806-1313

#### FILM STABILIZERS

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

#### FIRE & SAFETY PRODUCTS

Nautical Safety Products, P.O. Box 590462, Houston, TX 77259  
IMSSCO, 2040 Harbor Island Dr., Suite 201A, San Diego, CA 92101  
Nautical Safety Products, P.O. Box 590462, Houston, TX 77259  
Insulations, Inc., Rt. 5, 12360 Leisure Road, Baton Rouge, LA 70807  
Unitor Ship Service Inc., 2375 West Esther Street, Long Beach, CA 90813  
Grinnell Fire Protection, 835 Sharon Drive, Westlake, OH 44145  
Grinnell, 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, Osaka555, Japan

#### FUEL CONSERVATION

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

#### FUEL DECONTAMINATION

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

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

#### GANGWAYS, LADDERS

Nautical Safety Products, P.O. Box 590462, Houston, TX 77259-0462  
SlipNot Safety Flooring, 2545 Beaufait St., Detroit, MI 48207  
Wooster Products Inc., 1000 Spruce St., P.O. Box 896, Wooster, OH 44691

#### GASKETS/CLEATS

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

#### GEARS & GEAR REPAIR

Haley Marine Gears International, Inc., 2600 N. Concord Belle Chasse, LA 70037  
Nico Marine Specialties, 39 Louisiana St., West Wago, LA 70094  
The Falk Corp., PO Box 492, Milwaukee, WI 53201-0492  
Marine Gears, P.O. Box 689, Greenville, MI 38702  
Centofanti Marine Systems, Inc., P.O. Box 660, West Elizabeth, PA 15088-0660  
Cincinnati Gear Co., 5657 Wooster Pike, Cincinnati, OH 45227

#### GENERATOR

Alaska Diesel, 4420 14th Ave., NW, Seattle, WA 98107  
Baylor Co., 500 Industrial Blvd., Sugarland, TX 77478  
Insuland Recycling B.V., Deccaweg 3, 1042 AT Amsterdam, NETHERLANDS

#### GNDSS

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  
Sea, Inc., 7030 220th S.W. Mt. Lake Terrace, WA 98043

#### HATCHES AND DOORS

Railway Specialties Corp., 2979 State Rd., P.O. Box 29, Bristol, PA 19007  
Freeman Marine Equipment, 28336 Hunter Creek Rd., Gold Beach, OR 97444

#### HEAT EXCHANGERS

Alfa-Laval Separation inc., 955 Meams Rd., Warminster, PA 18974  
Beard Industries Inc., P.O. Box 31115, Shreveport, LA 71130  
Computube - A Division of Brianna Heat Transfer, Ltd., 15-20 Coleshill Industrial Estate, Station Road, Coleshill, Birmingham B46 1UP UK  
Crane Heatex, 17 Grandview Ave., West Orange, NJ 07052  
Tanter, Inc., 1054 Claussen Rd., Augusta, GA 30907-3215  
Tanter, Inc. (Texas Div.) P.O. Box 2289, Wichita Falls, TX 76307

#### HEAT TRANSFER FLUID

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

#### HOISTS

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

#### HORN/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  
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 Inflatables Boats, 410 Oak St., Friendsville, MD 21531  
Ocean Technical Services Inc., 1140 Peters Rd., Harvey, LA 70058-1705

#### HYDRAULIC SYSTEM FLUSHING

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

#### HYDRAULIC TRAINING

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

#### INFLATABLES

Ocean Technical Services Inc., 1140 Peters Rd., Harvey, LA 70058-1705  
Zodiac of North America, P.O. Box 400, Thompson Creek Road, Stevensville, Sparks, MD 21152

#### INSULATION

Blohm & Voss Light Insulation, Barteis & Laders GmbH, Nordereibstrasse 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

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

#### INTERIORS

Custom Ship Interiors, Inc., P.O. Box 882, Solomons, MD 20688  
Hopeman Brothers, P.O. Box 820, 435 Essex Ave., Waynesboro, VA 22980  
Insulations, Inc., Rt. 5, 12360 Leisure Rd, Baton Rouge, LA 70807  
Jamestown Metal Marine Sales, Inc., 4710 NW Second Ave, Boca Raton, FL 33431  
Marine Accommodations, Inc., 3830 Williamsburg Park Blvd., Building 7, Jacksonville FL 32257  
Maritime Services Corp., 3457 Guignard Drive, Hood River, OR 97031  
James P. Colie & Associates, 2116 Sherman St., Hollywood, FL 33020

#### ISOLATORS

Lo-Rez Vibration Control, Ltd., 186 West 8th Ave., Vancouver, B.C. V6Y 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 Ind., 1101 Edwards Ave., Jefferson, LA 70181  
CustomShip Interiors, Inc. P.O. Box 882, Solomons MD 20688  
Hopeman Brothers, Inc., P.O. Box 820, Waynesboro, VA 22980  
Insulations, Inc., 1101 Edwards Ave., Harahan, LA 70123  
Marine Accommodations, Inc., 3830 Williamsburg Park Blvd., Building 7, Jacksonville FL 32257  
Maritime Services Corp., 3457 Guignard Drive, Hood River, OR 97031  
Panel Specialists, Inc./Thermax, 3115 Range Rd., Temple, TX 76501  
Walz & Krenzer, 91 Willenbrock Rd., Unit B4, Oxford CT 06478

#### KEEL COOLERS

R.W. Femstrum & 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

#### LIFEBOATS/RAFTS

American Eagle Mfg. Inc., 780 Pearle 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

#### LIFESAVER EQUIPMENT

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

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

#### 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, Pearlard, TX 77588  
Francis Searchlights/Stam Supply Co., 4415 6th N.W., Seattle, WA 98107

#### LIQUID OVERFILL PROTECTION SYSTEMS

E.R.L. Marine Products, P.O. Box 1026, New Albany, IN 47151  
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

Gotten Marine Co. Inc., 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 Fenboat 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 CEILINGS

Hydro-Aluminium, 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  
Resolution Management, 11 Eves Drive Suite 140, Marlton, NJ 08053

Homblower Marine, Pier 3 Ferryboat Santa Rosa, San Francisco, CA 94111  
Boland Industrial & Consulting Services, P.O.B. 91360, Mobile, AL 36691

#### MARINE DECKING

Hopeman Brothers, Inc., P.O. Box 820, Waynesboro, VA 22980  
Insulations, Inc., Rt. 5, 12360 Leisure Road, Baton Rouge, LA 70807

Selby, P.O. Box 1600, Sapulpa, OK 74067  
Flexible Decking, 2708 N. Australian Ave. Ste. 9, West Palm Beach, FL 33407

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

#### 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

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

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

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

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

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

#### MARINE EQUIPMENT

Lake Shore Inc., P.O. Box 809, Iron Mountain, MI 49801, 1150 Plastic Plings Inc., 1485 South Willow Ave., Rialto, CA 92376

Waterman Supply, P.O. Box 596, Wilmington, CA 90748  
Maritime Power Corp., 200 Henderson Str., Jersey City, NJ 07302

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

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

Commercial & Marine Products, 3924 Forest Dr., #11, Columbia, SC 29204

#### MARINE FINANCING

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

#### MARINE INSULATION

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

#### MARINE SEATING

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

#### MARINE SHAFTING

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

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

#### MARINE SURPLUS SALES

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

#### MARITIME TRAINING & SCHOOLS

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

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

Marine Safety Int'l., Marine Terminal Laguardia Airport, NY 11371  
Calhoun MEBA Engineering School, 27050 St. Michaels Road, Easton, MD 21601

#### MECHANICAL PUMP SEALS

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

#### METERS

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

#### MONITORS

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

#### MONITORING SYSTEMS

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

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

#### MOORING LINES

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

#### MOTOR PROTECTION EQUIPMENT

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

#### NAUTICAL JEWELRY

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

#### NAVAL ARCHITECTS, MARINE ENGINEERS, SURVEYORS

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

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

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

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

C. Baxter & Associates, P.O. Box 9006, Mobile, AL 36609  
CDI Marine Co., 9550 Regency Square Blvd. Ste. 400, Jacksonville, FL 32225

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

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

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

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

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

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

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

Encon Mgmt & Engineering Consultant Services, P.O. Box 7760, Beaumont, TX 77706

GHM Inc. (Ind. Measurement Consultants), P.O. Box 1836, Newport News, VA 23601

Gibbs & Cox, Inc., 50 West 23rd St., New York, NY 10010  
Heger Dry Dock Engineers, Inc., P.O.B. 6605, Holliston, MA 01746

John W. Gilbert & Assoc., Inc., 199 State St., Boston, MA 02109  
The Glosten Assoc. Inc., 600 Mutual Life Bldg., 605 First Ave., Seattle, WA 98104

Guido Perla & Assoc., 720 3rd Ave., Ste. 1200, Seattle, WA 98104

Moms Guralnick Associates, Inc., 130 Sutter St., Ste. 400, San Francisco, CA 94104

C. Raymond Hunt Associates, 69 Long Wharf, Boston MA 02110

JHJ Inc., 3412 Progress Dr., Bensalem, PA 19020  
R.D. Jacobs & Associates, 11405 Main St., Roscoe, IL 61073

Kvaerner Masa Marine Inc., 201 Defense Highway, Suite 202, Annapolis, MD 21401

James S. Krogen, 799 Brickell Plaza Ste. 701, Miami, FL 33131

Rodney E. Lay & Associates, 13891 Atlantic Blvd., Jacksonville, FL 32225

MCA Engineers, Inc., 2960 Airway Ave., #A-103, Costa Mesa, CA 92626

Alan C. McClure Associates, Inc., 2600 South Gessner, Houston, TX 77063

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

John J. McMullen Associates, Inc., 4300 King St., Suite

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 VanBrunt St., Brooklyn, NY 11231  
 Harbormaster Marine Inc., 31777 Industrial Rd., Livonia, MI  
 48150  
 Harrington Metal, 6720 124th Ave. Lennville, MI 49408  
 Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241  
 Krupp Mak, 7555 Danbro Crescent, Mississauga, Ontario,  
 CANADA L5N 6P9  
 LIPS B.V., P.O. Box 6, 1510 BB Drunen, The Netherlands  
 Lohmann & Stollerfoht, P.O. Box 1860, D-58408 Witten,  
 Germany  
 Lo-Rez Vibration Control, 186 West 8th Ave., Vancouver, BC  
 CANADA, V5Y 1N2  
 Mapeco, Inc., 91 Willenbrock Rd., Unit B4, Oxford CT 06478  
 Markisches Werk, P.O. Box 1442, D-5884 Halver GERMANY  
 MAN B&W Diesel, 17 State St., New York, NY 10004  
 MAN B&W Diesel A/S, Ostervej 2, DK-4960 Holeyby,  
 DENMARK  
 MAN B&W Diesel A/S, Alpha Diesel, Niels Juels Vej 15, DK-9900  
 Frederikshavn, DENMARK  
 MAN B&W Diesel GmbH, Stadtbachstrasse 1, D-86153  
 Augsburg 1 GERMANY  
 Orion Corp., 1111 Cedar Creek Rd., Grafton, WI 53024  
 Oy Wartsila Ab, Vasa and Abo Divisions, P.O. Box 244,  
 SF65100 Vasa, FINLAND  
 S&S Propellers, 26-15 123rd St., Flushing, N.Y. 11354  
 Karl Senner Inc., 25 W Third, Kenner LA 70062  
 Schottel-Werft, Manizer Strasse 99, D-56322 Spay/Rhein,  
 GERMANY  
 Schottel Inc., 500 Industrial Blvd., Sugar Land, TX 77478  
 Siemens Electric Ltd., 1180 Courtnepark Rd., Mississauga,  
 ONTARIO  
 Stewart & Stevenson, 1400 Destrehan, P.O. Box 8, Harvey  
 LA 70059-0008  
 Thrustmaster of Texas, P.O. Box 840189-12227 IFM 529,  
 Houston, TX 77284-0189  
 Ulstein Bergen Diesel A/S, P.O. Box 924, N-5002, Bergen,  
 NORWAY  
 Ultra Hydraulics Limited, Cheltenham Road East, Gloucester,  
 GL2 9GN, ENGLAND  
 Voith Hydro Marine Technology, P.O.B. 1125, D89509,  
 Heidenheim, GERMANY  
 Marine Propulsion Inc., 1505 Corbin Ave., Hammond, LA 70403  
 The Cincinnati Gear Company, 5657 Wooster Pike,  
 Cincinnati, OH 45227  
 Renold Hi-Tec, 512 W. Crescentville Rd., Cincinnati, OH 45246  
 U.S. Rep: Voith Schneider America Inc., 121 Susquehanna Ave.,  
 Great Neck, NY 11021

**PUMP—Repair—Drives**  
 Scardana Americas Bkg., 502 Empire St., Greefield Park, J4V1V7  
 Canada  
 Gilkes, Inc., PO Box 628, Seabrook, TX 77586  
 Hamworthy Marine, Inc., 1129 Hospital Dr. Ste 3C,  
 Stockbridge, GA 30281  
 Marine Electric & Process Control, 3931 Leary Way NW, Seattle,  
 WA 98107  
 Kraissl Co., 299 Williams Avenue, Hackensack, NJ 07061  
 Vita Motivator, 566 Parker St., Newark, NJ 07104  
 Alfa Tec Inc., 4027 21st Ave. West, Seattle WA 98199

**RADARS/ARPAS**  
 Furuno USA, Inc., 271 Harbor Way, S. San Francisco, CA  
 94080  
 Radio-Holland USA, 8943 Gulf Freeway, Houston, TX 77017

**REFER COMPRESSORS**  
 CMP Corporation, P.O. Box 15199, Oklahoma City, OK 73155

**REFRIGERATION COMPRESSOR REPLACEMENT  
 PARTS**  
 CMP Corporation, P.O. Box 15199, Oklahoma City, OK 73155

**REMOTE VALVE OPERATORS**  
 Elliott Manufacturing, P.O. Box 773, Binghamton, NY 13902

**RN PROPULSION**  
 Boll Filter, 15 International Dr., East Granby, Ct., 06206  
 Goltens, 160 Van Brunt St., Brooklyn, NY 11231

**RIGID INFLATABLE BOATS**  
 Avon Marine, 11215 Young River Ave., Fountain Valley,  
 CA 92708  
 Willard Marine, Inc. 1250 N. Grove St., Anaheim, CA 92806  
 Zodiac of N. America Thompson Creek, P.O. Box 400,  
 Stevensville, MD 21666

**ROPE—Manila—Nylon—Hawsers—Fibers**  
 American Mfg. Co., 200 Southpark Rd., Lafayette, LA 70508  
 Bayer AG, D-41538, Dormagen, GERMANY  
 Phillystran, Inc., 151 Commerce Drive, Montgomeryville, PA  
 18936-9628  
 Puget Sound Rope, 1012 Second St., Anacortes, WA 98221  
 Pelican Rope Works, 4001 Carriage Dr., Santa Ana,  
 CA 92704  
 Rasmussen Equipment Co., P.O. Box 81206, Seattle,  
 WA 98108

**RUDDER BEARINGS & BUSHES**  
 Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH  
 44062-0067  
 Thordon Bearings, Inc., 3225 Mainway, Burlington, Ontario  
 Canada L7M 1A6  
 Vesco Plastics, P.O. Box 40647, Cleveland 2022, South Africa

**SAFETY PRODUCTS**  
 Viking Life Saving, 1625 N. Miami Ave., Miami, FL 33136  
 Welin Lambie N.A., Inc., 18 Ridgecrest Drive, Bridgewater Nova  
 Scotia, Canada B4V 3V8  
 New England Marine & Industrial, 200 Spaulding Turnpike,  
 Portsmouth, NH 03801  
 Nautical Safety Products, P.O. Box 590462, Houston, TX 77259

**SANITATION DEVICE—Pollution Control**  
 Byme, Rice & Turner, Inc., 1172 Camp Street, New Orleans,  
 LA 70130  
 Exceltech International Corp., 1110 Industrial Blvd., Sugarland, TX  
 77478  
 Envirovac Inc., 1260 Turret Dr., Rockford, IL 61111  
 Fast Systems, 3240 North Broadway, St. Louis, MO 63147  
 Headhunter Inc., 214 SW 21st Terrace, Fort Lauderdale, FL 33312  
 AlfaTec, Inc., 4027 21st Ave. West, Seattle, WA 98199  
 Owens Mfg., Hwy 92, Youngsville, LA 70592

**SATELLITE COMMUNICATIONS**  
 Boatracs, Inc., 6440 Lusk Blvd. #D-201, San Diego, CA  
 92121-2758  
 Furuno USA, Inc., 271 Harbor Way, S. San Francisco, CA  
 94080  
 KVH Industries, Inc., 110 Enterprise Center, Middleton, R.I.  
 02842-5268  
 ICG Satellite Communications, 8400 NW 52nd St., Suite 110,  
 Miami, FL 33166  
 Mackay Communications, 2721 Discovery Dr., Raleigh, N.C.  
 27604-1851  
 Iridium N.A., 8449 S.River Pkwy, Tempe, AZ 85284  
 Norwegian Telecom, Postboks 6701 St. Olavs Plass, N-0130,  
 Oslo, Norway  
 PTT Telecom, Station 12, P.O. Box 30150-2500 JD The  
 Hague, NETHERLANDS  
 Radio-Holland USA, 8943 Gulf Freeway, Houston, TX 77017

Singapore Telecom, 15 Hill Street, Telephone House, 2nd  
 Storey, Singapore 0617  
 Telstra Mobile Satellite & Radio Services, 79 St. Hilliers Rd.,  
 Auburn NSW 2144, AUSTRALIA  
 Magellan Systems, 960 Overland Court, San Dimas, CA 91773  
 Comsat Maritime Services, 6560 Rock Spring Drive, Bethesda, MD  
 20817-1146

**SCARIFIERS**  
 Desmond-Stephan, P.O.B. 30, Urbana, OH 43078

**SEALS**  
 John Crane Marine, USA, 1536 Barclay Blvd, Buffalo Grove,  
 IL 60089  
 Blohm & Voss Industrie GmbH, P.O. Box 10 07 20, D-20457  
 Hamburg, GERMANY  
 Duramax Marine, 16025 Johnson St., Middlefield, OH 44062  
 Circle Seal Controls Inc., 2301 Wardlow Circle, P.O. Box 3300  
 Corona, CA  
 U.S.A. Reps: Simplex-Turmar Inc, P.O. Box 168, Little Neck,  
 NY 11363-0168

**SEATING**  
 H.O. Bostrom, 818 Progress Ave., Waukesha, WI

**SHAFT HORSEPOWER MEASURING SYSTEM**  
 FCS, Inc., 22 Main Street, Centerbrook, CT 06409  
 Instruments Computers & Controls, 70 South Bow Rd.,  
 Hookset, N.H. 03106

**SHAFT SEALS**  
 Duramax Marine, 16025 Johnson St., Middlefield, OH 44062

**SHIP LIFTS**  
 Synchrolift Inc., Two Datan Center, 9130 S. Dadeland Blvd.,  
 Miami, FL 33156-7850

**SHIP VALUATION**  
 Capt. E.S. Geary, P.O. Box 1246, Fajardo, P.R. 00738

**SHIPBUILDING—Repairs, Maintenance, Drydocking**  
 American Eagle Mfg., 780 Pearle Jensen Way, La Conner  
 WA 98257  
 Amfels, Inc., P.O. Box 3107, Brownsville, TX 78523  
 Astilleros Espanoles, S.A. Ochandiano, 14-16 28023 El Planio  
 SPAIN  
 Atlantic Marine, Inc., P.O. Box 3202, Mobile, AL 36652  
 Atlantic Marine, Inc., 8500 Heckscher Dr., Jacksonville, FL 32226  
 Avondale Industries Inc., P.O. Box 50280, New Orleans LA 70150  
 Bender Shipbuilding & Repair, P.O. Box 42, Mobile AL 36601  
 Bissio Marine Co., P.O.Box 4113, New Orleans, LA 70178  
 Blount Marine, 461 Water St., Warren, R.I. 02885  
 Bollinger Lockport & Larose, P.O. Box 250, Lockport, LA 70374-  
 0250  
 Caridoc, P.O. Box 1147 Port Of Spain, Trinidad, W.I.  
 Chris-Marine AB, P.O. Box 9025, S-2000 39, Malmö, SWEDEN  
 Conrad Industries, 1501 Front Street, P.O. Box 790, Morgan City,  
 LA 70381  
 Eastern Shipbuilding Group, 2200 Nelson Street, Panama City,  
 FL 32402  
 Fincantieri SpA Cantieri Navali Italiani, Via Cipro 11, 16129 Genoa  
 ITALY  
 GMD Shipyard, Flushing Ave. & Cumberland, Brooklyn, NY 11205  
 Gulf Coast Fabrication, Inc., P.O. Box 539, Lakeshore, MS 39558  
 HDW, Kiel, Germany, USA Rep.: Roland Marine Inc., 90 Broad St.,  
 NY, NY 10004  
 Halter Marine Group, Inc., 13085 Industrial Seaway Rd, Gulfport,  
 MS 39503  
 Hitachi Zosen, Hitachi Shipbuilding & Engineering Co., 1-1-1  
 Hitotsubashi Chiyoda-Ku, Tokyo 100 Japan  
 In-Place Machining Co., Inc. 929 North Buffum Street, Milwaukee,  
 WI 53212-3793  
 Jacksonville Shipyards, 750 E. Bay St., Jacksonville, FL 32202  
 Jeffboat, Inc., P.O. Box 610, Jeffersonville IN 47130  
 Kvaerner Masa-Yards Oy, Box 132, SF-00151, Helsinki, FINLAND  
 Laevac Shipyards, P.O.Box 1190, HWY 90 East, Jennings, LA  
 70546  
 Lindenau GmbH, Skagerrakerufer 10, Postfach 9093 D-2300 Kiel,  
 Friedrichsort GERMANY  
 Motor-Service AB, Box 2115, 144 04 Ronninge, SWEDEN  
 Munson Hammerhead, 780 Pearle Jensen Way, La Conner WA  
 98257  
 Newport News, 4101 Washington Ave., Newport News, VA  
 23607  
 Peterson Builders, Inc., 101 Pennsylvania Ave., Sturgeon Bay,  
 WI 54235-0650  
 Thomas Marine, 37 Bransford Street, Patchogue, NY 11772  
 Samsung Heavy Ind., 25, 1-ka, Bongrae-dong, Chung-ku, Seoul,  
 Korea  
 SeaArk, P.O. Box 210, Monticello AR 71655  
 SeaFab, P.O. Box 1651, 4111 Cedar St. Pascagoula, MS 39587  
 Service Marine Industries, P.O. Box 3606, Morgan City LA 70381  
 Southwest Marine, Foot of Sampson Street, P.O. Box 13008, San  
 Diego, CA 92170  
 Skipperliner Shipyards, 621 Park Plaza Dr, Dept 21, LaCrosse WI  
 54601  
 Steiner Shipyard, Inc., P.O. Box 742, Bayou la Batre, AL 36509  
 Swath Ocean, 979 G Street, Chula Vista, CA 92011  
 Talleres Navales del Golfo, Isote San Juan de Ulva S/N, 91800  
 Veracruz, Ver. Mexico  
 Washburn Doughty, P.O. Box 296, E. Boothbay, ME 04544  
 Westport Shipyard, P.O. Box 308, Westport, WA 98595  
 Willard Marine, Inc., 1250 N. Grove St., Anaheim, CA 92806  
 Zodiac of North America Inc., Thompson Creek Rd., P.O. Box 400,  
 Stevensville, MD21666  
 Friede Goldman, 525 E. Capitol Street, Suite 402, Jackson, MS  
 39201  
 Tampa Bay Shipbuilding, 1130 McClosky Blvd., Tampa, FL  
 33605  
 Ocean Technical Services Inc., 1140 Peters Rd., Harvey, LA  
 70058-1705  
 Belmont Metals, Inc. 356 Belmont Ave., Brooklyn, NY 11207  
 Goltens Worldwide, 160 Van Brunt St., Brooklyn, NY 11231

**SHIPYARD/CABLES**  
 Baltimore Marine Industries, 600 Shipyard Rd., Baltimore, MD  
 21219-2599  
 American Shipyard Corp., One Washington St., POB  
 570, Newport, R.I. 02840-0943  
 Arxiter Wire & Cable, 2617 Edenboro Ave., Metairie, LA  
 70002  
 G.M.D. Shipyard, Flushing Ave./Cumberland, Brooklyn, NY

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

**SHOWERS AND FAUCETS**  
 Scanmix Corp., 230 Bartlett St., Lewiston, ME 04240

**SHRINKWRAP CONTAINMENT**  
 Hipp Plastic Wrap, 4070 Kearny Mesa Rd., Sand Diego,  
 CA 92111

**SILENCERS**  
 Sillex Inc., 7850 Tranmere Dr., Mississauga, Ontario L5S1L9  
 Applegate Industrial, 1440 Government Street, Baton Rouge, LA  
 70802  
 Beard Industries Inc., P.O. Box 31115, Shreveport LA 71130  
 Nelson Division, Exhaust & Filtration Systems, Hwy. 51  
 West, P.O. Box 428, Stoughton, WI 53589

**SIMULATION TRAINING**  
 Houston Marine Training Services, 5728 Jefferson Hwy,  
 New Orleans, LA 70123  
 Applied High Technology, 4 Place Dee Commerce  
 Brossard, Suite 201 Quebec Canada J4W-3B3  
 Marine Safety, Marine Air Terminal, Laguardia Airport, NY 11371

**SKILLED LABORERS**  
 Amerforce, 650 E. 27th St., Jacksonville, FL 32206

**SOUND CONTROL**  
 Soundcoat, One Burt Dr., Deer Park, NY 11729

**STAIRMASTER SAFETY TREADS**  
 SlipNot Safety Flooring, 2545 Beaufait St., Detroit, MI 48207  
 Wooster Products, Inc., 1000 Spruce Street, Wooster, OH 44691

**STEERING GEARS/STEERING SYSTEMS**  
 A. Van der Velden B.V. Rotterdam, P.O.B. 2061, 2930 AB  
 Krimpen a/d Lek, NETHERLANDS  
 Cunningham Marine Hydraulics Co., 201 Harrison St.,  
 Hoboken, NJ 07030  
 Summer Equipment, 24 West 4th Ave., Vancouver, B.C.  
 V5Y1G3  
 Kobelt Manufacturing Co., Ltd., 8238-129 street, Surrey, B.C.  
 V3W0A6  
 Jastram Engineering, 485 Mountain Hwy N., North  
 Vancouver, B.C. CANADA V7J 2L3

**STERN TUBE BEARINGS/BUSHES**  
 Blohm & Voss, Industrie Gmb H, P.O.B 100720, D-20457,  
 Hamburg GERMANY  
 IHC Lagersmit, P.O.B. 5 - 2960 AA Kinderdijk - HOLLAND  
 Raikio Ltd., Loudwater, High Wycombe, Bucks Hamshire  
 ENGLAND HP109QV  
 Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH  
 44062-0067  
 Thordon Bearings, Inc., 3225 Mainway, Burlington, Ontario  
 Canada L7M 1A6  
 Vesco Plastics, P.O. Box 40647, Cleveland 2022, South Africa

**STERN TUBE SEALS**  
 Blohm & Voss Industrie GmbH, P.O. Box 10 07 20, D-20457  
 Hamburg GERMANY  
 Duramax Marine, 16025 Johnson St., P.O. Box 67, Middlefield, OH  
 44062-0067  
 U.S.A. Reps: Simplex-Turmar Inc, P.O. Box 168, Little Neck,  
 NY 11363-0168  
 IHC Lagersmit, P.O.B. 5 - 2960 AA Kinderdijk - HOLLAND  
 John Crane Marine USA, 1536 Barclay Blvd., Buffalo Grove, IL  
 60089

**STORAGE/WORKSHELTERS**  
 Poly-Steel Shelters, 1209 E. Ocean Blvd., Stuart, FL 34996

**STRAINERS**  
 Kraissl Co., 299 Williams Ave., Hackensack, NJ 07061

**STUD/BOLT TENSIONERS**  
 Superbolt, P.O. Box 683, Carnegie, PA 15106

**SURFACE PREP TOOLS**  
 Aurand Mig., 1210 Ellis St., Cincinnati, Ohio 45223  
 Glaco, Inc., P.O. Box 1441, Minneapolis, MN 55440-1441  
 Flow International Corp., 23500 64th Ave. S., Kent, WA 98032

**SURGE SUPPRESSOR**  
 Engineered Data Products, P.O. Box 565, Woodbury, NJ 08096

**TANK LEVELING INDICATORS**  
 Bergan Tank, 3409 Gulf Breeze Pkwy, Gulf Breeze, FL 32561  
 ERL Marine Products div, PO Box 1026, New Albany, IN  
 47151-1026  
 Ian-Conrad Bergan, 3409 Gulf Breeze Parkway, Gulf Breeze,  
 FL 32561  
 Kockum Sonics, Inc., 933 Industry Rd., Ste105, Kenner, LA 70062  
 MMC International, 60 Inip Dr, Inwood NY 11096  
 Prime Mover Controls, 3600 Gilmore Way, Burnaby V5G 4R8  
 CANADA  
 Saab Marine Electronics AB, P.O. Box 13045, S-402 51  
 Göteborg SWEDEN  
 Technical Marine Service, 6040 North Cutter Circle, Portland,  
 OR 97217  
 Electronic Marine Systems, 800 Ferndale Pl., Rahway, N.J. 07065  
 King Engineering, P.O. Box 1228, Ann Arbor, MI 48106  
 Auxitrol, 168 Bureaux de la Colline, 92213 Saint-Cloud Cedex,  
 France

**TANK LIQUID LEVEL GAUGES**  
 Headhunter, Inc., 214 SW 21st Terrace, Fort Lauderdale, FL  
 33312  
 King Engineering Corp., P.O. Box 1228, Ann Arbor, MI 48106  
 Kockum Sonics, Inc., 933 Industry Rd., Ste105, Kenner, LA 70062

**TESTING SERVICES**  
 Wyle Laboratories, 7800 Govern's Dr. S.W., Huntsville, AL 35807  
 Fleet Technologies, 311 Legget Dr., Kanata, Ont, K2K 1Z8  
 Canada

**THICKNESS TESTING**  
 Cygnus Instruments, 1993 Moreland Parkway, Suite 202,  
 Annapolis, MD 21401  
 M.A.C.E., 5910 N.E. 15th Ave., Fort Lauderdale, FL 33331

**TOILET SYSTEMS**  
 Headhunter, Inc., 214 SW 21st Terrace, Fort Lauderdale, FL  
 33312

**TORSIONAL VIBRATION SPECIALISTS**  
 M.A.C.E., 5910 N.E. 15th Ave., Fort Lauderdale, FL 33331  
 T.W. Spaetgens, 186 W. 8th Ave., Vancouver, BC, CANADA,  
 V5Y 1N2  
 Vibration Engineering Corp., 9300 Gamebird, Houston,  
 TX 77034

**TOWING—Barges, Vessel Chartering, Lighterage,  
 Salvage, etc.**  
 Jack Faulkner, 2419 Caddy Lane, Flossmoor IL 60422

**TRANSMISSIONS**  
 ZF Marine 3131 SW 42nd St., Ft. Lauderdale, FL 33312

**TURBOCHARGERS**  
 ABB Turbocharger Co., 1460 Livingston Ave., North  
 Brunswick, NJ 08902

**ULTRASONIC TESTING**  
 Coast Diving Services, P. O. Box 1548, San Pedro CA 90733  
 M.A.C.E., 5910 N.E. 15th Ave., Fort Lauderdale, FL 33331

**UNDERSEA CABLE CHARTS**  
 AT&T Undersea Cable, 340 Mt. Kemble Ave, Morristown, NJ  
 07960

**UNDERWATER EQUIPMENT/SERVICES**  
 South Texas Underwater Divers, 2921 16th Ave, North,  
 Texas City, TX 77590  
 J.W. Fisher, 65 Anthony St., Berkley, MA 02779

**VACUUM EQUIPMENT**  
 Vector Technologies, 6820 N. 43rd St., Milwaukee, WI 53209

**VACUUM TOILET SYSTEM**  
 Envirovac Inc., 1260 Turret Dr., Rockford, IL 61111  
 Fast Systems, Inc., 3240 N. Broadway, St. Louis, MO 63147  
 Jets Vacuum Sewage System, P.O. Box 14, N-6060 Hareid,  
 NORWAY

**VACUUM CONVEYORS**  
 Vector Technologies, 6820 N. 43rd St., Milwaukee, WI 53209

**VALVE CONTROL SYSTEM**  
 Elliott Mfg., P.O. Box 773, Binghamton, NY 13902

**VALVES AND FITTINGS**  
 Cia-Val Co., P.O. Box 1325, Newport Beach, CA 92663  
 ERL Marine Products Div., PO Box 1026, New Albany, IN 47151  
 Ian-Conrad Bergan, 3409 Gulf Breeze Pkwy, Gulf Breeze, FL  
 32551  
 Fetteroff Corp., P.O. Box 103, Skippack, PA 19474  
 Leslie Controls, 12501 Telecom Dr., Tampa, FL 33637  
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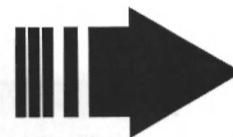
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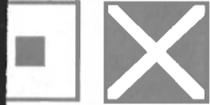
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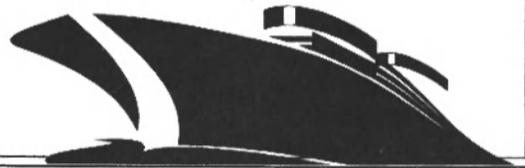
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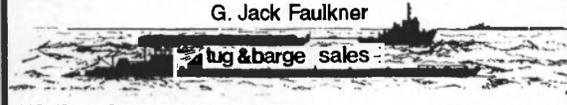


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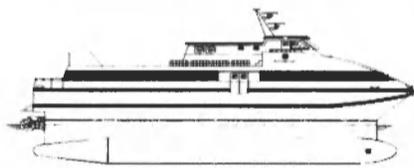
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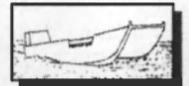
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