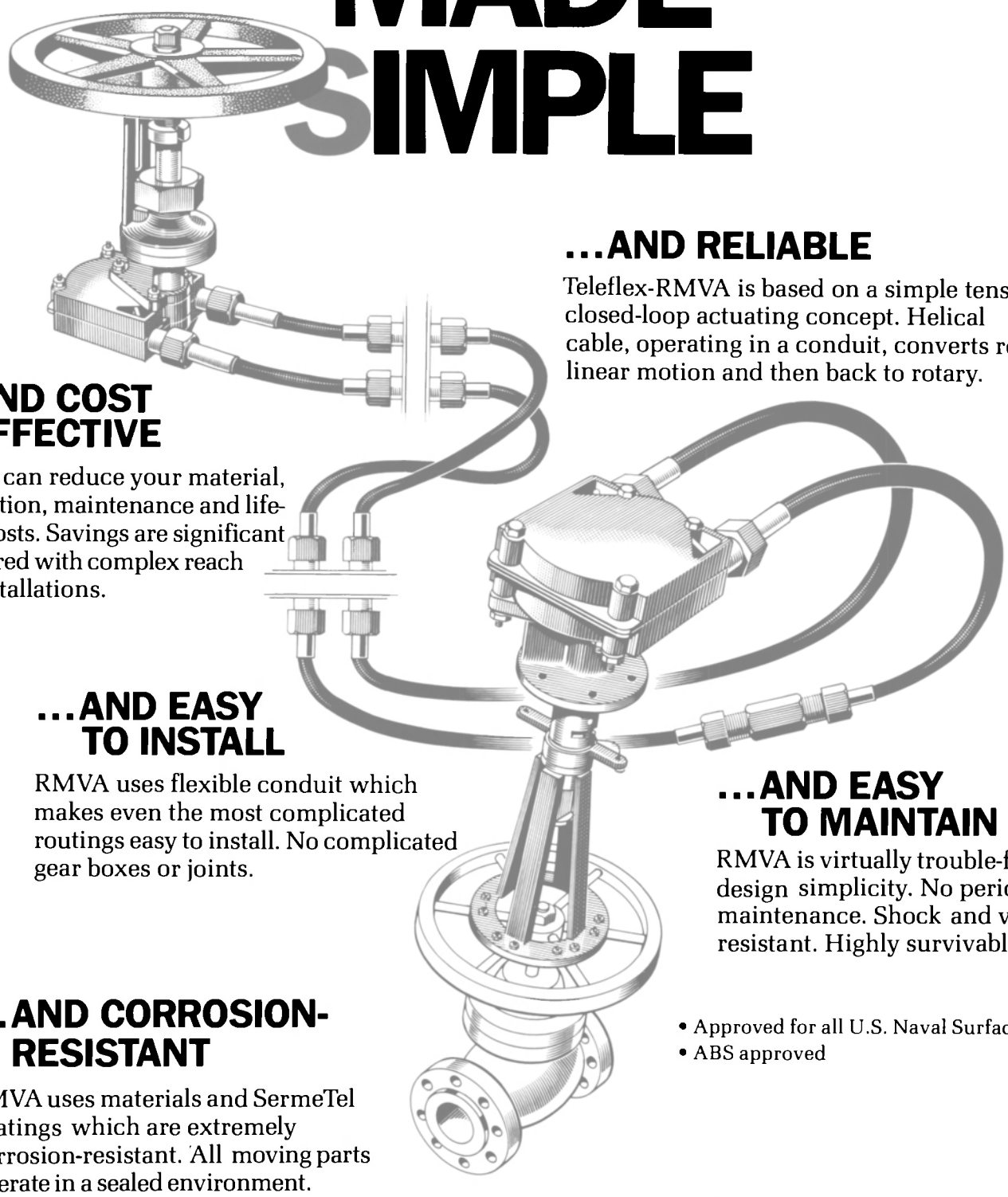
MARITIME REPORTER
AND
ENGINEERING NEWS

NAVAL TECHNOLOGY & SHIPBUILDING
DIESEL POWER REVIEW • LUBRICANTS REVIEW

JULY 1988 ISSUE

REMOTE VALVE ACTUATION MADE SIMPLE



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ON THE COVER

Cover Photo: Norwegian Cruise Line's new M/S Seaward built by Wartsila Marine-Turku (see page 7).

Stolt-Nielsen Buys Out Oiltanking's Interest In Houston Storage Terminal

Stolt Terminals Inc., a wholly owned subsidiary of Stolt Tankers and Terminals (Holdings) S.A., has purchased the interest held by Oiltanking Holding USA Inc., in their Stolt & Oiltanking Chemical Terminal joint venture in Houston. The amicable arrangement dissolves a partnership of six years. Stolt-Nielsen, as part of its corporate objective of becoming a fully integrated transportation and distribution company, wishes to expand the chemical storage facility to achieve closer integration with its tanker operations. The terminal will be marketed as Stolthaven Houston. Oiltanking Holding USA Inc. has decided to concentrate on petroleum storage and handling, one of its primary interests worldwide.

Stolt-Nielsen's objective in the acquisition and subsequent expansion of Stolthaven Houston is to develop its "Owner's Berth" concept by making the terminal the focal point for cargo consolidation, transshipment and onward distribution, and thereby improve the cargo handling performance of the Stolt-Nielsen tankers calling at the Port of Houston.

Stolt Tankers and Terminals operates more than 55 parcel tankers, totaling 1.4 million deadweight tons, on worldwide trade routes, as well as four bulk liquid storage terminals and one cargo transfer facility with over 3.5 million barrels of capacity, and a fleet of more than 1,900 intermodal tank containers.

For more information and free literature,

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Editorial and Executive Offices
118 East 25th Street, New York, NY 10010
(212) 477-6700 • ITT Telex: 424768 MARINTI
Telefax: (212) 254-6271

Publishers:	JOHN E. O'MALLEY CHARLES P. O'MALLEY
Editorial Director:	CHARLES P. O'MALLEY
Editor:	JOHN SNYDER
Senior Editor:	THOMAS H. PHILLIPS
Consulting Editor:	ROBERT WARE
Advertising Sales Director:	JOHN C. O'MALLEY
Regional Sales Manager:	LUCIA ANNUNZIATA
Production Manager:	LILIAN IRVINE
Circulation Manager:	M. SOTTILE

Advertising Circulation and Sales Offices
118 East 25th Street, New York, NY 10010
Telephone (212) 477-6700

REPRESENTATIVES

U.S. Gulf States — MR. JAMES N. McCLINTOCK
Wheelhouse One Building
634 Village Lane North, Suite 205
Mandeville, LA 70448
Telephone: (504) 626-7990
Telefax: (504) 624-5163

France — MR. NORBERT M. HELLIN
6 bis, rue de la Belle Feuille
F-92100 Boulogne, France
Telephone: 1-46-05-63-77 Fax: 1-46-03-33-21

Italy — MR. VITTORIO F. NEGRONE
Ediconsult Internazionale
Piazza Fontane Marose, 3-16123 Genova, Italy
Telephone: (010) 543.659-268.334-268.513
Telex: 211197 EDINT I
Editorial Consultant: DR. VICTORIA MUNSEY
Munsey Consultants
Strada Del Nobile 59
10131 Torino, Italy
Telephone: 11-68-3639 Fax: 11-650-3478

Scandinavia — MR. STEPHAN R. G. ORN
AB Stephan R. G. Orn
Box 184, S-271 00 Ystad, Sweden
Telephone 0411-184 00
Telex: 33335 Orn S Telefax: 411 10531

West Germany — MR. HELMUT MOLLER
Amhusarendenkmal 8A
2000 Hamburg 70
Federal Republic of Germany
Telephone: (40) 6525-384

United Kingdom — MR. MICHAEL J. DAMSELL
Euromedia, Ltd.
Tern House, Upper West St.,
Reigate, Surrey RH2 9HX, England
Telephone: 07372 42558
Telex: 932699 KENPUB G.

Korea — MR. CHRIS MAENG
IPR Int'l PR, INC.
Yongsan, P.O. Box 100, Seoul, Korea
Telephone: 273-7765 Telex: MOCNDM K23231

Japan — MR. TOSHIO EGUSA
Publinetwork, Inc.
Kaneko Bldg. 4-29-8,
Shimbashi, Minato-ku, Tokyo 105 Japan
Telephone: (03) 459-9618
Fax: 436-1931 Telex: 2425280 BESNA J

Singapore — MR. VICTOR CHIA
Market Trends Pvt. Ltd.
122 Middle Road, #07-08
Midlink Plaza, Singapore 0718
Telex: HENSAL RS20006

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Curtis Bay Towing Changes Name

Thomas E. Moran, chairman of Moran Towing Corporation, recently announced that Curtis Bay Towing Company, the 78-year-old marine transportation company, will change its name at its three ports of operation to Moran Towing of Maryland, Inc., Moran Towing of Pennsylvania, Inc., and Moran Towing of Virginia, Inc., respectively, effective July 1, 1988.

In making the announcement, Mr. **Moran** said: "Curtis Bay Towing has, in fact, been an affiliate of Moran Towing Corporation (Greenwich, Conn.) since 1958. No personnel, operational, or policy changes will be made in connection with the name change."

Thus, the blue diamond which has identified the Curtis Bay tugs in the ports of Philadelphia, Baltimore and Hampton Roads will be replaced with the white "M" which identifies Moran tugboats all over the world and principally in the ports of Portsmouth, N.H., Portland, Maine, New York, N.Y., Jacksonville, Fla., and Port Arthur, Texas.

Moran Towing Corporation is one of the foremost tug operators on the Atlantic and Gulf Coasts.

Arthur Engel Chosen Maritime Man Of The Year

Arthur Engel, president and chief executive officer of Southwest Marine, Inc., has been chosen Maritime Man of the Year by The Propeller Club of The United States, Port of San Diego. Mr. **Engel** was presented with The Brass Hat Award by Rear Adm. **Joseph Rizza,** president of The Propeller Club, during ceremonies which took place recently at Hotel Del Coronado.

The award was bestowed upon Mr. **Engel** in honor of his efforts to promote, further, and support the maritime industry. The recipient of this award must have a track record of commendable accomplishments, and must be recognized nationally as an outstanding leader in his field.

The keynote speaker, Vice Adm. **Piotti,** Commander, Sea Lift Command, Washington, D.C., addressed a crowd of over 400 attendees.

The Brass Hat Award was originally initiated in 1948 by The Propeller Club, Port of the Golden Gate, to annually honor the member who has done the most to promote the American merchant marine. The idea was brought to the San Diego Propeller Club by Admiral **Rizza,** and has become a yearly event.

General Thermodynamics Offers Free Literature On 300-A BMEP Balancer

General Thermodynamics Corporation of Plymouth, Mass., is offering free literature which gives technical data on their Model 300-A BMEP Balancer, the most common use of which is to adjust the fuel distribution to an engine to assure that each cylinder is producing an equal share of power.

It is designed to fit the standard indicator valve and is quickly connected and sealed with slightly more than hand tight torque. Readings are taken for each cylinder, then fuel adjustments are made either up or down until all cylinder yield the same pressure reading.

An alternate use of the Model 300-A BMEP Balancer is to determine the actual field performance of an installed engine under load. The cylinder load is first distributed equally using the Balancer. Then the average Balancer reading is referred to a previously prepared chart for the engine, and the actual power being developed is read out. BMEP is determined simultaneously.

For further information and a free copy of the literature on the Model 300-A BMEP Balancer from General Thermodynamics,

Circle 91 on Reader Service Card

Norwegian Cruise Line's new M/S Seaward in New York Harbor. She is powered by four Sulzer ZA40 engines and will cruise at a speed of 21 knots.

Wartsila Marine-Turku Delivers 1,800-Passenger Cruise Ship To Norwegian Cruise Line

Vessel Christened 'Seaward' In New York Ceremony

The Turku yard of Finnish shipbuilder Wartsila Marine Industries Inc. recently delivered its biggest passenger vessel to date to Norwegian shipowner Kloster Cruise Ltd. The 1,800-passenger vessel is the first new generation cruise ship built at the yard.

The vessel then departed Turku for her maiden voyage to New York via Kristiansand, Norway, for her official naming ceremony. World class long distance runner **Grete Waitz,** eight-time winner of the New York Marathon, christened the cruise ship Seaward at ceremonies at Pier 88 in Manhattan.

The 708-1/2-foot Seaward has a beam of 95 feet, maximum draft of 23 feet and gross tonnage of 42,300. The vessel is powered by four eight-cylinder Sulzer ZA40 medium-speed diesel engines which produce a total of 28,800 bhp. She can cruise at speeds of more than 21 knots.

Shaft alternators driven by power take-offs (PTOs) from the two main gearboxes will provide electricity while maneuvering, and will also supply a part of the ship's at-sea auxiliary power requirements.

The vessel, which is manned by a crew of 600, will be operated by Norwegian Cruise Line, Miami, Fla., a subsidiary of Kloster Cruise Ltd., on seven-day cruises in the Caribbean.

In addition to the 774 passenger cabins on board, there is ample public space, including three large restaurants, three night clubs, seven bars, a casino, spacious shops, a beauty salon, saunas, a fitness center, two swimming pools, whirlpools, a laudrette, a hospital and several rooms reserved for various entertainment games.

After the delivery of the Seaward, Wartsila-Turku's orderbook now includes eight passenger vessels of various types. For free literature on the shipbuilding, converting and ship-repairing services of Wartsila-Turku,

Circle 47 on Reader Service Card

Lease With Option To Buy Signed For M.S. Atlantic By Premier Cruise Unit

The Premier Cruise Line subsidiary of Greyhound Corp. recently signed a lease, with an option to buy, for the 36,000-ton vessel M.S. Atlantic from Merchant Ship Trustees LTV, a Netherlands Antilles trust company.

The vessel, built in 1982 for $100 million, was renamed the Star/Ship Atlantic and will begin sailing in December from Premier Cruise's base in Port Canaveral, Fla.

The vessel is expected to increase Premier's passenger capacity by more than 60 percent according to Greyhound, a consumer-products, transportation, manufacturing and financial-services concern

Watercom Names Gerald A. Motta VP, Operations

Gerald A. Motta has been named vice president of operations for Waterway Communications System, Inc., by its president, **Richard A. Baker.** Waterway Communications System, Inc., Jeffersonville, Ind., is responsible for the development of Watercom, a new direct-dial telephone service for the marine industry.

Mr. **Motta** brings over 23 years of telecommunications experience to Watercom. He has extensive senior level management experience with marine electronic systems, including radar, RF/VHF/UHV systems, Omega navigational systems, and HF satellite communications.

Watercom is a direct-dial telephone network providing the marine industry with improved telecommunications. The network serves 4,000 miles of inland waterways with high quality, automated telephone service from land to vessel, vessel to land, and vessel to vessel. Service extends to the Mississippi, Ohio and Illinois Rivers and the Gulf Intracoastal Waterways with incidental coverage extending to the tributaries of the waterway and offshore waters of the Gulf of Mexico.

For more information and free literature on Watercom,

Circle 55 on Reader Service Card

SPD Technologies Acquires Brown Boveri Switchgear Unit —Literature Available

SPD Technologies, Philadelphia, Pa., recently announced the completion of its acquisition of the Navy Switchgear Division of Brown Boveri Power Equipment, Inc., based in Montgomeryville, Pa.

According to **George M. Gordon,** president and chief executive officer of SPD Technologies, the Navy Switchgear Division will become an operating subsidiary of SPD.

The acquisition of the Brown Boveri division solidifies SPD Technologies' position as the nation's largest developer and producer of electrical distribution and protection systems for U.S. Navy ships.

In announcing the agreement, Mr. **Gordon** indicated that the additional capacity to produce high-quality switchgear would enhance the cost-efficiency of the firm's overall capabilities and provide new opportunities to diversify.

The transaction marks SPD's first acquisition since becoming an independent company as a result of a management buy out from Gould Inc. in 1987.

SPD Technologies is a world leader in the design, development and manufacture of advanced electronically controlled electrical systems protection equipment for military applications and other harsh operating environments. Headquartered in Philadelphia, the company has service, repair and overhaul facilities across the U.S.

For free literature detailing the electrical systems protection equipment offered by SPD,

Circle 59 on Reader Service Card

Jurong Shipyard Receives Repair, Conversion Orders Worth About $45 Million

Jurong Shipyard, Ltd. of Singapore recently received specialized conversion and vessel repair contracts totaling about $45 million.

The new orders include major repairs to six tankers fire-damaged in the Persian Gulf, the jumboizing of four West German containerships, repairs to a Soviet drillship, refurbishing and repairs to an Abu Dhabi craneship and conversion of three supply vessels into reefer ships.

The new orders are in addition to routine drydockings and general repairs scheduled at the yard, which is among the top three ship repairers in Singapore.

For literature detailing the shipbuilding and repair services and facilities of Jurong Shipyard,

Circle 83 on Reader Service Card

Racal Marine Names Richard A. Muller Product Sales Manager

Racal Marine Inc., Cranford, N.J., recently announced the appointment of **Richard A. Muller** as product sales manager. Racal Marine, a unit of the international Racal group of electronics and security companies, specializes in marine navigation systems, radar and instrumentation. Mr. **Muller** will be primarily responsible for the recently introduced Racal Bright Track series of automatic radar plotting aids.

Mr. **Muller** was previously associated with Racal from 1978 to 1984, as sales manager for marine electronics equipment. From 1984 until rejoining Racal, he was with Krupp Atlas Electronics in Clark, N.J., as regional sales manager for navigation and hydrographic products in the eastern U.S. and Canada.

Soundcoat Introduces Four Lightweight Vibration Damping Materials

The Soundcoat Company of Deer Park, N.Y., is offering a free eight-page bulletin on constrained layer-type vibration damping materials, called Soundfoil, which the company's materials laboratory has developed for control of noise and vibration.

Soundfoil is described in the bulletin as a highly efficient vibration-damping composite specially designed to reduce the resonant vibrations of thin sheet metals and thin composite panels. It consists of an aluminum foil alloy and a viscoelastic damping polymer. Each of the following Soundfoils are specifically designed to control vibration under different types of environmental and temperature conditions: Soundfoil "D" for use at high temperatures with peak damping at 140 F to 280 F; Soundfoil "LT" for low temperature applications with peak damping at -40 F to 40 F; Soundfoil "M" for room temperature and below, with peak damping at 30 F to 100 F; and Soundfoil "N" is optimum use at room temperature and above with peak damping at 60 F to 150 F.

These varieties of lightweight, thin vibration damping materials allow Soundcoat to provide solutions for diverse applications such as oil pans, rocker arm covers, transformers, electrical appliances, business machines, cameras, ships and boats to helicopters and aerospace products.

All Soundcoat materials are available with pressure sensitive adhesive and can be custom-cut for fast and cost-effective production-line assembly or field retrofit.

For more information and a free copy of the bulletin from The Soundcoat Company,

Circle 1 on Reader Service Card

DIESEL POWER REVIEW

One of the more difficult tasks facing both marine engineers and vessel owners contemplating new construction or the reengining of an existing vessel is keeping up with the latest developments in diesel engines for both main propulsion and auxiliary power. Manufacturers of marine diesel engines offer a multitude of selections and options to owners of vessels of all sizes, from small workboats to the largest oceangoing ships—low-speed, medium-speed and high-speed units; two-stroke and four-stroke cycle designs; cross-head- and trunk-piston types; loop-scavenged and uniflow-scavenged styles; and conventional- and opposed-piston machines. Application, engine availability range, fuel economy, fuel compatibility, maintenance and flexibility are just some of the criteria for an engine's selection.

In an effort to sort out some of the newest choices being offered by diesel engine manufacturers to the marine industry, MR/EN asked major diesel engine manufacturers to provide information on their latest developments and advancements. The following review is based upon the replies received as of press time.

Free product literature, brochures and technical reports are available from the manufacturers included in this review. Just circle the appropriate Reader Service number(s) on the postpaid card in the back of this issue.

ALCO

Circle 11 on Reader Service Card

Alco Power Inc., a subsidiary of Bombardier Inc. of Montreal, Canada, has opened a new service, training and distribution center.

Strategically located on the U.S. East Coast in Norfolk, Va., this new facility is staffed with trained technicians dedicated to providing complete support for all Alco customers with emphasis on the popular Alco 251 model series. The 251 is offered in six-, eight-, 12-, 16- and 18-cylinder configurations and its power range is from 700 to over 4,000 hp. These marine diesel engines comply with major classification society regulations and the rigid specifications of the U.S. military.

The Norfolk operation is headquarters for Alco's U.S. sales and marketing team. A training department provides "hands-on" instruction in the operation and maintenance of the Alco 251 diesel engine utilizing an actual 12-cylinder engine. Additionally, the after sales service department and the renewal parts order processing operations will be conducted from this center.

The Norfolk office is also designed to complement and support Alco's sales office in Houston, Texas, as well as Alco's manufacturing facilities located in Auburn, N.Y., and Montreal, Canada.

After a series of improvements to its pistons, cylinder heads and camshafts, the Alco 251 engine now offers reduced fuel consumption, lower maintenance costs and enhanced engine/component reliability.

ALSTHOM

Circle 10 on Reader Service Card

The French diesel engine manufacturer S.E.M.T. Pielstick, a wholly owned Alsthom Group subsidiary which incorporated all assets and activities of Alsthom's Diesel Group in 1987, offers high- and medium-speed diesel engines within the power range of 1,000 to 30,000 bhp for commercial and naval ship propulsion, locomotives and stationary power plants.

Only one year after being introduced in the marine market, S.E.M.T. Pielstick's PC40 type medium-speed diesel engines were sold in six-, seven-, eight-, and nine-cylinder versions.

This successful introduction of S.E.M.T. Pielstick's biggest engine type started in Japan in 1986. Four 9PC40s with Recovery Power Turbine for two vehicle/passenger ferries of Shinnihonkai Ferry Co. Ltd., were ordered at IHI, one of S.E.M.T.'s Japanese licensees. Each of the 1,7261-grt ferries will be powered by a twin engine arrangement of 2 x 9PC40.

According to the company, the M/V New Hamansu and the New Shiirayuri now have the most economical medium-speed diesel engine installations. Both 9PC40s on the new Japanese interisland ferry New Hamanasu develop a total power of 21,870 kw (29,700 hp) and the engines set up new standards with a SFC of 164.6 g/kwhr.

The shop-test program finished with a series of tests which were used to plot performance curves. The company reports that during these trials, the recorded SFC plunged below 120 g/hphr for the first time in medium-speed diesel engine history, to 119.7 g/hphr (162.7 g/kwhr).

Already, more than 6,000 hours have been recorded on the working hour meters of the first engines. Overall, 17 PC40 engines are now in service or under construction.

The PC40 derivates from the PC4 engine which appeared in 1977 as the first large bore medium-speed engine with high efficiency.

Multipurpose, container, reefer, RO/RO vessels and tankers were fitted with single or twin engine installations. In addition, the PC4 found immediate application in power stations. For example, in Indonesia an installation consisting of 9 x 18PC4 together with PC2-5 engines represents the biggest diesel engine power station in the world (227.4 mw).

More than 200 units of S.E.M.T. Pielstick's PC4 family have been built or are on order at present. The oldest PC4 type has completed almost 80,000 operating hours.

The S.E.M.T. Pielstick PC40 engine design offers a concentration of important advantages, such as: extensive service experience accumulated over 10 years, high fuel efficiency, flexibility to almost all requirements or particular applications, simplicity in design, advanced technology, worldwide service points and spare parts availability.

ATLANTIC DETROIT DIESEL ALLISON

Circle 12 on Reader Service Card

The management of Atlantic Detroit Diesel Allison, Inc., has bought the Detroit Diesel Allison distributorship located in New York and New Jersey from Penske Corporation. The announcement was made recently by **Eugene C. Enlow,** president of the newly formed Atlantic Detroit Diesel Allison distributorship.

The new company will continue operations at four facilities in New Jersey and two locations in New York formerly owned by Penske.

Penske Power, Inc., has been the Detroit Diesel Allison distributor for the metro-New York/Northern New Jersey market since 1975. Its engineering, sales and marketing divisions have been active in high-performance marine propulsion systems for pleasure and commercial craft, power generating systems for both prime and standby applications (most recently eight 1,400 kw-units for Shearson-American Express World Financial center) and highly sophisticated onboard computerized monitoring systems for various diesel applications.

Penske's parts and service division introduced two-hour response time, "around the clock," to the City of New York and is currently under contract with many large metropolitan area fleet customers.

BERGEN DIESEL

Circle 15 on Reader Service Card

One of the latest designs from Bergen Diesel of Norway, the Type BR, is a four-stroke, turbocharged and intercooled engine with a bore of 320 mm and stroke of 360 mm. It is available in an in-line configuration with six, eight, or nine cylinders, with maximum continuous ratings of 425-500 bhp per cylinder at engine speeds of 720/750 rpm.

Type BRM for main propulsion has engine ratings of 3,000-4,500 bhp at 750 rpm. Ratings of the Type BRG for power generation range from 2,015 to 3,020 kw at 720 rpm/60 Hz, and 2,100-3,150 kw at 750 rpm/50 Hz. Backed by more than 20 years of experience with heavy fuel operation, Bergen's BR series is an engine design that aims at very high reliability and long intervals between overhauls, even when running on the poorest qualities of heavy fuel. Excellent access is provided for all maintenance work, and special tools such as hydraulic tightening jacks for the important bolt connections further ease and reduce maintenance time.

The cylinder block is a one-piece design with underslung crankshaft, a very rigid structure in nodular cast iron. Cylinder liners are centrifugally cast, with bore cooling only for the upper part where needed. The cylinder head is a bore-cooled design with thick bottom for good control of mechanical and thermal loads. The fully forged crankshaft with continuous grain flow has a large diameter journal and pin for low bearing loads.

Connecting rods are forged in alloy steel and machined all over. Bearings are steel-backed with lead/bronze bearing material and soft overlay. Pistons are of two-piece design, with three compression rings and one oil scraper ring, all chromium-plated to insure low wear rates. The fuel injection system of L'Orange make was developed for 1,400 bar injection pressure and has constant pressure unloading for cavitation-free operation at all loads/speeds.

CATERPILLAR

Circle 14 on Reader Service Card

In May, Caterpillar, Inc., Mossville, Ill., increased production of its popular 3600 Engine Series and advised its dealers to begin full-scale marketing.

The 3600 Engine Family of four-cycle engines has a bore of 280 mm and a stroke of 300 mm. The 3600 Family, with an engine speed range of 720 to 1,000 rpm, has four members: in-line six- and eight-cylinder versions, a V-12 and a 4,500-kw continuous-rated V-16.

After 10 years of development and over three years and 500,000 operating hours, the 3600 Family is a proven performer. Customers throughout the world are responding favorably.

For example, in the U.S., the M/V Ce'Cile Erikson's 3606 engine has accumulated over 22,000 hours operating between Georgia and the Caribbean islands. Ashland Oil, Cincinnati, Ohio, recently chris-

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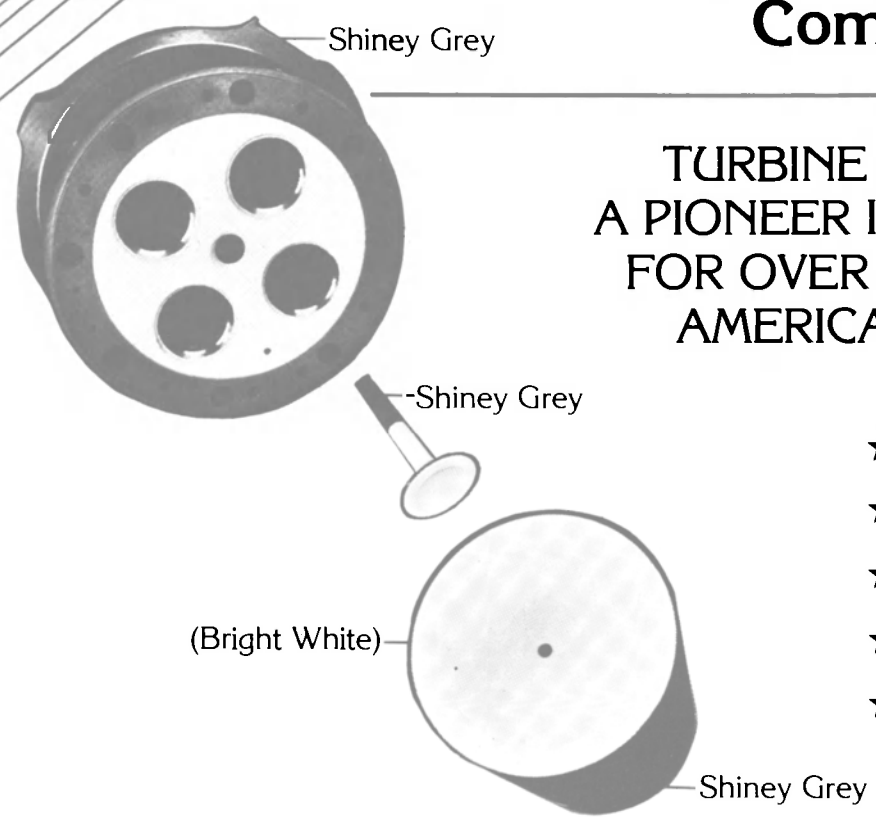

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(continued)
tened the last in a series of three 4,200-hp towboats, the SuperAmerica, all of which are powered by twin 3606s.

In Europe, a Norwegian trawler/processor has accumulated over 6,000 operating hours on her 3608 engine. In the Netherlands, the M/V Onderneming III is moving cargo on the Rhine River using a 3606 with over 7,000 operating hours. In France, four new trawlers are being outfitted with 3606s.

In Asia, eight 3606s are bound for new tugboats in China.

In addition, the U.S. Navy is using five 3608 generator sets aboard the new AOE-6 resupply ships.

Caterpillar designed the 3600 for efficient heavy fuel operation. Heavy fuel units are operating in the Great Lakes, Canary Islands, Belgium and Brazil. The first oceangoing containership to benefit from Cat 3600 heavy fuel auxiliaries will be repowered this month.

Excellent fuel consumption is achieved by using a high-pressure unit injector combined with efficient turbocharging of the laboratory-developed combustion system. As a result, Caterpillar will guarantee specific fuel consumption dependent on fuel specifications.

CUMMINS

Circle 16 on Reader Service Card

Cummins Engine Company, Inc., Columbus, Ind., which had acquired majority ownership of the Onan Corporation in early 1986, has announced an agreement with Hawker-Siddeley and Onan whereby Cummins will assume responsibility for the Onan L Series diesel engines. Under the agreement, which covers only the L Series diesel engines, the engine will be designated the Cummins A Series.

With the addition of the A Series, Cummins power range will be expanded to 41 horsepower on the low end. This enables Cummins to offer diesel power for a wide variety of applications from 41 to 9,000 hp.

The Cummins A Series engine family, which will open up a number of new markets for the company, consists of three, four and six-cylinder naturally aspirated models, as well as a six-cylinder turbocharged model. These engines, which are smaller than the Cummins B Series, offer a wide power range of 41 to 120 hp at 3,600 rpm (compared to the B Series automotive rating of 105 to 186 hp at 2,800 rpm). The A is designed as an in-line, four-stroke, water-cooled engine and employs an indirect injection system. It can be used in generator set, marine auxiliary propulsion and small industrial equipment applications.

DETROIT DIESEL

Circle 17 on Reader Service Card

Since 1938, the name Detroit Diesel on a marine diesel engine has represented reliable, durable performance. Detroit Diesel Corporation (DDC) offers diesel engines ranging from 5 to 2,200 horsepower.

Detroit Diesel Corporation introduced its new 6V-53TI diesel engine rated at 400 bhp during the 1988 Miami International Boat Show. This engine has many of the same premium features that are found in larger Detroit Diesel engines such as replaceable cylinder liners, cast iron crosshead pistons, four-valve heads and unit fuel injectors.

The 6V-53TI offers customers fuel economy, performance and reliability.

Because of advanced component technology, the new 6V-53TI provides 25 percent increase in power levels. Approximately 1-1/4 horsepower per cubic inch displacement means the 6V-53TI produces more speed with less engine weight and better power-to-weight ratio.

The 6V-53TI is a compact power package that features a totally watercooled turbocharger and exhaust system providing a cooler environment below deck and more room where the engine has to work.

Available this fall, the new Detroit Diesel 16V-149TI engine is rated at 2,200 horsepower. The engine is a result of extensive development programs which have resulted in features such as totally watercooled turbochargers, risers and exhaust manifolds. Turbo-matching to the engine provides improved performance, clean exhaust and fuel economy improvements.

The 2,200 hp 16V-149TI was derived from a patrol application developed and placed in service two years ago. DDC anticipates the same excellent durability and relaibility for this new engine.

DEUTZ-MWM

Circle 18 on Reader Service Card

The Marine Division of Stuttgart-based engine builder J. Wizemann GmbH & Co. has joined forces with Motoren-Werke Mannheim AG for cooperation in the passenger boat propulsion engine sector.

According to the management of the two companies, under the agreement Wizemann intends to match, at its marine center at Hochberg, Germany, Deutz MWM basic engines to the particular requirements of passenger vessel application. All worldwide sales regarding these engines will be undertaken by Deutz MWM sales organization.

Under the program, Wizemann will adapt the engines' cooling, exhaust and fuel supply systems, the electronics, auxiliary drives and mounting.

The partnership is based on Deutz MWM's solid basic engines backed by an efficient worldwide sales and service organization and Wizemann's extensive experience in matching an engine to the special requirements of passenger boat application.

The first marine engine the two companies introduced under their new cooperation is the WD 234 V12TI rated at 810 kw (1,100 hp). Preproduction units are due to be available in November 1988. The beginning of regular production is scheduled for January 1989. The two companies expect to sell 200 units by 1990.

Besides the WD 234, Deutz MWM offers the medium-sized 604B diesel engine series, specially designed for fast ships and passenger vessels. The series covers a power range of 1,000, 1,500 and 2,000 Kw (1,400, 2,000 and 2,700 hp).

At present, Wizemann is preparing another propulsion engine for passenger boat application. This is a six-cylinder, turbocharged, charge air-cooled in-line engine of the Deutz MWM 226B Series which includes two- , three- , four- and six-cylinder models. A prototype is due to be tested early in 1989, while the beginning of regular production is scheduled for mid-1989.

ELECTRO-MOTIVE

Circle 22 on Reader Service Card

The latest diesel engine design from the Electro-Motive Division (EMD) of General Motors is the 710G Series, offering increased reliability, better fuel economy, and the potential for significantly higher horsepower in the future. The new design is an evolutionary development of EMD's turbocharged, uniflow-scavenged, two-stroke cycle engines. The simplicity of design, maintainability, and high reliability of those engines have been retained in the new design.

The 16-cylinder 710G is rated 3,600 bhp at 900 rpm for marine applications. It has a bore of 9.06 inches, stroke of 11 inches, and displacement of 710 cubic inches per cylinder.

The design of the 710G is a logical outgrowth of EMD's current production series, the 645F engines. The most recent version of that series, the 645FB, is the result of a succession of incremental improvements. From 1980 to 1983, for example, the fuel efficiency of the 645F was increased by six percent and the compression ratio was raised from 14.5:1 to 16:1.

The 710G can also be viewed as a new dimension in engine design in terms of its potential for future development. Greater displacement and an advanced-design turbocharger give the 710G the capacity for significant increases in horsepower. Thus, the 710G combines innovation with the proven technology of its predecessor, but its potential makes it more than just this year's model.

The 710G is EMD's most fuel-efficient engine to date; full-load consumption has been improved by nine percent over the 1980 645F3 engine.

The longer stroke and added displacement of the 710G led to structural improvements in the engine, including: new Model G crankcase; larger-diameter plunger injectors; larger-diameter crankshaft; longer cylinder liner; and longer piston and rod assembly. Overall dimensions also increased; the 710G is 4⅝ inches longer and 1⅝ inches higher.

The added engine length is the result of a larger, extremely efficient turbocharger. Entry to the turbine was streamlined to improve gas flow, and an improved exhaust diffuser also reduces flow restriction. The turbocharger is deeper to accommodate a larger annulus for a smoother and less restrictive discharge of exhaust gases. Overall, the turbocharger is said to be the most efficient ever produced by EMD.

The state-of-the-art G turbocharger provides a 15-percent increase in air flow for reduced thermal loading of critical engine components. This higher air flow, combined with an increased injection rate from the new 0.56-inch plunger injector, accounts for the increase in fuel economy at rated output, with no increase in engine thermal loading.

A key concern in the development of a large-displacement diesel is reliability. Throughout the development of the 710G, EMD used advanced laboratory techniques to analyze stress and predict performance. Finite element analysis and comprehensive strain-gauge testing were used extensively to take full advantage of EMD's broad experience with the 645 engines. Total development cost of the 710G was $60 million, and the tooling cost alone was $78 million.

GRANDI MOTORI

Circle 19 on Reader Service Card

"GMT" is the trademark that distinguishes the large and medium-sized diesel engines designed in Italy by the Grandi Motori Division of Fincantieri-Cantieri Navali Italiani SpA, with the continuing experience and technology accumulated since the beginning of the century.

The engines designed and built by GMT are characterized by their reliability, ease of operation and maintenance and low-operating cost.

The GMT production range including high-speed engines (with 210 and 230-mm bores) and medium-speed engines (with 420 and 550-mm bores) has recently been expanded with the newly designed A320 Series (320-mm bore by 360-mm stroke) developing 500 hp/cylinder at 750 rpm.

The prototype has been tested at the brake for more than 2,000 hours and is still undergoing running tests for various different applications under extreme conditions.

Seven engines of this family, which will be fitted in generating sets for marine application, are already under production, while four others will be employed for both propulsion and stationary applications.

GMT production is characterized by its competitiveness in applications for the navy, marine industry,

railways, gas and bio-gas plants, urban co-generation plants, etc.

ISOTTA FRASCHINI

Circle 20 on Reader Service Card

Isotta Fraschini SpA of Italy designs and manufactures a broad range of diesel engines for various applications. The ID 32 Series for marine propulsion offers a power range from 180 to 400 bhp at 2,700 to 3,000 rpm.

The ID 38 Series is rated from 180 to 400 bhp at 2,700-2,900 rpm for workboat propulsion, and 500 bhp at 3,000 rpm in military applications. The ID 36 Series has a power range of from 300 to 1,320 bhp at 1,650-1,800 rpm for workboats, and up to 1,600 bhp at 1,900 rpm for military vessels.

The ID 36 engines are available in V configuration with 6, 8, 12, and 16 cylinders; a 10-cylinder version is under development. All production engines in this series are available in amagnetic versions.

Isotta also manufactures, under license, the Paxman Diesel model PV2000 engine, which has a power range from 1,000 to 4,500 bhp at 1,600 rpm.

KRUPP MAK

Circle 23 on Reader Service Card

A medium-speed diesel engine designed for heavy fuel operation and low fuel consumption is an ideal basis for engines with the load profile for naval operations.

Diesel engine manufacturer Krupp MaK, which has more than 100 years' experience in naval equipment, offers a number of medium-speed, four-stroke heavy fuel engines in the output range from 740 to 9,900 kw (1,000-13,500 hp).

For example, Krupp MaK offers the heavy-fuel engines M453C and M332, both of which boost low fuel consumption. The company reports that both engines feature an excellent ratio of maximum to mean piston pressure, but a moderate, and therefore operational safe, values. Additionally, the moderate engine load permits a very favorable compression. The engines run very clean at low loads, partially as the result of high injection energy.

Both engines feature clean and simple construction. Through fine tuning and the use of high-grade spheroidal graphite iron casting, both engines feature excellent rigidity and thus low vibration.

The relatively long piston strokes of the MaK engines permit quiet running with high mechanical efficiency. The cylinder air exchange is more effective as with a short stroke engine. The engines are built for a low thermal load, in order to be suitable for heavy fuel oil operation. This provides the highest operational safety at frequently changing loads, which are usual in naval operation. A bonus feature of the MaK engines' designs is an extremely clean exhaust. The marriage of nitrided cylinder liners and the all-around chromium plating of the piston rings and associated ring grooves results in extremely low wear, and consequently, excellent lube oil consumption.

Since the engines are designed for rough operation, an unusually long overall service life is expected for naval operation. Piston rings should be changed after 20,000 hours, valves overhauled at 10,000 hours and pistons and cylinder liners should have a service life approximately equal to the life cycle of the engine itself.

MAN B&W DIESEL
Denmark

Circle 24 on Reader Service Card

MAN B&W Diesel's two-stroke engine program, the MC engines, is available with eight different cylinder bores, from 26 cm to 90 cm.

Three different stroke to bore ratios are available and the engines cover a nominal unit output range from 1,460 kw at 250 rpm to 47,280 kw at 90 rpm.

With these engines, which were introduced in 1982, being built by licensees throughout the world, MAN B&W holds a major share of the world market for low-speed diesel engine propulsion.

The engines are designed for high

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efficiency and reliability which is proven by their excellent service record aboard about 800 ships and the fact that virtually no major modifications or design changes have been necessitated over the years, proving the stability in design based on the company's long tradition in low speed uniflow scavenged diesels.

With fuel rates below 160 g/kwh, an engine efficiency of more than 50 percent is obtained, with established working cycle parameters. Further possibilities to enhance total economy are available in the form of layout flexibility, enabling the supply of tailor-made engines optimized for the ship designer's wishes for specific output/speed combinations.

Other possibilities exist in the use of standardized power take-offs (PTOs) and turbo-compound systems as well as in the establishment of integrated energy systems on board comprising both MAN B&W two-stroke main engines and four-stroke auxiliary engines.

Hence, wide application possibilities can be met with the MC engines and its pertaining pre-designed or tailor-made scope of system engineering.

MAN B&W DIESEL
Germany

Circle 27 on Reader Service Card

Even in the face of the difficult market conditions for marine newbuildings and stationary diesel power stations, medium-speed four-stroke engines built by MAN B&W Diesel have solidified their excellent market position. In the last 24 months, a total of 92 engines, developing over 980,000 hp, have been sold in the engine series 40/45, 40/54, 52/55 and 58/64. Two thirds of these engines power ships and one third are intended for diesel power stations. These sales figures were achieved in equal shares by the Augsburg works and the worldwide network of licensees. One noteworthy event was the sale of seven L40/54 diesel engines to Meyer Werft shipyard to power a new cruise liner being built for cruise operator Chandris.

Although the demand for large merchant vessels and the market for stationary power supply units both reached their lowest points to date in the last few years, MAN B&W Diesel was able to further increase its market share in the output range between 5,000 and 16,000 hp (3,676 and 11,264 kw), with their economical, technicallly advanced and refined four-stroke engines.

In the output range 500-2,000 kw, MAN B&W's Holeby works launched an upgraded version of the tried and tested "23 and 28" engine series. MAN B&W was able to secure a worldwide market share of 18 percent for marine auxiliary gensets in this output range. Its market success was mainly the result of design improvements achieved by the engineering department at Augsburg working in close cooperation with MAN B&W's licensees.

The new generation engines involved the further enhancement of the proven features which make these gensets ideal for burning heavy fuel up to IF 700 (7,000 sec. R1), without restrictions as to low-load operation or starting and stopping. In addition, various measures were implemented which open up new operating possibilities and provide for increased reliability. These features include: flexible engine layout; electrical output adjusted to best meet the needs of the operator. Further adjustment is also possible while the ship is in service so as to minimize specific fuel consumption; constant-pressure turbocharging; integrated charge air system—this system, for which a patent is pending, enables the genset to operate continuously at low-load down to idle. Thus generating back-up capacity is readily available at all times; and low space requirement—it was possible to reduce the length and width of the genset by optimizing the attachment of additional equipment.

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← Circle 304 on Reader Service Card

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MTU

Circle 26 on Reader Service Card

MTU of North America, Inc., the North American marketing, sales and service subsidiary of MTU Friedrichshafen, offers a full line of compact, high-speed diesel engines for marine applications ranging from 150 (183 Series) to 10,000 horsepower per engine.

The 396 Series is the most widely used version of MTU diesel engines for passenger boat applications. First developed in 1975 from the predecessor 331 Series engines, the 396 Series family is comprised of four-stroke, 90-degree V-configuration engines with six, eight, 12 and 16 cylinders of 3.96 liters displacement. The engines also feature direct fuel injection, liquid cooling (including a three-walled exhaust manifold), exhaust gas turbocharging and charge air cooling.

In the marine version, the 16V 396 TB94 produces 2,900 hp at 1,975 rpm (continuous power) and 3,480 hp at 2,100 rpm (maximum power). A power density of 215 hp/cylinder was achieved by raising the mean effective pressure from 17.3 to 23 bar. The unit's weight-to-power ratio is approximately 3.2 pounds/hp.

A digital electronic governor makes it possible to safely exploit the engine's power reserves and simplifies interfacing with the electronic propulsion plant monitoring and control system (MTU-developed MCS-4, one of the marine industry's most advanced systems). In conjunction with electronic engine monitoring, the governor controls additional functions including sequential turbocharging, cylinder cut-out and charge transfer, and very-high-pressure fuel injection, each working together to provide maximum power, fuel and operating efficiency.

PERKINS

Circle 25 on Reader Service Card

Perkins North America, Lawrenceville, Ga., a subsidiary of the Perkins Engines Group, Petersborough, England. Over the years it has become a leading supplier of diesel engines in North America, obtaining a major share of four market segments—welding, non-captive agricultural, material handling and marine—in the 50 to 350 horsepower range. In 1984, it expanded into the heavy-duty diesel market by acquiring Rolls-Royce diesels, and later, in a joint venture with ISM of Japan, introduced a small compact engine line known as the 100 Series. Perkins now offers a range from 10 to 1,200 hp.

Recently, Perkins launched a new line of light commercial marine diesel engines. The engines, comprising 16 different units, are being marketed as Power Prestige.

They include Perkins' newest Prima and Perama small diesels, the well-established four- and six-cylinder medium-sized Range 4 engines and the V8 and V12 units built at Perkins' Shrewsbury, U.K., factory.

Perkins recently added the M275Ti engine to its Range 4 Series. The turbocharged and charge-cooled six-cylinder engine has a power output of up to 187 kw (250 bhp) at 2,800 rpm.

In addition, Perkins launched the Perama and Prima compact, lightweight marine diesel engines.

The Perama engines include the M30 and M25, three-cylinder diesels offering 21.6 kw (29 bhp) and 18.6 kw (25 bhp) at 3,600 rpm.

The new Prima line consists of three models—the turbocharged Prima M80T offering 78 bhp at 4,500 rpm, followed by the naturally aspirated Prima M60 and M50 developing 59 bhp at 4,000 rpm and 50 bhp at 4,000 rpm.

SCANIA

Circle 28 on Reader Service Card

The Scania Division, Industrial & Marine Engines, of Saab-Scania, offers a number of diesel engines for both main shipboard propulsion and auxiliary power.

For onboard propulsion applications, Scania offers heat exchanger or keel-cooled engines for continuous uninterrupted service (ranging from 152 hp at 2,200 rpm to 379 hp at 1,800 rpm), medium-duty commercial service (296 hp at 1,800 rpm to 421 hp at 1,800 rpm) and light-duty commercial service (171 hp at 2,200 rpm to 450 hp at 2,100 rpm).

For auxiliary power applications, the firm offers engines for 50 Hz applications (ranging from 89 kw to 263 kw) and 60 Hz (101 kw to 296 kw).

In-line six-cylinder engines offered by Scania include the models DN 11, DS 11 and DSI 11 in keel-cooled and heat exchanger versions, as well as the models DN 9 and DS 9 in keel-cooled versions only.

Scania offers the V-8 DS 14 (turbocharged) in heat exchanger and keel-cooled versions and the V-8 DSI 14 (turbocharged and intercooled) in heat exchanger version only.

Built for economical operation and long service life, Scania engines incorporate Keystone-type piston rings which ensure good lube oil economy and an excellent seal between the piston and the cylinder wall, at the same time as they eliminate coking in ring grooves.

Another advantage of Keystone rings is that, in conjunction with other design features of Scania engines, they enable full load to be assumed instantly on starting without jeopardizing engine life.

SULZER

Circle 29 on Reader Service Card

The reknowned RTA low-speed diesel engine program of Sulzer Brothers Limited of Switzerland was expanded last year with the introduction of the RTA72 (720-mm bore). With four to eight cylinders, the RTA72 engines cover a power range from 7,680 to 28,000 bhp at speeds of 66 to 91 rpm.

Two 111,000-dwt crude oil tankers recently ordered in Yugoslavia by the Teekay Shipping group of the U.S. include the first contracts for Sulzer RTA72 low-speed diesel engines.

Ordered from the 3. Maj Shipbuilding Industry in Rijeka, Yugoslavia, the vessels will each be powered by a five-cylinder Sulzer RTA72 engine built under license by 3. Maj. Each have a maximum continuous output of 14,340 bhp (10,550 kw) at 78 revolutions per minute. Measuring about 810 feet long, the ships will have a service speed of 12 knots, and are due for delivery in 1988 and 1989.

The RTA72 is available in models with four to eight cylinders providing a power range of 7,680-28,000 bhp (5,640-20,560 kw) at speeds from 66 to 91 revolutions per minute. The 720 mm cylinder bore follows the RTA52, RTA62 and RTA84M designs providing comparatively lower rotational speeds than earlier RTA designs.

The RTA series is said to present one of the most cost-effective solutions for ship propulsion. Its overall economy combines the benefits of low-fuel consumption, low engine speeds, good waste heat recovery, high reliability, long times between overhauls, capability to burn low-quality residual fuels, and low maintenance costs, all supported by Sulzer's worldwide service network.

The integral power takeoff of RTA engines provides for both main engine-driven generators and efficiency booster exhaust power turbines. with PTO and waste heat recovery, RTA engines are reported to be ideal as integrated energy plants meeting all of the ship's requirements for propulsion, electrical power, and heating services in one simple prime mover.

Sulzer has also introduced a longer-stroke version of its 400-mm-bore, medium-speed four-stroke engine. The ZA40S is a long-stroke version of the proven ZA40 engine. By increasing the stroke from 480 mm to 560 mm, a significant improvement in fuel economy was achieved (4 grams per bhp-hour), while increasing the maximum continuous rating from 870 to 900 bhp per cylinder and lowering the engine speed from 580 to 510 rpm.

The longer stroke and resulting lower engine speed of the ZA40S have the advantages of: better combusion as the time available for combustion is increased; better mechanical efficiency due to lower frictional losses in the engine bearings; and improved combustion chamber geometry. All of these features contribute to the improvement in specific fuel consumption without inreasing the maximum firing pressure above 155 bar as in the ZA40.

The ZA40S engine is available as an in-line version with six, eight, or nine cylinders, and in a V configuration with 12, 14, 16, or 18 cylinders, and ranging in output from 5,400 to 16,200 bhp at 510 rpm. At an economy rating of 750 bhp per cylinder at 510 rpm, the V engines achieve a specific fuel consumption of 129 g/bhp-hr. By using an exhaust gas power turbine as an efficiency booster, the specific fuel rate can be improved by three percent to 125 g/bhp-hr.

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SWDIESEL

Circle 30 on Reader Service Card

Based upon decades of experience, Dutch engine manufacturer SWDiesel has developed a large variety of medium-speed engines ranging in power from 400 kw (536 hp) to 13,000 kw (17,433 hp).

The introduction of advanced computer design systems has led to the development of the new "G" version of the company's F240 engine. This new system makes it possible for engine components to be optimally designed and selected to form a tailor-made, client-required application of the diesel engine plant. The optional equipment includes cooling and heating systems for lubrication oil, fuel injection and fuel treatment, as well as safety monitoring and alarm devices. Through the CAD system, all drawings of engine dimensions, positions of pipe connections, and all necessary diagrams and flow sheets are produced. As a result, the customer is supplied with a complete package of information—tailored and matched to his particular application.

The new "G" version of the F240 has an improved fuel injection system resulting in a better fuel economy and reduction of thermal loading, especially for burning heavy fuels. The charge air system has been simplified compared to the former F240. The number of parts of the charge air system is more or less halved, with, consequently, a more accessible and easier design. This improved charge air system can be matched perfectly to the new highly efficient turbochargers and the increased air flow. The advanced injection system results in a faster and better combustion, especially with low grade fuels. Endurance tests have shown that the durability of engine components such as fuel injection nozzles, bearings, piston rings, pistons, etc., have resulted in better lifetimes than can be expected with the previous F240 version.

Comprehensive research, sophisticated calculating methods, and the latest tools and equipment have enabled SWDiesel to manufacture a well-balanced and modern diesel engine—powerful, fuel-efficient and highly reliable.

VOLVO PENTA

Circle 21 on Reader Service Card

Whether you need power for jobs requiring Heavy Duty (HD), Medium Duty (MD), or Light Duty ratings, Volvo Penta has a full series of engines from which to choose, with the extra equipment and accessories for specialized workboat needs. With propulsion systems performing reliably in over 100 countries worldwide, Volvo Penta has an array of powerful, efficient engines and a network of skilled technicians to serve virtually every commercial need, including multi-engine installatins for large vessels.

Developed from the start as workboat engines, the TAMD121D and TMD121C are the biggest, most powerful diesels in Volvo Penta's program. Both are direct-injected, in-line sixes with turbocharging, and the TAMD121D also features aftercooling for even better output and performance. The TAMD121D produces 367 hp at 1,800 rpm (HD), 388 hp at 1,900 rpm (MD), and 422 hp at 2,000 rpm, while the TMD121C develops 300 hp at 1,800 rpm (HD), 320 hp at 1,800 rmp (MD), and 340 hp at 2,000 rpm (LD), comparatively.

Developed with the help of sophisticated computer technology, the turbocharged and aftercooled TAMD71 and TAMD61 represent the latest developments in the field of diesel technology. The TAMD71 provides 222 hp at 2,000 rpm (HD), 292 hp at 2,500 rpm (MD), and 262 hp at 2,500 rpm (LD), while the TAMD61 produces 187 hp at 2,200 rpm (HD), 228 hp at 2,500 rpm (MD) and 306 hp at 2,800 rpm (LD). New cylinder heads with flame barriers increase gasket life, while new intake and exhaust channel designs give identical swirl characteristics for each cylinder, reducing smoke and increasing fuel efficiency. New gear-driven freshwater circulation

pump and a plate-type oil cooler team up to provide more effective cooling. Adjustable rear engine brackets make installation easier and anti-vibration mounts help reduce noise.

The 31 and 41 Series are a new generation of marine diesels for workboats, including three 4-cylinder and two 6-cylinder direct-injected models, available in naturally aspirated (31 Series only), turbocharged, and turbocharged and aftercooled versions. Due to lower heat losses with direct injection, fuel consumption has been slashed by about 15 percent, without losing the exceptionally good acceleration and response.

WARTSILA DIESEL

Circle 32 on Reader Service Card

Finnish engine maker Wartsila Diesel has introduced the Wartsila Vasa 46, an innovative medium-speed, four-stroke heavy fuel engine designed for maximum operational reliability. The most significant design features of the Vasa 46 are the thick-pad technology for reduced bearing loads, the new SwirlEx charging system for high efficiency at all loads and speeds and Twin Injection, the double injection system for a high rate of combustion and low fuel consumption. The anti-vibration technology of the Vasa 46 includes rigid engine structure, full balancing and resilient mounting. The output range of the engine is 3,600-16,300 kw (4,828-21,858 hp) at a speed range of 450-514 rpm.

The first Vasa 46 installation will be aboard a multipurpose RO/RO vessel being built at the J.J. Sietas Shipyard in Hamburg. The vessel, scheduled for completion in September 1988, will have a six-cylinder Vasa 46 as her main engine.

In another installation, English United Baltic Corporation's new RO/RO vessel under construction at Hyundai Heavy Industries' Ulsan shipyard will be equipped with a "father-and-son" engine arrangement consisting of a six-cylinder and a nine-cylinder Vasa 46 main engine.

Vasa 46 main engines will also be installed on two new passenger/car ferries under construction for Finnish-Swedish Silja Line.

Another recent introduction from Wartsila is the Wartsila Vasa 22/26, a powerful medium-speed auxiliary engine. This engine is well-suited for power production in different types of vessels. Rigid design of the components combined with an optimized combustion process guarantees reliable and economical operation at all loads, even on the lowest grade heavy fuels. The Vasa 22/26 has a cylinder bore of 220 mm and a piston stroke of 260 mm. The output range is 54—3,000 kw at speeds ranging from 720 to 1,100 rpm.

The latest achievement in the development of the Wartsila Diesel engine range is the Wartsila Vasa GD, a new gas diesel engine that can operate on a wide variety of fuels, from poor quality heavy fuel to high quality hydrocarbon gases without any engine modification or loss of power. The Vasa GD is a multifuel engine well suited for a number of different installations: offshore power plants, pumping and compressor stations and fuel-off-the-well operation in the oil industry.

Davy And McDermott Form Joint Company

Davy Corporation and McDermott International have agreed to form a joint company for project management, design engineering, procurement, onshore and offshore construction management services for the oil and gas exploration and production industry in the U.K. sector of the North Sea. The company will also undertake work in the U.K. for projects outside this sector.

The new company, Davy McDermott Limited, will be owned 51 percent by Davy and 49 percent by McDermott.

Annual sales of Davy and McDermott total around 2.5 billion.

SNAME To Hold 1988 Ship Production Symposium In Seattle, August 24-26

The 1988 Ship Production Symposium, sponsored by the Ship Production Committee of the Society of Naval Architects and Marine Engineers (SNAME) and hosted by its Pacific Northwest Section, will take place August 24-26, 1988 at the Edgewater Inn in Seattle, Wash.

The theme of this year's technical program is "Improving Shipbuilding Productivity: Repair-New Construction-Conversion."

Productivity is the key to the survival of American shipbuilding. Rapid improvements are occurring in design techniques, equipment, and production methods and concepts as applied to new construction, repair and conversion.

Steering committee chairmen **E.W.H. Clendenning and Jesse W. Brasher** have organized 23 diversified technical presentations and panel discussions by experts on the theme subject. This well-rounded program provides information on the latest advances in this rapidly changing industry.

On Wednesday, August 24, the opening session of the technical program will be a discussion of "Status of NSRP/U.S. Shipbuilding," with Mr. **Brasher, Virgil Rinehart** from the Maritime Administration, and **Edward T. Kenny** from the U.S. Navy. Rear Adm. **Malcolm MacKinnon III,** USN, will deliver the keynote luncheon address. The technical program is complemented by tours and social activities that will enhance registrants' appreciation of the Seattle area.

On Friday, August 26, three tour groups are planned. One tour will take in the Pacific Museum of Flight and the Bird-Johnson Propeller Plant. Two tours are scheduled for the Boeing Airplane Plant and the Bird-Johnson Propeller Plant.

Spouses and guests can take advantage of the City of Seattle tour and lunch on Wednesday, August 24 from 10 a.m. to 2 p.m.

For registration information, contact: The Society of Naval Architects and Marine Engineers, 601 Pavonia Avenue, Jersey City, N.J. 07306; telephone: (201) 798-4800. Due to a limited number of rooms, the Society is offering an early registration discount before July 22.

New Component Improves Operating Performance Of Omnipure MSD

Continuing development of the Omnipure Marine Sanitation Device (MSD) has resulted in a new configuration of the Omnipure Electrocatalytic Cell, or Book Cell. As described in a product information sheet, this new component will significantly improve the operating performance of the Omnipure MSD, while simultaneously increasing the operating life of the cell through easier maintenance and repair.

All Omnipure MSDs are currently manufactured by EES Corporation and being fitted with the Book Cell. The cylindrical model of this component is now obsolete and is no longer available. The Retrofit Kits are complete, self-contained packages that will facilitate the installation of the Book Cells to existing MSDs currently having the old style, or cylindrical cell.

For more information and free literature,

Circle 74 on Reader Service Card

STAL Refrigeration AB Secures $6-Million Order For Cooling Installations

STAL Refrigeration of Sweden has secured one of the largest individual orders ever for cooling systems on board ships. The order is valued at close to $6 million.

The order is for refrigeration installations for the air conditioning of three cruise liners that are being built by the Wartsila yards in Finland for Carnival Cruise Line (CCL) of Miami, Fla. Each vessel will carry 2,600 passengers.

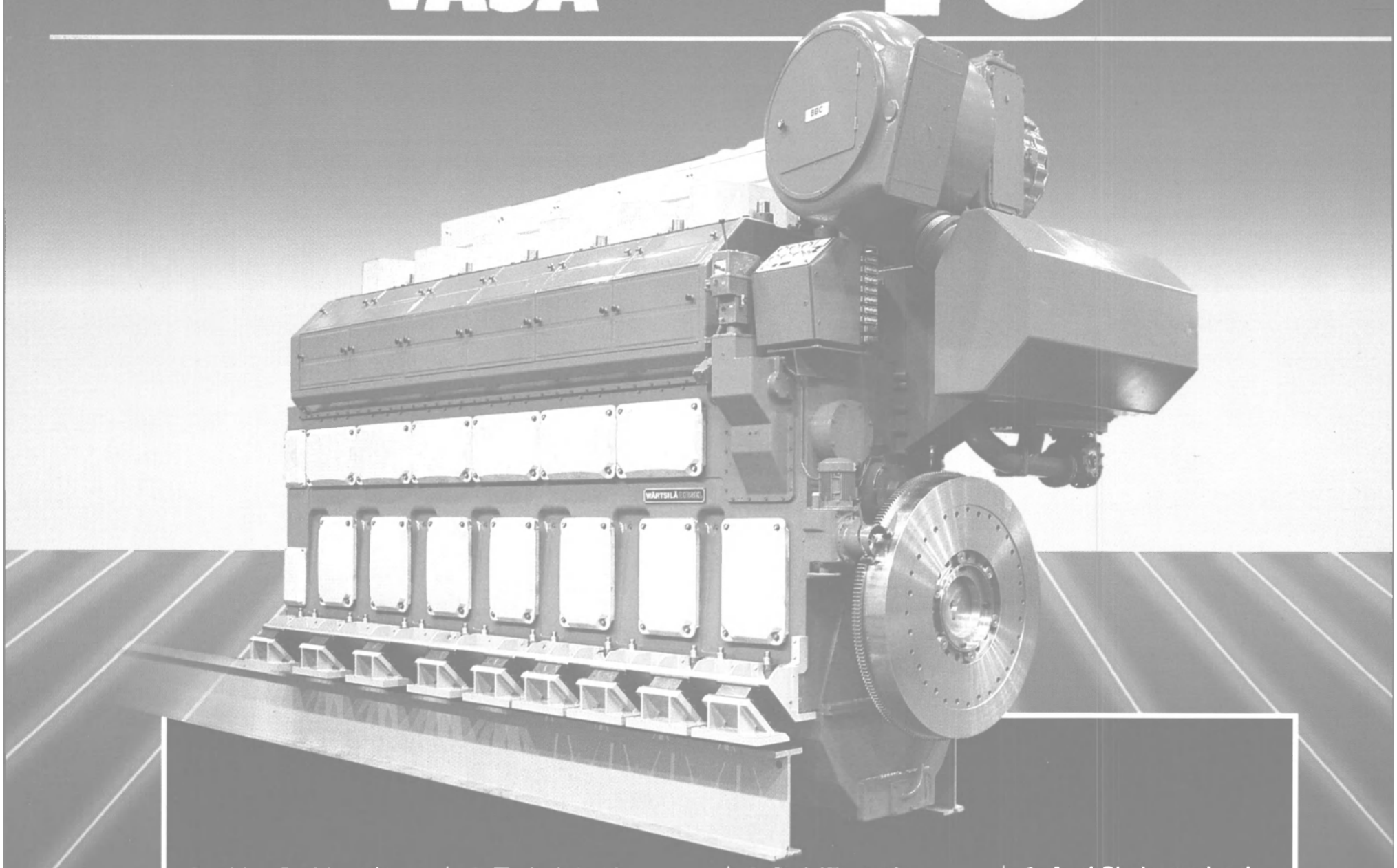
With these three new vessels in their fleet, CCL is believed to be the largest cruise operator in the world. For free literature giving full information on STAL Refrigeration AB,

Circle 76 on Reader Service Card

Circle 300 on Reader Service Card →

THE REALLY RELIABLE ENGINE

WÄRTSILÄ VASA 46



- Thick-Pad bearing technology is the revolutionary concept for bearing reliability.
- Twin injection ensures the lowest fuel consumption and reliable combustion on really heavy fuels.
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- Anti-Shake technology incorporates rigid engine structure, full balancing and an option for resilient mounting. All make for onboard comfort.

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Tlx. 147074 wdi ct
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Marrero (New Orleans), LA 70072
Tel. (504) 341-7201
Tlx. 810-951-6386 wartsila marr
Telecopier (504) 341-0426

The Fredholm is powered by a single five-cylinder, two-stroke MAN B&W L70MCE engine, which develops 10,900 bhp.

Burmeister & Wain Christens Panamax Product Tanker

Danish shipbuilders Burmeister & Wain recently christened the ninth in a series of Panamax 59,999-dwt product tankers, built by the yard since 1985.

The M/T Fredholm, which was christened by **Jacqueline Weil,** was contracted by K/S Frederiksholm, a Danish partnership. Like her sister ship, the M/T Chrisholm, the Fredholm will be operated by Norwegian shipowner Torvald Klaveness & Co. A/S.

The Fredholm has an overall length of 750 feet, breadth of 106 feet, design draft of 38 feet, scantling draft of 54-1/2 feet and cargo tank capacity of 90,500 m^3. She is powered by one five-cylinder, two-stroke, MAN B&W L70MCE diesel engine, which develops 10,900 bhp at 84 mcr. She is fitted with a 23-1/2-foot-diameter propeller. Her average speed at loaded design draft is about 15.1 knots.

The Fredholm is a single-screw tanker built to Det norske Veritas class and is to be classed and registered +1A1 "tanker for oil and caustic soda, COW, EO, INERT," and in accordance with the International Convention for the Prevention of Pollution of the Sea, and the U.S. Coast Guard's rules and regulations for foreign flag tankers.

Besides the Fredholm, which is due to be delivered this month, Burmeister & Wain shipyard has orders for two additional product tankers from PetroBulk Carriers A/S, which are due to be delivered in December 1988 and April 1989, respectively.

For free literature fully detailing the shipbuilding and ship-repairing services of Burmeister & Wain,

Circle 50 on Reader Service Card

BHP Petroleum Orders Production Barge From IHI

Ishikawajima-Harima Industries (IHI) of Japan recently received an order from BHP Petroleum of Australia to build a 140,000-dwt barge which will be used as an oilfield production/storage facility. The unmanned barge will be utilized at the Challis field in the Timor Sea.

Earlier, BHP had ordered a 90,000-ton crude oil carrier from IHI. She will be chartered by BHP Petroleum and operated by BHP Transport.

Castrol
MARINE OILS

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2 MAJOR NEW MARINE OILS FROM Castrol

CDX 30

A 5 TBN alkaline detergent system oil specifically formulated to meet the requirements of all current and future crosshead engines. Through a carefully designed additive system it imparts excellent water-shedding and rust protection qualities, high oxidation resistance and thermal stability coupled with the load carrying properties of a gear oil.

MLC 30

The product of continuing development. MLC 30 is a 12 TBN heavy-duty formulation suitable for use in those higher rated engines using distillate fuels. It surpasses the MIL-L-2104C and API-CD performance levels and will find most usage within the coastal, inland waterway and fishing market segments.

MLC has gained approvals from all principal medium speed engine manufacturers.

Performance and Protection — A Worldwide Promise

Circle 133 on Reader Service Card

Castrol Inc., Raritan Plaza II, Raritan Center, Edison, New Jersey 08837, Telephone No. (201) 225-6390, Telefax No. (201) 225-1069, Telex No. 219894 "CASED UR"
FOR MORE INFORMATION ON CASTROL AND THEIR WORLDWIDE SERVICES TO THE SHIPPING INDUSTRY, PLEASE CONTACT YOUR LOCAL CASTROL MARINE OFFICE OR CASTROL LIMITED, INTERNATIONAL MARINE, BURMAH HOUSE, PIPERS WAY, SWINDON, WILTSHIRE, SN3 1RE ENGLAND. TELEX 449221. TELEPHONE (0793) 30151

MMS Brochures Detail Cost-Cutting Ship And Shore Management Systems

Marine Management Systems (MMS), a leader in providing computerized management information systems for the shipping industry, is offering a free set of brochures describing these systems, as well as various services offered by the company.

"MMS—An Overview," one of the brochures included in the literature, points out that MMS deals exclusively with the shipping industry to provide services in the areas of shipboard and shoreside applications systems and management consulting; that MMS has chosen as its microcomputer the IBM® PC (personal computer) which offers the power, speed and versatility to meet all shipboard and shoreside requirements; and that MMS can offer clients a full range of hardware, software and support, all from a single source.

Other brochures offered discuss the MMS "Planned Maintenance System" (PMS), which is described as an efficient, orderly and comprehensive system to help reduce ship repair and downtime costs; the MMS "Spare Parts Inventory Management System" (SPIM) which offers vessel operators the ability to exercise precise control over spare parts inventory; and the MMS "Condition Monitoring System" which, according to MMS, provides an easy-to-use shipboard predictive maintenance capability by offering the ability to detect problems in equipment before failures occur.

Also included is a brochure on the Cargomax load, stability and stress calculation system. The heart of Cargomax is a multipurpose IBM PC Microcomputer that uses a vessel loading program specially designed to reflect the physical characteristics of a ship. MMS says that with Cargomax, ship stability and stress calculations are performed quickly and precisely so that cargo is distributed in a way that maximizes the capacity of a ship while guaranteeing its safety.

With regard to hardware, MMS systems operate on MS DOS personal computers. With MMS' position as a full-service dealer for IBM, Zenith, Epson and others, they offer clients a full range of hardware, software and support, all from a single source.

For further information and free copies of the brochures on systems and services offered by MMS,

Circle 98 on Reader Service Card

Clipper Navigation Names Don Auburn Port Engineer

Clipper Navigation, Inc. has selected **Don Auburn** as its port engineer. Mr. **Auburn** has 40 years of marine engineering experience.

Mr. **Auburn** will be responsible for all aspects relative to the maintenance of the Victoria Clipper and its mechanical and electrical systems.

The Catalina Flyer, built by Nichols Brothers Boat Builders, Whidbey Island, Wash., is powered by two specially lightened Catapillar 3516TA diesel engines.

Nichols Brothers Boat Builders Delivers 500-Passenger Catamaran

Reportedly Largest Passenger Catamaran Built In U.S.

Nichols Brothers Boat Builders, Whidbey Island, Wash., have delivered what is said to be the largest high-speed passenger catamaran built in the U.S. to Catalina Passenger Service, for service between Newport Harbor and Catalina Island in southern California.

The 118-foot, 500-passenger ferry, the Catalina Flyer, is the 10th of a series of passenger catamarans built by Nichols Brothers. Like the other vessels in the series, the Catalina Flyer is a Catamarans International-designed boat. Nichols Brothers and Gladding-Hearn Shipbuilding, Somerset, Mass., are the only U.S. yards licensed to build the Australian-designed boats. Nichols Brothers believes that the Catalina Flyer could be the largest high-speed catamaran built to date in terms of both size and passenger capacity.

The Catalina Flyer, which replaces the Catalina Holiday on the Newport-to-Catalina route for Catalina Passenger Service, is powered by two specially lightened 2,000-hp Caterpillar 3516 TA diesel engines coupled to Reintjes WVS-1023 2.538:1 reduction gears and fitted with Lips three-bladed Cunial-bronze propellers. She can reach speeds of about 30 knots, but will travel on her route at about 27 knots. Systems Engineering of Bothell, Wash., supplied her propulsion system controls. Hough Marine of Seattle engineered her electrohydraulic steering system. The Catalina Flyer's auxiliary power is supplied by two 40-kw generators driven by two John Deere engines.

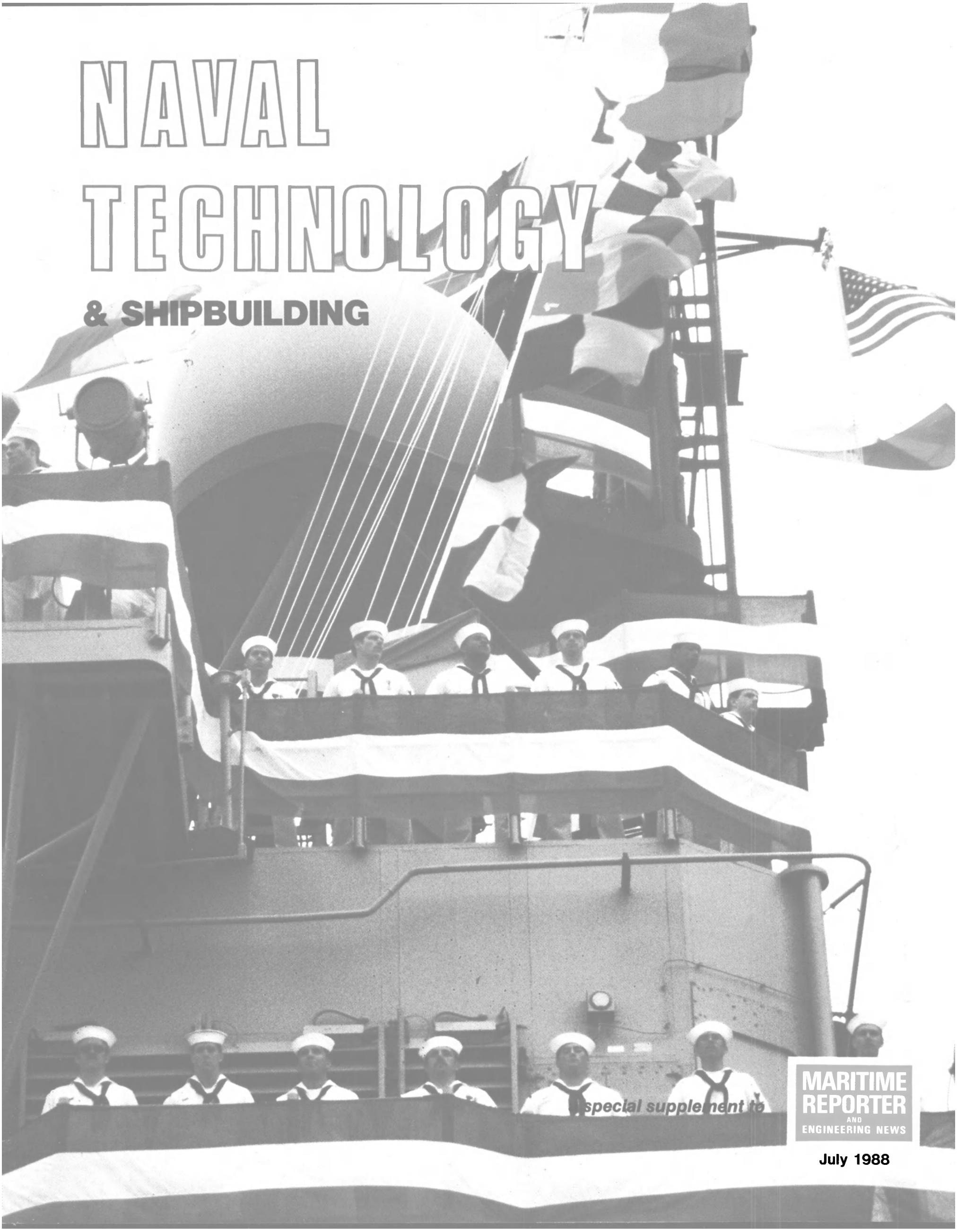
With a beam of 40 feet and a draft of 8 feet, the vessel will carry a maximum fuel load of 3,000 gallons. Fresh water tankage is 400 gallons.

The electronics equipment aboard the Catalina Flyer was provided by Northern Marine Electronics of Seattle. Equipment includes a Ross DR600D flasher, two ICOM VHF radios, Furuno 151OD and 8030D radars, a Sperry 8T autopilot and a Furuno LC-90 loran.

The Catalina Flyer offers snack and refreshment bar service with small dinettes in two enclosed cabins. Open air seating is provided

(continued on page 49)

NAVAL TECHNOLOGY & SHIPBUILDING



special supplement to

MARITIME REPORTER AND ENGINEERING NEWS

July 1988

Mechanical limit switches are still preferable to electronic proximity switches in most Navy applications. Here, a Namco Snap-Lock® switch controls a davit gearbox. Rugged Snap-Lock switches have reliably stood up to harsh environments like this for years.

"Are Limit Switches Too 'Old Fashioned' For Today's Navy?"

Not By a Long Shot.

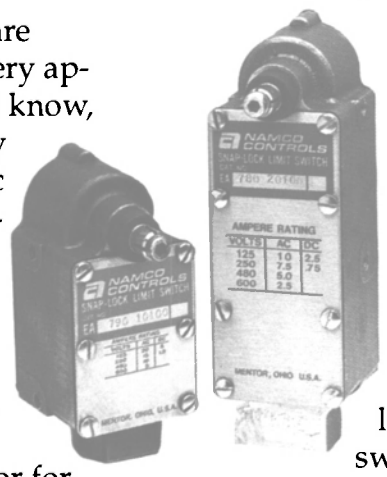
Here's Why...

Electronic sensors are great...but not for every application. We should know, since we make nearly all kinds of electronic and electro-mechanical switches, including proximity, photoelectric, fiber optic and laser sensors.

We also make limit switches, which, in our mind, are superior for Navy and marine tasks.

Why Limit Switches?

Most importantly, our limit switches are proven rugged and reliable. Right now, we've got thousands on the seas. All are made by Namco, the only supplier of nuclear qualified limit switches to the U.S. nuclear industry and Navy.



Additionally, our switches meet MIL-C-2212...just try to find a proximity switch that can.

Finally, our limit switches are "seaman-friendly." By that we mean repairable at sea, if necessary. Unfortunately, electronic switches cannot be fixed...just discarded.

All in all, knowing what mechanical and electronic switches can and can't do, we recommend mechanical limit switches for most Navy and marine uses. Call us, we'll be happy to show you more!

NAMCO

Mechanical Switches Are Best For Navy Use

- Meet MIL-C-2212
- Wide temperature operating range: -40°C to 150°C
- Nuclear qualified, including radiation
- High shock and vibration resistant
- Non-corroding and rust-resistant materials throughout
- Most performance for least dollars
- Carry high voltage and current
- Self-cleaning sliding contact or butt contact versions
- Submersible and watertight
- No special protection needed for RFI/EMI environments
- Multiple contacts, so that one switch can operate more than one system

Call or write for our Navy/Marine Switch Selector catalog.

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Circle 30 on Reader Service Card

BUSINESS OPPORTUNITIES IN THE NEW NAVAL TECHNOLOGY PROGRAM

By Dr. James R. McCaul, President
International Maritime Associates, Inc.

Over the next two years the U.S. Navy will spend more than $18 billion on developing new systems and equipment. The program offers many exciting business opportunities for manufacturers, engineering firms, systems integrators, etc.

Spending Is Up For New Technology

Navy R&D spending has grown impressively over the past 10 years. In 1980, the Navy spent $4.6 billion for R&D. This figure has now more than doubled—to $9.5 billion in 1988 and $9.2 billion in 1989. Exhibit 1, "Trend in the Navy R&D Budget," provides details on Navy R&D spending from 1980-1989.

Range of Technology Development

Navy technology development efforts range from the highly esoteric to the very practical. They include development of sensors for anti-air and antisubmarine warfare, C^3 systems for command and control, ship and naval aircraft development, missile and torpedo engineering, electronic warfare concepts, etc. Some of the most advanced technology is being developed—advanced composites, parallel computing, laser communications, distributed control systems, etc. And some of the more mature technology is being refined—hull forms, propeller design, mines, electric drive, navigation systems, etc.

Photo: The Navy's Aegis guided missile cruiser Bunker Hill (CG 52) on sea trials and the recently overhauled guided missile destroyer USS Preble (DDG 46).
Ingalls Shipbuilding photo.

Program Structure

There are more than 270 Navy R&D programs—grouped according to stage of development:

- 6.1 and 6.2 programs involve research and exploratory development;
- 6.3 programs deal with advanced development;
- 6.4 programs focus on system and component engineering.

Projects usually enter the system at the 6.1 or 6.2 level, transition to 6.3 when found feasible and move to 6.4 engineering as the final R&D stage. Transition into the procurement budget (SCN, WPN or OPN) follows successful test and demonstration. Funding requirements generally increase dramatically as a project moves through this development/production pipeline. Exhibits 2 and 3 depict project transition and a typical funding profile.

Business Strategy

Successful Navy contractors have often been involved in early stages of system R&D. For example:

- RCA traces its highly successful role as Aegis manufacturer and system integrator to involvement in R&D efforts in the 1960s. Procurement contracts received by RCA for Aegis systems now exceed $3 billion.
- Boeing's involvement in the Sea Lance stand-off weapon can be traced back many years to its role in early exploratory research.
- Martin Marietta's development role in vertical launch system design led to its current position as one of two VLS suppliers.
- GE's early and sustained involvement in sonar sensor R&D has positioned the firm as dominant sonar system supplier.

What distinguishes these firms is their use of the Navy funded R&D to: (1) establish initial position; (2) widen and deepen technical development; (3) evolve into a key developer role; and (4) transition into full production as sole source or lead manufacturer.

(continued)

Exhibit 1—Trend in the Navy R&D Budget

FY	$ (in billions)	Index (1980-100)
1980	$4.6	100
1981	5.0	109
1982	5.8	126
1983	6.1	133
1984	7.6	165
1985	9.2	200
1986	9.6	209
1987	9.4	204
1988	9.5	207
1989	9.2*	200

*Proposed

Source: Dep't of the Navy

(continued)

Opportunities exist for both large and small firms to employ similar strategy for future business development—using Navy R&D as the vehicle. This strategy entails: (1) developing an understanding of future R&D programs; (2) matching the firm's capabilities with these programs; (3) measuring the competition; (4) shortlisting programs and areas of interest; and (5) formulating and implementing a plan of action for initial entry and growth.

Entry can be either at prime or subcontract level. Contact with Navy managers in key activities will provide the basis for identifying prime contract opportunities. Contact with current prime contractors will provide the basis for establishing a position as subcontractor.

To illustrate the nature and extent of opportunities in Navy technology, one area—underwater sound surveillance systems—is described as detailed from an IMA Report.

Underwater Sound Surveillance Systems

The concept of planting listening devices on the ocean floor dates from WWII. After the war, the Navy began development of deep ocean arrays of hydrophones designed to listen for submarines. Since then, a number of sound surveillance system (SOSUS) arrays have been placed in position off the U.S. coast and in overseas locations.

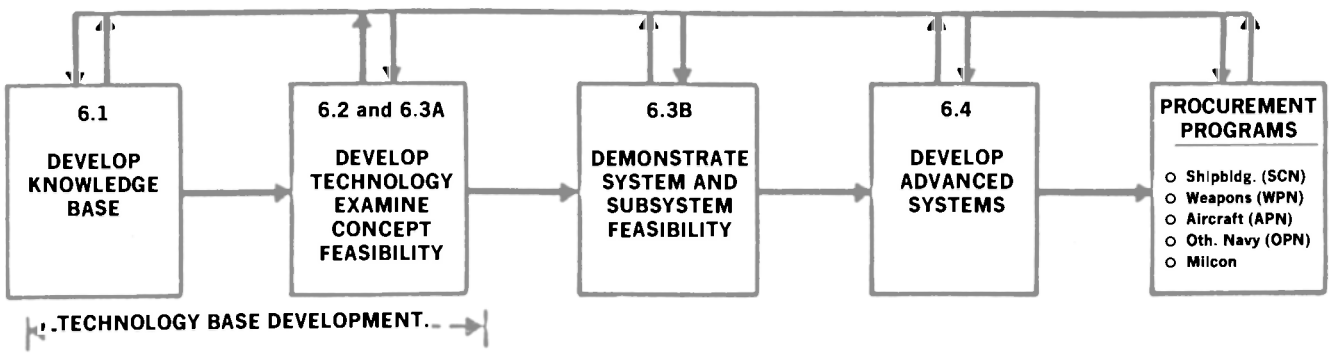
The IUSS program (PE 24311) is designed to improve underwater surveillance systems and hardware. Specific work includes: (1) software development for the Wide Band Acoustic Recall; and (2) development of prototype signal characterization algorithms.

FDS (PE 63784) is a major development program to design and install an advanced undersea surveillance system using fiber optic technology employing a large number of sensors in fields or barriers. Development efforts build on Bell Laboratories' experience in commercial fiber optic communications systems. Work involves development of multiplexer/sensor hardware, modified cable handling equipment and improved deployment technique.

Future Direction

Major IUSS milestones include sea trials in October 1989 and system EDM specification in September 1990. DNSARC IIA for the FDS was scheduled in May 1988. Prototype production is planned to start in July 1989. Final design specifications are to be completed by April 1990. Procurement plans call for 7,150 NM cable, 200 clusters, 205 multiplexers/repeaters and 339 repeaters by 1992.

Exhibit 2—R&D/Procurement Pipeline



Comments and Issues

Advances in quieting technology have greatly reduced the effectiveness of on-board listening devices. Offboard ASW sensors are a high priority element in the Navy's future ASW strategy. Development of the IUSS will expand on existing SOSUS capability. In the longer term, the Navy hopes to develop and deploy the FDS and plans to spend almost $700 million on FDS RDT&E through program completion.

How to Order IMA's Full Report on Naval Technology

A recently published report by IMA provides details for 204 specific naval technology development activities. Current and planned efforts are described. Navy managers and current key contractors are named. A five-year funding profile from FY 1985 through 1989 is provided for each program. Issues affecting future spending are discussed.

The report contains a four-year history of major Navy technology development and engineering contracts. These contracts are arranged in alphabetical order according to contractor. The period covered extends from January 1984 through December 1987.

Organization charts and names of key personnel in 13 commands or laboratories involved in naval technology development are provided.

The 220-page report is available for $550. It can be obtained by contacting: International Maritime Associates, Inc., 835 New Hampshire Avenue, N.W., Washington, D.C. 20037; telephone: (202) 333-8501. Telephone orders will be accepted.

Exhibit 3—Typical Funding Profile

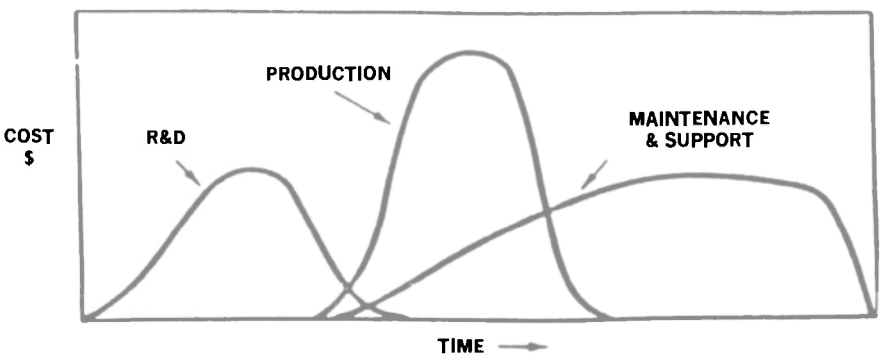


Exhibit 4—Navy Budget for Underwater Sound Surveillance Systems

	—millions of dollars— FY 1985	FY 1986	FY 1987	FY 1988
Underwater surveillance systems (IUSS) PE 24311	$31.9	$40.9	$35.0	$29.9
Fixed distributed systems (FDS) PE 63784	12.4	16.3	27.3	64.6[1]
Total RDT&E	**$44.3**	**$57.2**	**$62.3**	**$94.5**
OPN Funds	80.9	81.0	83.2	55.5
Milcon Funds	NA	5.8	10.0	0

Notes: 1. Navy asked for $76 million; final budget approval is for $64.6 million.

Planned Spending:

	—millions of dollars— FY 1989 Last Year's Plan	Current Budget Plan
Underwater surveillance systems (IUSS) PE 24311	$43.4	$40.9
Fixed distributed systems (FDS) PE 63784	112.0	104.9
Total RDT&E	**$155.4**	**$145.8**

Navy Managers:
Space & Naval Warfare Systems Command, Washington, D.C.
Naval Ocean System Center, San Diego, Calif.

Key Contractors:
Bell Laboratories, Whippany, N.J.
TRW, McLean, Va.
AT&T, Greensboro, N.C.

The YPs are of wood hull construction, with an aluminum superstructure, overall length of 108 feet, beam of 22 feet 9 inches.

Marinette Marine Delivers First Of Seven Training Vessels

The Naval Education and Training Center (NETC), located in Newport, R.I., recently took delivery of a new Class (YP-683) Yard Patrol training vessel. This YP is the first of seven YP-683 Class vessels the NETC will be receiving during the next three months from Marinette Marine Corporation, Marinette, Wis.

Marinette Marine, under contract to the U.S. Navy for 20 of the YP-683 Class Yard Patrol Boats, has delivered 13 of the vessels to the Annapolis Naval Academy, Annapolis, Md. The remaining vessels are scheduled for delivery to the NETC in Newport and will augment the existing fleet of YPs presently in use at the center for training students in basic seamanship, shiphandling and naval communications.

The YPs are of wood hull construction, with an aluminum superstructure, overall length of 108 feet, beam of 22 feet 9 inches, and full load draft of 5 feet 9 inches.

Marinette Marine Corporation is a firm of engineers and construction specialists providing military and commercial clients with the latest state-of-the-art ship design and construction.

For free literature giving full details on the facilities and capabilities of Marinette Marine,

Circle 64 on Reader Service Card

House Subcommittee Looks To Open Competition To Build Fourth Aegis Destroyer

The House Defense Appropriations Subcommittee recently added language to the FY 1989 defense appropriations bill which would order the Navy to open the competition to build a fourth Aegis guided missile destroyer to all qualified U.S. shipyards.

This, however, is based on whether or not the Navy will be able to come up with the funding to build a fourth Aegis destroyer. The Senate recently amended the FY 1989 defense authorization bill to authorize the Navy to purchase a fourth DDG-51 Arleigh Burke Class destroyer, without appropriating additional funding for the ship. The Navy was authorized by the Senate to use as much as $730 million of funds appropriated from previous years that remained available in order to build the fourth ship. The Navy had requested to build only three DDG-51s in FY 1989.

Last year, similar circumstances arose when the Senate authorized the Navy to build five CG-47 Ticonderoga Class guided missile cruisers, and only appropriated funds for four. The Navy, however, was able to come up with the funding. Like last year, industry analysts expect the Navy to find the funding to build the fourth destroyer.

Opening up the competition for the proposed fourth ship offers a glimmer of hope to Avondale Shipyards, New Orleans, La., which has been seeking to build the 466-foot ships. At present, only Bath Iron Works, Bath, Maine, which is the lead yard for the class, and Ingalls Shipbuilding Division of Litton Industries, Pascagoula, Miss., are constructing the ships. Bath is building the Arleigh Burke (DDG-51) and the John Paul Jones (DDG-53), while Ingalls is building the John Barry (DDG-52).

Arleigh Burke Class (DDG-51) destroyers are expected to be the backbone of the U.S. Navy, replacing both the older Adams Class (DDG-2) and Farragut Class (DDG-37) guided missile destroyers. With an overall length of 466 feet, beam of 59 feet and full load displacement of 8,300 tons, DDG-51s are powered by four GE LM2500 gas turbine engines to speeds in excess of 30 knots. The ships are fitted with sophisticated weaponary for long range strike, anti-surface, anti-air, and antisubmarine warfare capabilities.

In other areas, the House subcommittee only made slight changes in the Navy's shipbuilding plan. The subcommittee cut $107 million from the administration's request for the Trident submarine building program, lowering funding from $1.23 billion to $1.12 billion to construct one Trident. The subcommittee also cut $74 million from the administration's request to build a oceanographic research vessel (AGOR).

However, the subcommittee added three more fleet oilers (T-AOs) to bring the total to five ships. Funding for this program jumped from $284.9 million to $403.9 million.

Overall, the shipbuilding budget dropped slightly, from $9.13 billion to $8.77 billion.

Navy Awards $23.1-Million Contract To Bath Iron Works

Bath Iron Works Corporation, Bath, Maine, was recently awarded a $23.1-million U.S. Navy contract for lead yard services for the DDG-51 Class follow-on destroyers. Work is expected to be completed in May 1989. (N00024-87-C-2077).

Ingalls Shipbuilding Receives $7-Million Award For Cruiser Shakedown

Ingalls Shipbuilding Division, Litton Industries, Pascagoula, Miss., recently was awarded a $7-million contract by the U.S. Navy to conduct the post shakedown availability for the USS San Jacinto (CG-56). The work is expected to be completed in October 1988 (N00024-88-G-2818).

U.S. NAVY

CURRENT NAVY & COAST GUARD VESSELS UNDER CONTRACT AT U.S. YARDS

(As of May 1988)

SHIPYARD Navy Designation	NAME	APPROX. CONTRACT $	EST. DELIVERY
Avondale Shipyards			
T-AO-193	Walter S. Diehl	116,000,000	8/88
T-AO-195	Leroy Grumman	101,000,000	5/89
T-AO-197	Pecos	100,633,789	3/90
LSD-44	Gunston Hall	166,000,000	8/88
LSD-45	Comstock	153,400,000	2/89
LSD-46	Tortuga	153,400,000	4/89
LSD-47	unnamed	150,000,000	11/89
LSD-48	unnamed	150,000,000	5/90
Bath Iron Works			
CG-58	Philippine Sea	252,800,000	1/89
CG-60	Normandy	191,800,000	9/89
CG-61	Monterrey	191,800,000	12/89
CG-63	Cowpens	193,300,000	4/90
CG-64	Gettysburg	193,300,000	11/90
CG-67	unnamed	236,041,276	4/92
CG-70	unnamed	226,123,977	6/93
DDG-51	Arleigh Burke	321,000,000	7/90
DDG-53	John Paul Jones	189,900,000	7/92
DDG-51 Class	—	22,600,000[1]	5/92
DDG-51 Class	—	23,100,000[1]	5/89
Bethlehem-Sparrows Point			
T AGS-39	Maury	66,000,000	8/88
T-AGS-40	Tanner	66,000,000	2/89
Bollinger Shipyard			
WPB (16)	unnamed	99,306,516	2/90
General Dynamics-Electric Boat			
SSN-751	San Juan	280,100,000	6/88
SSN-752	Pasadena	280,100,000	10/88
SSN-754	Topeka	324,500,000	2/89
SSN-755	Miami	324,500,000	6/89
SSN-757	Alexandria	283,000,000	10/89
SSN-760	unnamed	258,166,750	2/90
SSN-761	unnamed	258,166,750	6/90
SSN-762	unnamed	258,166,750	10/90
SSN-763	unnamed	258,166,750	2/91
SSN-21 Class	—	28,900,000[3]	—
SSBN-734	Tennessee	523,700,000	12/88
SSBN-735	Pennsylvania	531,600,000	8/89
SSBN-736	unnamed	500,870,000	4/90
SSBN-737	unnamed	616,400,000	12/90
SSBN-738	unnamed	674,100,000	12/91
SSBN-739	unnamed	615,000,000	12/92
SSBN-734 Class	—	48,400,000[3]	12/88
SSBN-740	unnamed	644,000,000	7/94
Halter Marine			
T-AGOS-13	Adventurous	14,250,000	8/88
T-AGOS-14	Worthy	14,250,000	12/88
T-AGOS-15	Titan	13,844,067	3/89
T-AGOS-16	Capable	14,031,914	7/89
T-AGOS-17	Intrepid	14,031,914	11/89
T-AGOS-18	Relentless	14,031,914	3/90
Ingalls Shipbuilding			
CG-57	Lake Champlain		8/88
CG-59	Princeton	325,500,000	10/88
CG-62	Chancellorsville	238,600,000	6/89
CG-65	Chosin	242,600,000	11/90
CG-66	Hue City	193,980,662	10/91
CG-68	Anzio	163,980,664	4/92
CG-69, 71, 72 & 73	unnamed	769,142,667	1/94
CG-47 Class	—	215,982,000[6]	1/94
CG-47 Class	—	44,128,775[5]	—
CG-47 Class	—	3,608,809[6]	10/89
DDG-52	John Barry	162,149,000	9/91
LHD-1	Wasp	1,365,700,000	3/89
LHD-2	Essex	402,494,000	4/92
LHD-3	Kearsage	378,685,000[4]	1/93
DD-963 & DDG-993 Class	—	14,100,000[1]	3/93

SHIPYARD Navy Designation	NAME	APPROX. CONTRACT $	EST. DELIVERY
Intermarine USA			
MHC-51	Osprey	20,926,936	4/91
Lockheed-Gulfport			
LCAC (2)	unnamed	24,800,000	88
LCAC (7)	unnamed	115,586,281	—
LCAC	—	31,759,154[6]	90
Lockheed-Seattle			
LCAC (7)	unnamed	115,586,251	6/91
LCU (Army-7)	unnamed	26,000,000	—
Lockheed-Savannah			
LCU	Macon	—	5/88
LCUs (Army-12)	unnamed	—	7/88-11/89
Marinette Marine			
MCM-2	Defender	46,000,000	8/88
MCM-4	Champion	42,000,000	12/88
MCM-7	Patriot	51,848,816	10/89
McDermott Inc.			
SWATH T-AGOS-19	Victorious	25,424,347	2/90
YTT 8 & 9	unnamed	21,700,000	—
YTT 10	unnamed	10,913,817	5/90
NASSCO			
AOE-6	Supply	290,097,944	4/91
Newport News Shipbuilding			
CVN-72	Abraham Lincoln	1,550,000,000	12/89
CVN-73	George Washington	1,550,000,000	12/91
CVN-74	unnamed	724,368,395[6]	
CVN-75	unnamed		—
SSN-688 Class	—	22,000,000[1]	10/88
SSN-723	Oklahoma City	225,100,000	5/88
SSN-750	Newport News	278,000,000	8/88
SSN-753	Albany	319,000,000	7/89
SSN-756	Scranton	259,833,000	9/89
SSN-758	Asheville	259,833,333	1/90
SSN-759	unnamed	259,833,333	6/90
SSN-760	unnamed	55,000,000[6]	—
SSN-764	unnamed	257,118,500	2/91
SSN-765	unnamed	257,118,500	5/91
SSN-766	unnamed	257,118,500	8/91
SSN-767	unnamed	257,118,500	11/91
SSN-21 Class	—	325,000,000[7]	2/94
SSN-21 Class	—	28,900,003[3]	—
Pennsylvania Shipbuilding			
T-AO-191	Benjamin Isherwood	111,000,000	10/88
T-AO-192	Henry Eckford	111,000,000	5/89
T-AO-194	John Ericsson	97,500,000	2/90
T-AO-196	Kanawha	95,025,000	11/90
Peterson Builders			
MCM-3	Sentry	57,900,000	7/88
MCM-5	Guardian	57,900,000	6/89
MCM-6	Devastator	48,287,461	8/89
MCM-8	Scout	48,287,461	6/90
Robert E. Derecktor Shipyard			
WMEC-911	Forward	30,160,000	9/88
WMEC-912	Legare	30,160,000	5/89
WMEC-913	Mohawk	30,160,000	5/89
TB (Army-2)	unnamed	16,500,000	89
Tacoma Boatbuilding			
T-AGOS-11	Audacious	9,295,000	6/89
T-AGOS-12	Bold	9,295,000	10/89
Textron Marine			
LCAC-13-24 (12)	unnamed	187,000,000	89/-6/91
LCAC	—	4,760,374[2]	9/88
Todd Pacific-San Pedro			
FFG-61	Ingraham	96,100,000	11/88

Footnotes: 1. Lead yard services contract; 2. Engineering and technical services contract. 3. Design contract; 4. Contains $26 million for advanced procurement of material for LHD-4; 5. Yard planning services; 6. Long lead procurement; 7. Detail design contract.

KEY TO NAVY DESIGNATIONS

AOE	Fast Combat Support Ship	T-AGS	Surveying Ship*	MHC	Mine Hunter, Coastal	LCM	Landing Craft, Mechanized
CG	Guided Missile Cruiser	T-AO	Oiler*	MSH	Mine Hunter	LCU	Landing Craft, Utility
CVN	Aircraft Carrier, Nuclear	TB	Tugboat	SSBN	Ballistic Missile Sub, Nuclear	LHD	Amphibious Transport Dock
DDG	Guided Missile Destroyer	WMEC	Medium Endurance Cutter†	SSN	Submarine, Nuclear	LSD	Dock Landing Ship
FFG	Guided Missile Frigate	WPB	Patrol Boat†	SWCM	Special Warfare Craft, Medium	LSV	Logistic Support Vehicle
LCAC	Landing Craft, Air Cushion	YTT	Warping Tug	T-AGOS	Ocean Surveillance Ship*	MCM	Mine Countermeasures Ship

*Assigned to Military Sealift Command
†Coast Guard

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DIRECT MILL SHIPMENTS IN STANDARDS AND SPECIALS

QUALITY ASSURANCE PROGRAM
IN ACCORDANCE WITH

MIL-I-45208
MIL-STD-45662
MIC LEVEL 1

MATERIALS

CARBON & ALLOY STEEL
NICKEL-COPPER
NICKEL-COPPER-ALUMINUM
STAINLESS STEEL
SILICON BRONZE
NAVAL BRASS
BRASS
TITANIUM
ALUMINUM

PARTIAL LISTING OF
FASTENER SPECIFICATIONS

MIL-S-1222
MIL-B- 857
FF-S-86
ANSI B18.2.1
ANSI B18.2.2
ASTM F 593
ASTM F 594

NICKEL-COPPER FASTENER STOCK PROGRAM

HEX HEAD CAP SCREWS									
Diameter / Length	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
1/2	*	*							
5/8	*	*	*						
3/4	*	*	*	*	*				
7/8	*	*	*		*				
1	*	*	*	*	*	*	*		
1 1/4	*	*	*	*	*	*	*		
1 1/2	*	*	*	*	*	*	*		
1 3/4	*	*	*	*	*	*	*		
2	*	*	*	*	*	*	*	*	
2 1/4	*	*	*	*	*	*	*	*	*
2 1/2	*	*	*	*	*	*	*	*	*
2 3/4		*	*		*	*	*	*	*
3	*	*	*	*	*	*	*	*	*
3 1/4						*	*	*	
3 1/2			*	*	*	*	*	*	*
3 3/4						*	*	*	
4			*	*	*	*	*	*	*
4 1/2						*	*		
5						*	*	*	*
5 1/2						*	*		
6						*	*	*	*

FINISH NUTS	*	*	*	*	*	*	*	*	*
THREADED ROD	*	*	*	*	*	*	*	*	*
FLAT WASHERS	*	*	*	*	*	*	*	*	*
LOCK WASHERS	*	*	*	*	*	*	*	*	*
SOCKET CAP SCREWS	*	*	*	*	*	*	*		

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MAJOR NAVY CONTRACTS

The following special section features the latest U.S. Navy contract awards for shipbuilding, ship repair, conversion, maintenance, shipboard electronics, communication systems, weapons, etc. This special section covers contracts awarded between March 23 and May 31, 1988. For contract awards prior to these dates, see the Naval Technology & Shipbuilding Supplement in the May issue of MR/EN.

March 23

General Electric Company, Machinery Apparatus Operation, Schenectady, N.Y. was awarded a **$36,615,000** modification to a previously awarded cost-plus-fixed-fee contract for naval nuclear propulsion components. Work will be completed September 30, 1996. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-4035).

Southwest Marine Incorporated, San Diego, Calif., was awarded a **$3,036,390** firm-fixed-price contract for Phased Maintenance Availability (PMA) for USS Tripoli (LPH-10) Work will be completed July 15, 1988. The Supervisor of Shipbuilding, Conversion and Repair, San Diego, Calif., was the contracting activity (N00024-85-H-8221).

March 29

Newport News Shipbuilding and Dry Dock Company, Newport News, Va., was awarded a **$724,368,395** cost-plus-fixed-fee contract for long lead time material and effort for CVN-74 and CVN-75. Work will be completed May 30, 1998. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-2055).

March 31

McDermott Incorporated, McDermott Shipyards, Amelia, La., was awarded a **$10,913,817** firm-fixed-price contract for one Torpedo Test Craft (YTT). Work will be completed in May 1990. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-2093).

Litton Systems Incorporated, Ingalls Shipbuilding Division, Pascagoula, Miss., was awarded a **$14,100,000** cost-plus-fixed-fee contract for planning yard services for DD-963 and DDG-993 class ships. Work will be completed in March 1993. The Naval Sea Systems Command, Washington, D.C., was the contracting acitivity (N00024-88-C-2081).

April 1

Southwest Marine Incorporated, San Diego, Calif., was awarded a **$10,758,453** firm-fixed-price contract for Extended Drydocking Selected Restricted Availability for USS George Philip (FFG-12). Work will be completed April 21, 1989. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-H-8221)

Metro Machine Corporation, Norfolk, Va., was awarded a **$3,089,604** firm-fixed-price contract for Drydocking Selected Restricted Availability (DSRA) for USS John King (DDG-3). Work will be performed in Norfolk, Va., and is expected to be completed September 2, 1988. The Naval Sea Systems Command, Washington, D.C., is the contracting activity (N00024-85-H-8187).

April 4

Northwest Marine Iron Works, Portland, Ore., was awarded a **$14,091,106** firm-fixed-priced contract for the regular overhaul of USS Okinawa (LPH-3). Work will be completed January 27, 1989. The Supervisor of Shipbuilding, Conversion and Repair, San Diego, Calif., was the contracting activity (N00024-85-H-8197).

April 5

American Transport Line Limited, Teaneck, N.J., was awarded a firm-fixed-rate indefinite quantity, indefinite delivery contract for ocean transportation between the U.S. East Coast and Praia Da Vittoria, Azores, in support of the Air Force Logistics Command. The cost is estimated to be approximately **$18,000,000** over the term of the contract. The period of performance is 29 months from May 1, 1988. The Military Sealift Command, Washington, D.C., was the contracting authority (N00033-88-D-8507).

April 12

Sperry Marine Incorporated, Charlottesville, Va., was awarded a **$7,234,367** fixed-price-incentive contact for AN/BPS-XX radar for all SSBN-726, SSN-688 and SSN-21 class submarines. Work will be completed in December 1992. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-5673).

April 15

Bender Shipbuilding and Repair Company Incorporated, Mobile, Ala., was awarded a **$5,429,704** firm-fixed-price contract for the drydocking and overhaul of USNS Redstone (T-AGM 20), a Military Sealift Command long range missile tracking support ship. The Military Sealift Command, Washington, D.C., was the contracting activity (N62381-88-C-0212).

April 19

Norfolk Naval Shipyard, Portsmouth, Va., was the successful offeror in a competitive program between public and private sector shipyards for the Selected Restricted Availability (SRA) for USS Memphis (SSN-691). The SRA was assigned on a firm-fixed-price basis. The price of this effort is **$8,486,562.** Work will be performed in Portsmouth and is expected to be completed October 12, 1988. The Naval Sea

Systems Command, Washington, D.C., was the requiring activity.

Charleston Naval Shipyard, Charleston, S.C., was the successful offeror in a competitive program between public and private sector shipyards for the Extended Refit Period (ERP) for USS Henry L. Stimson (SSBN-655) and USS Mariano G. Vallejo (SSBN-658) The ERP is being assigned on a firm-fixed-price basis. The price for this effort is **$19,673,812.** Work will be completed in August 1989. The Naval Sea Systems Command, Washington, D.C., was the requiring activity.

April 26

General Electric Company, Washington, D.C., was awarded a **$6,280,000** firm-fixed-price contract for installation and checkout services for main propulsion complexes for SSN-688 and SSBN-726 class submarines. Work will be performed in Groton, Conn., and is expected to be completed in April 1993. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-4310).

April 27

Central Gulf Lines Incorporated, New Orleans, La., was awarded a **$25,074,939** firm-fixed-price contract including options for the time charter of M/V Woerman Mercur, a dry cargo ship that will be reflagged to the U.S. prior to delivery to the Military Sealift Command. The contract performance period is 17 months with two 17-month options. The Military Sealift Command, Washington, D.C., was the contracting activity (N00033-88-R-1136).

Red River Shipping Corporation, Phoenix, Ariz., was awarded a firm-fixed-price contract set aside for small and disadvantaged business concerns totaling **$35,366,660,** including options, for the time charter of M/V Tacna II, a dry cargo ship that will be renamed and reflagged to the U.S. and will function as part of the U.S. Navy's Afloat Prepositioning Force. The contract period is 17 months with two 17-month options. The Military Sealift Command, Washington, D.C., was the contracting activity (N00033-88-R-1101).

April 28

Sperry Marine Incorporated, Charlottesville, Va., was awarded a **$14,450,000** firm-fixed-price contract for 10 Automatic Direction Finding (ADF) group periscope masts for SSN-688 class submarines. Work will be performed in Charlottesville, and is expected to be completed by May 31, 1990. The Naval Sea Command, Washington, D.C., was the contracting activity (N00024-88-C-4079).

General Electric Company, Pittsfield, Mass., was awarded a **$38,987,728** fixed-price-incentive contract for guidance systems components for the Trident Missile Program. Work will be completed July 31, 1990. The Strategic Systems Program Office, Washington, D.C., was the contracting activity (N00030-88-C-0145).

Kollmorgen Corporation, Electro-Optical Division, Northampton, Mass., was awarded a **$3,051,000** firm-fixed-price supply contract for Trident type submarine periscope sets for SSBNs 738, 739 and 740. Work will be performed in Northampton, and is expected to be completed in January 1989. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-4131).

April 29

Textron Marine Systems, Division of Textron, New Oreleans, La., was awarded a **$4,760,374** cost-plus-fixed-fee contract for engineering and technical services in support of the Landing Craft Air Cushion (LCAC) program. Work will be performed in Panama City, Fla. (75 percent), and New Orleans (25 percent), and is expected to be completed September 30, 1988. The Naval Sea Systems Command, Washington, D.C., was the contracting activity (N00024-88-C-2160).

Ingalls Shipbuilding Incorporated, Pascagoula, Miss., was issued a **$3,608,809** modiifcation to procure 29 line items of rotatable pool equipment for Aegis class cruisers. Equipment includes air, air conditioning and refrigeration compressors; pumps and motors for fuel and lubricating oil; and pumps for cooling water, seawater, and hydraulics. Work will be completed in October 1989. The Supervisor of Shipbuilding, Conversion and Repair, Pascagoula, Miss., was the contracting activity (N00024-87-C-2031).

May 2

Continental Maritime of San Francisco Inc., has received a **$3.2-million** contract for the Drydocking Phased Maintenance Availability for USS Lang (FF-1060). The work is expected to be completed by October, 19, 1988. The contract was awarded by the Supervisor of Shipbuilding, Conversion and Repair, San Francisco, Calif. (N00024-85-H-8218).

May 4

Continental Maritime of San Diego, Calif., has received a **$4.5-million** contract for phased maintenance of USS Hoel (DDG-13). Maintenance includes repairs to the boilers and propulsion system, as well as underwater hull preservation. Work is expected to be completed by September 23, 1988. The contract was awarded by the Supervisor of Shipbuilding, Conversion and Repair, San Diego, Calif. (N00024-85-H-8212).

May 5

General Electric Co., Marine and Industrial Engines and Service Division, Cincinnati, Ohio, has received a **$7.2-million** contract for spare parts for LM 2500 gas turbine engines. These parts include special support equipment, pool spares, repair parts, shipboard spares and modification kits as required for the Spanish Navy. Work

U.S. NAVY

CURRENT NAVY, COAST GUARD & MARAD OVERHAUL, REPAIR & CONVERSION CONTRACTS AT U.S. SHIPYARDS

(As of May 1988)

SHIPYARD	SHIP	TYPE OF WORK	$VALUE	COMP
Alabama Dry Dock	USS Lexington (AVT-16)	PM	10,131,466	8/90
Atlantic Dry Dock	USS Underwood (LSD-36)	DSRA	7,466,000	8/88
Avondale Shipyards	USS Boone (FFG-28)	SRA	9,998,452	7/88
	USS John J. Hall (FFG-32)	DSRA	11,170,581	9/88
	USS Radford (DD-968)	ROH	20,700,000	5/89
Bath Iron Works	4 USCG cutters	ROH	117,452,000	89
	USS Koelsch (FF-1049)	OH	12,000,000	8/88
Bender Shipbuilding & Repair	USS Redstone (T-AGM-20)	DD & OH	5,429,704	9/88
Bethlehem Steel— Sparrows Point	USNS Neosho (T-AO-143)	DD & OH	4,489,339	5/88
Braswell Shipyards	USNS Neosho (T-AO-143)	DD & OH	7,366,392	8/88
Charleston Naval Shipyard	USS Andrew Jackson (SSBN-619)	OH	112,058,684	3/90
	USS Woodrow Wilson (SSBN-624)	OH	120,928,007	3/89
	USS Henry L. Stimson (SSBN-655) & USS Mariano J. Vallejo (SSBN-658)	REF	19,673,812	8/89
Colonna's Shipyards	USS Richard E. Byrd (DDG-23)	DSRA	4,280,000	7/88
Continental Maritime	USS Ranger (CV-61)	SRA	4,926,630	6/88
	USS Mars (AFS-1)	DPMA	10,073,284	5/88
	USS Lang (FF-1060)	PMA	3,200,000	10/88
	USS Hoel (DDG-13)	PM	4,500,000	9/88
	USS Rentz (FFG-46)	DSRA	4,400,000	12/88
DMI Shipyard	MSB-1	ROH	41,057,000	—
General Ship Corporation	USS Trippe (FF-1075)	ROH	8,801,078	5/88
	USS Stephen W. Graves (FFG-29)	EDSRA	10,969,490	6/88
Houston Ship Repair	Mount Washington (NDRF)	REP	549,000	5/88
Industrial Welding & Machine	State of Maine (MarAd)	REP	517,200	5/88
Ingalls Shipbuilding	USS Stark (FFG-31)	REP	28,700,000	8/88
	USS Wisconsin (BB-64)	MOD	221,768,170	10/88
	USS Richmond K. Turner (CG-20)	ROH	28,780,830	8/88
	USS San Jacinto (CG-56)	PSA	7,000,000	10/88
Jonathan Shipyard	USS Saginaw	PM	9,900,000	6/90
Long Beach Naval Yard	LPH Class Ships	PM	8,096,132	10/90
McDermott Inc.	IX-513 Barge	MODIF	7,422,802	4/88
Metro Machine	Atlantic Fleet LPDs	PM	5,334,400	8/91
	USS Bowen (FF-1079)	OH	6,900,000	—
	USS John King (DDG-3)	DSRA	3,089,604	9/88
	USS Claude V. Ricketts (DDG-5)	DSRA	4,100,000	10/88
Mid-Coast Marine	USCG buoy tenders, Ironwood & Sweet Briar	DD	670,000	5/88
Moon Engineering	USS Conynham (DDG-17)	REP	1,484,444	—
NASSCO	4 LSTs	PM	3,500,000	90
	3 LSTs	MAINT	5,858,543	—
	USS Elliott (DD-967)	ROH	27,779,349	9/88
Newport News Shipbuilding	USS Pittsburgh (SSN-720)	SRA	7,055,300	7/88
	USS Enterprise (CVN-65)	OH	34,277,751	9/88
	USS Newport News (SSN-750)	PSA	3,400,000	1/89
	Surface Ship Support Barge	REP	48,095,123	7/89
	USS Oklahoma City (SSN-723)	PSA	3,367,692	—
	USS Key West (SSN-722)	PSA	38,000,000	12/88
	USS George C. Marshall (SSBN-654)	REF	11,172,200	10/88
	USS Lewis & Clark (SSBN-644)	REF	10,751,500	7/88
	USS Jacksonville (SSN-699)	TEST	[illegible],000,000	8/88
Norfolk Naval Yard	USS Baton Rouge (SSN-689)	SRA	5,462,494	10/88
	USS Vulcan (AR-5)	DSRA	4,800,000	5/88
	USS Memphis (SSN-691)	SRA	8,486,562	10/88
Norfolk Shipbuilding	AO-178, 179 & 186	PM	38,900,000	—
	USS Lawrence (DDG-4)	REP	4,966,666	—
	USS Puget Sound (AD-36)	ROH	12,210,546	5/88
	USS Resolute (AFDM-10)	ROH	9,200,000	6/88
	Mormacsea & Mormacsaga (RRF)	UPG	7,973,482	—
Northwest Marine Iron Works	USS Anchorage (LSD-36)	ROH	15,300,000	11/88
	USS Paul Foster (DD-964)	ROH	26,423,466	5/88
	USS Okinawa (LPH-3)	ROH	14,091,106	1/89
Pennsylvania Shipbuilding	USS Patterson (FF-1061)	PM	5-10 mil/yr	—
Philadelphia Navy Yard	USS Independence (CV-62)	SLEP	240,000,000	—
Portsmouth Naval Yard	USS Kamehameha (SSBN-642)	ROH	112,100,000	11/88
	USS Albuquerque (SSN-706) & USS Philadelphia (SSN-690)	SRA	11,416,336	11/88
Puget Sound Naval Yard	USS Nimitz (CVN-68)	REP & OH	—	89
	USS Alexander Hamilton (SSBN-617)	ROH	110,713,798	11/88
Robert E. Derecktor	USS Connole (FFG-12)	ROH	2,500,000	—
Service Engineering	USNS Spica (T-AFS-9)	OH	10,700,000	—
	AE-29, -32-34	PM	4,154,000	89
Southwest Marine	USS Dubuque (LPD-8)	OH	10,000,000	—
	USS George Philip (FFG-12)	EDSRA	10,758,483	4/89
	USS Tripoli (LPH-10)	PMA	3,036,390	7/88
	USS Wichita (AOR-1) & USS Kansas (AOR-3)	REP	41,600,000	—
	USS Pluck (MSO-464)	SRA	1,041,000	—
	LST-1185, -1186 & 1191	OH	35,000,000	87-89
	USS Okinawa (LPH-3)	ROH	16,114,285	7/88
	USS Durham (LKA-114)	DD	7,611,149	7/88
	USS Anchorage (LSD-36)	ROH	15,048,870	11/88
	USS Stein (FF-1065)	ROH	9,148,194	10/88
Tacoma Boatbuilding	USNS Hayes (T-AG-195)	CONV	33,878,232	3/90
Tampa Shipyards	T-ACS-7 & 8	CONV	43,158,333	10/88
Todd-Seattle	USS Camden (AOE-2)	REP	12,643,642	7/88
	8 WHECs	OH	234,903,000	2/91
Todd-San Pedro	USS Crommelin (FFG-37)	REP &DD	4,200,000	9/88
USCG-Curtis Bay	14 buoy tenders	SLEP	8,500,000	—
	16 WMECs	MAINT	—	—

Legend: CONV-Conversion; DEACT-Deactivation; DSRA-Docking Selected Restricted Availability; EDSTRA-Extended Docking Selected Restricted Availability; MAINT-Maintenance; MODIF-Moficiation; MMA-Major Maintenance Availability; OH-Overhaul; PM-Phased Maintenance; PMA-Phased Maintenance Availability; PSA-post-Shakedown Availability; REF-refit; REP-Repair; ROH-Reglar Overhaul; SER-Service; SLEP-Service Life Extension Program; SRA-Selected Restricted Availability; UPG-Upgrade.

Major Navy Contracts

(continued)

is expected to be completed in September 1991. The contract was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-88-C-4274).

Newport News Shipbuilding and Dry Dock Co., Newport News, Va., has received a **$8-million** contract for the pre-shock testing availability of USS Jacksonville (SSN-699). Work is expected to be completed by August 8, 1988. The contract was awarded by the Supervisor of Shipbuilding, Conversion and Repair, Newport News, Va. (N00024-86-H-8002).

Todd Pacific Shipyards Corp., San Pedro, Calif., has received a **4.2-million** contract for hull, mechanical and electrical repairs, alterations and drydocking for USS Crommelin (FFG-37). Work is expected to be completed by September 23, 1988. The contract was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-85-H-8237).

May 6

Lake Shore Inc., Iron Mountain, Mich., has received a **$4.4-million** contract for five A/S32A-36 aircraft salvage cranes for use aboard aircraft carriers and other aviation capable ships. Work is expected to be completed in July 1990. The contract was awarded by the Naval Air Systems Command, Washington, D.C. (N00019-86-C-0028).

May 12

Metro Machine Corp., Norfolk, Va., has received a **$4.1-million** contract for Drydock Selected Restricted Availability for USS Claude V. Ricketts (DDG-5). Work is expected to be completed by October 6, 1988. The contract was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-85-H-8187).

Gibbs, and Cox Inc., N.Y., received a **$13.1-million** contract for technical data and services for the Taiwanese frigate (PFG II) program. Work is expected to be completed in September 1991. The contract was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-88-C-2152).

May 25

CSS Technology Associates, Chantilly, Va., has received a **$15.2-million** contract for technical services for Ohio-class submarines. Work is expected to be completed in September 1991. The contract was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-88-C-6213).

May 27

Raytheon Co., Equipment Division, Wayland, Mass., was awarded a **$20.6-million** contract for NATO Seasparrow surface missile systems. Work is expected to be completed in August 1990. The contract combines purchases for the U.S. Navy (60 percent) and Portugal (39.8 percent). The conctract was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-88-C-5136).

Ingalls Shipbuilding Inc., Pasagoula, Miss., was awarded a **$7-million** contract to conduct post shakedown availability for the USS San Jacinto (CG-56). Work is expected to be completed in October 1988. The contract was awarded by the Supervisor of Shipbuilding, Conversion and Repair, Pascagoula, Miss. (N00024-88-G-2818).

CCC Georgia Inc., Brunswick, Ga., was awarded a **$6.5 million** contract for intermodal transportation of containerized and breakbulk cargo between Seattle and the Naval Air Station, Adak, Alaska. The performance period is 24 months, beginning in July 1988. The contract was awarded by the Military Sealift Command, Washington, D.C. (N0003-88-R-8503).

May 31

Continental Maritime of San Diego, San Diego, Calif., was awarded a **$4.4-million** contract for drydocking selected restricted availability for the USS Rentz (FFG-46). Work is expected to be completed in December 1988. The contract was awarded by the Supervisor of Shipbuilding, Conversion and Repair, San Diego, Calif. (N00024-85-H-8512).

Bath Iron Works Corp., Bath, Maine, was awarded a **$23.1-million** contract for lead yard services for the DDG-51 class follow-on ships. Work is expected to be completed in May 1989. The contact was awarded by the Naval Sea Systems Command, Washington, D.C. (N00024-87-C-2077).

Technology Applications Awarded $9-Million SNAP I Contract

Technology Applications, Inc. (TAI), a professional and technical services firm, has been awarded a $9-million, three-year contract by the Space and Naval Warfare Systems Command (SPAWAR) to perform SNAP I (Shipboard Nontactical ADP Program I) installations on Navy vessels on the East and West Coasts. TAI has performed SNAP I installations on both coasts since 1985, working out of offices in Norfolk, Va., on the East Coast and San Diego on the West Coast.

NAVSEA Names Voynik 'Engineer Of The Year'

Vice Adm. **William H. Rowden,** USN, recently awarded "Naval Sea Systems Command, Engineer of the Year" honors to **Gerald M. Voynik,** program manager for U.S. Navy Mineforce Ships.

In his present NAVSEA position for Mine Sweeper Ocean (MSO) and Mine Sweeping Boats (MSB) Class vessels, Mr. **Voynik** initiated an aggressive program to restore hull, machinery/electrical capability to give the aging mineforce fleet known as MSO/MSB Retirement Deferral.

Mr. **Voynik** was honored for achievements for resolution of long-standing hull maintenance, alignment problems and innovations in machinery magnetic signature improvements. Through his efforts and programs, MSOs and MSBs have achieved a renewed mission posture and state of readiness for the U.S. Navy.

Mr. **Voynik** joined NAVSEA in 1981. He is a member of the Society of Naval Architects and Marine Engineers (SNAME). Prior to joining government service, he worked in a variety of commercial industry shore-based marine and New York area towing industry positions.

Under Seas Defense '88 To Be Held In San Diego On October 3-6

Under Seas Defense '88 (USD), an international exposition and conference on underwater warfare technology, will be held in the Holiday Inn at Embarcadero, San Diego, Calif., from October 3-6.

Under Seas Defense '88 is the second annual exposition and conference in this series. It will feature exhibits and technical presentations on various aspects of submarine, antisubmarine, mine and mine countermeasures warfare technology.

Last year, at USD '87, also held in San Diego, more than 1,500 people registered and attended. Participation is expected from the U.S., as well as North American Treaty Organization (NATO) and Western-aligned nations.

The keynote speaker for the technical conference on Tuesday, October 4, will be Capt. **Roger M. Venables** of the Royal Navy. He will speak on the importance of allied cooperation in meeting the antisubmarine warfare challenge. This chiefly involves 650 operational Soviet submarines that are constantly improving in noise reduction techniques and with greater weapons load and launch capabilities. Captain **Venables** will also be the featured banquet speaker the evening of October 5 at the Admiral Kidd Club, Naval Training Station, San Diego.

At present, Captain **Venables** is Captain (S/M), First Submarine Squadron at HMS Dolphin, Gosport, U.K. His command includes 10 submarines and the Royal Navy Submarine School, which also accommodates the famous "Perisher Course" for future submarine commanding officers.

For further information on USD '88, contact: USD '88, P.O. Box 368, Spring Valley, Calif. 92077; telephone: (619) 465-2262; telex: 530111 WE INC UD, ELN 62772181.

Kelly Klosure Units Used By General Ship In Navy Renovation Work

General Ship Corporation of Boston, Mass., which specializes in shipbuilding, diesel and steam engines, conversions, overhauls, renovations, and repairs in both the private and commercial shipping industries, was contracted by the U.S. Government to perform modifications that would update and enlarge the capabilities of both the U.S. Steven W. Gross and the USS Tripp.

In performing the necessary repairs, System 2 panels from Kelly Klosure Systems of Fremont, Neb., were used for on-board and on-dock protection of employees and instruments.

Kelly is one of the leading manufacturers of weather protection systems and semi-permanent relocatable buildings. Kelly's modular panels are available in a variety of finishes from fiberglass to galvanized steel and are used primarily for weather protection of both people and equipment.

In order to enlarge the U.S. Steven W. Gross, decks had to be removed to allow access to the structural steel of the ship's frame. Kelly's System 2 panels were used for deck replacements during this procedure to create a self-framing building that could be reconfigured on the same site quickly and easily. When General Ship finished one section, the System 2 structure was reconfigured and moved to the next.

Another System 2 semipermanent relocatable building was used to protect the sonar equipment of the USS Tripp. While renovations were being performed on-board, the sonar equipment was removed and placed on the pier and protected by the System 2, which features a side-lapping edge that ensures a watertight, weatherproof seal.

According to the manufacturer, shipyards throughout the U.S. have found Kelly's weather protection panels to be invaluable aids, and Naval and commercial shipyards on both coasts use and reuse Kelly units as dockside storage, fabrication, training and lunchroom facilities, etc.

For free literature giving full information on Kelly Klosure Systems,

Circle 84 on Reader Service Card

Navy Awards $4.4-Million Contract To Continental Maritime

Continental Maritime of San Diego, San Diego, Calif., was recently awarded a $4.4-million contract by the U.S. Navy for the Drydocking Selected Restricted Availability (DSRA) of the USS Rentz (FFG-46). The work is expected to be completed in December 1988 (N00024-85-H-8212).

Trinity Marine Group Names Eric Richards T-AGOS Program Manager

Trinity Marine Group has named **Eric Richards** program manager for six T-AGOS ocean surveillance ships under construction for the U.S. Navy at Halter Marine's Moss Point, Miss., shipyard.

The first vessel in the approximately $85-million contract will be delivered this summer.

John Dane III, president of Trinity Marine Group, said Mr. **Richards** will coordinate all aspects of the vessels' construction from interface with the Navy and regulatory agencies, to intra-company communications, to management of subcontractor programs.

Mr. **Richards** has served as production control manager and assistant yard manager at the Halter Moss Point facility. His shipbuilding experience includes oceangoing tugs, large trawler/processors, oil field boats, and other specialty vessels.

Halter Marine, Inc. is one of the Trinity Marine Group shipyards owned by Trinity Industries, Inc. of Dallas, Texas.

Marine Machinery Association Holds Government-Industry Forum On Ship Repair And Parts Quality

The Marine Machinery Association (MMA) recently held its Government-Industry Forum in Norfolk, Va.

MMA's president, **Larry Holley** of Warren Pumps, Inc., opened the meeting, explaining that the location was chosen to bring the forum close to the operating forces and promote a dialogue on current critical issues facing manufacturers and the users of their products.

More than 100 representatives of the marine machinery industry and the Navy attended. Industry was represented by 36 machinery and equipment manufacturing companies. NAVSEA headquarters sent representatives from Washington, and the government contingent included a number of participants from NAVSEACENLANT, PERA ASL, SUPSHIPS Newport News, and SUPSHIPS Portsmouth.

Washington lawyer **Jack Janetatos** of Baker & McKenzie, MMA's founding president, gave the keynote address. He reported that the Commission on Merchant Marine and Defense has heard and acted on MMA's view that the diversion of spare parts and repair services to replicators is hurting the nation's ability to maintain an in-

(continued)

In attendance at the MMA Government-Industry Forum were: **Jack Flanigan,** chairman of the board of MMA; **Jack Janetatos,** Baker & McKenzie; and Rear Adm. **David Donohue,** Fleet Maintenance Officer, CINCLANTFLT.

dustrial base to produce new equipment.

Mr. **Janetatos** stated that the SSN-21 program, in asking for Level 3 technical data, was buying more data than it could ever use or manage. This, coupled with the demand for unlimited rights in data, was wasteful and contrary to the expressed intent of Congress.

Gordon Flynn, president of Hardie-Tynes, discussed machinery repair from the viewpoint of the manufacturer. He emphasized the importance of competence, knowledge, and quality control in overhauling machinery. Mr. **Flynn** was strongly in favor of the growing concept of a rotating pool of high population equipment to cut turnaround time.

Capt. **Mort Kenyon,** Combat Systems Maintenance Officer at SURFLANT, provided an inside look at how the Master Ordnance Repair system worked. Captain **Kenyon** detailed the manner in which quality is ensured in this program where 85 percent of the work is done in the private sector.

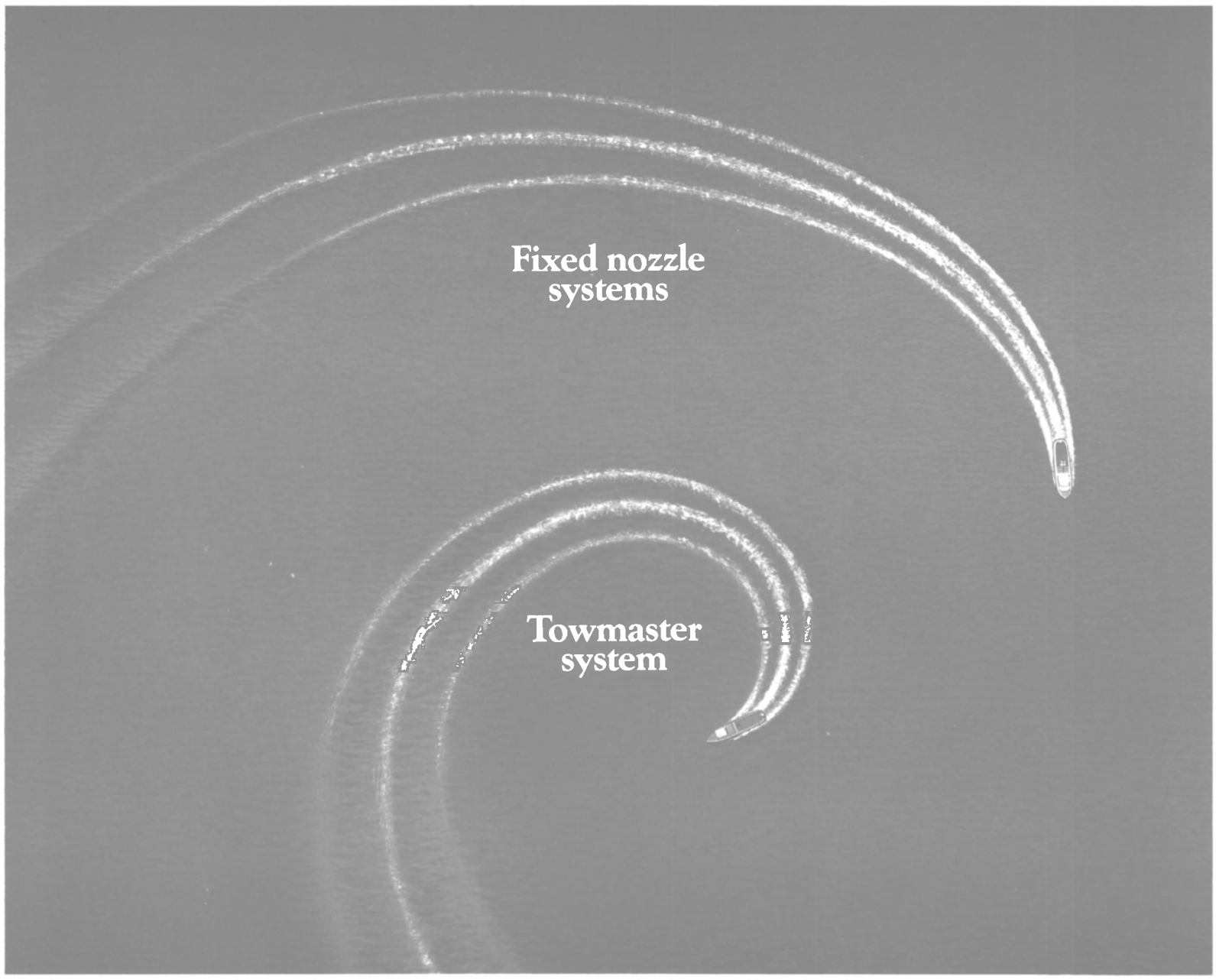
Rear Adm. **David Donohue,** Fleet Maintenance Officer at CINCLANTFLT, gave a luncheon speech on the diminishing budget available to the Navy in general and to the ship maintenance in the Atlantic Fleet in particular.

Admiral **Donohue** emphasized that quality parts and repair services are essential to the fleet, and he challenged the manufacturers to lower prices in the face of the budget reductions. He closed with a call for greater efficiency and quality on the part of the industry.

Cameron Blandford of Newport News Shipbuilding and Drydock Co., who testified before the Commission on Merchant Marine and Defense at the same session as the MMA delegation, expressed agreement with the Commission's desire to revitalize the merchant marine and was, in general, pleased with the body recommendations in their most recent report.

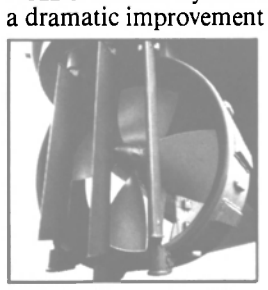
The final speaker was Capt. **Alan Johnson,** Assistant Chief of Staff, Ship Materiel, Commander Naval Air Force, U.S. Atlantic Fleet, who explained how AIRLANT is coping with a decreasing maintenance budget and the problems caused by heavy operating schedules and the homeporting of ships at a distance from repair facilities. He quoted from MMA's testimony to the Merchant Marine Commission in agreeing with the critical need for quality in repairs and parts. Captain **Johnson** closed by urging a plan for AIRLANT's engineers to work directly with MMA representatives to improve quality.

Those manufacturers interested in joining the MMA, should contact: the Marine Machinery Association, 1700 K Street, Suite 903, Washington, D.C. 20006; or telephone: (202) 293-7169.



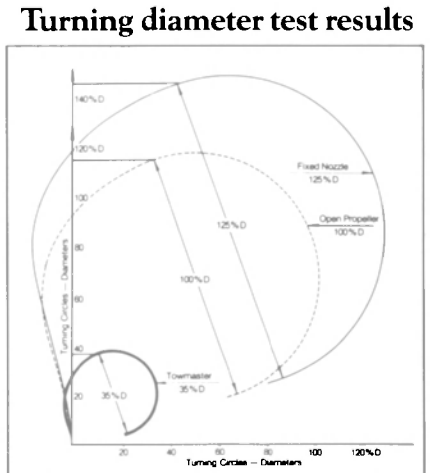
The Towmaster™ Nozzle/Rudder System can cut your turning circle by 70%

If your vessel has a ducted propeller system, Michigan Wheel's Towmaster Nozzle/Rudder System can give you a dramatic improvement in maneuverability and turning efficiency. In fact, if your vessel presently has a fixed nozzle system, tests prove the Towmaster Nozzle/Rudder System could reduce your turning circle by 70%. If yours is an open propeller system, you can expect an improvement of up to 60%.



The Towmaster can give you this kind of performance because of its unique triple-rudder design. Each rudder, by itself, produces a higher lift-to-drag ratio than conventional centerline rudders.

Turning diameter test results



Based upon single screw results

Together, they create a cascade effect that can allow 60° helm angles before rudder stall occurs.

And because the Towmaster also reduces rudder torque and makes more efficient use of propeller thrust, vessel operation is easier and less fatiguing.

The Michigan Wheel Towmaster Nozzle/Rudder System. It's proven its ability to increase maneuverability and overall operating efficiency in over 100 applications. To learn how it can do the same for you, contact Michigan Wheel for complete facts and the name of the distributor nearest to you.

Michigan Wheel Corporation

1501 Buchanan Ave. S.W.
Grand Rapids, MI 49507
Phone (616) 452-6941
Telex 6877077 MIMOT UW

Circle 154 on Reader Service Card

Nichols Catamaran

(continued)

under a canopy aft on the second deck and atop the bridge deck. A dance floor has been installed on the main deck. Bogen stereo entertainment systems and color videos are mounted in the cabins.

According to **Bob Black,** manager of Catalina Passenger Service, an increasing demand for speed on the Catalina route prompted the order for the catamaran. Mr. **Black** said that the Catalina Flyer would cut travel time by more than half on the route.

Nichols Brothers' 11th and 12th catamarans are already under construction at the Whidbey Island boatyard. Nichols is building a sister ship to the U.S. Army's Jera that was christened at Langley, Wash., in April. Nichols is also building an advanced marine concept catamaran that will be 122 feet in length, the details of which will be announced shortly, according to Nichols Brothers president **Matt Nichols.**

For free literature detailing the boatbuilding services offered by Nichols Brothers Boat Builders,

Circle 51 on Reader Service Card

CATALINA FLYER
Equipment List

Main engines	Caterpillar
Generator engines	John Deere
Reduction gears	Reintjes
Propellers	Lips
Propulsion controls	Systems Engineering
Steering	Hough Marine
Starters	Klockner-Moeller
VHF radios	ICOM
Radars	Furuno
Autopilot	Sperry
Loran	Furuno
Flasher	Ross
Wiring & light fixtures	Hardware Specialty
Sound entertainment system	Bogen
Coatings	Hempel

Equitable Reopens Louisiana Shipyard To Build Coal Barges

Equitable Shipyards, Inc. has reopened its Madisonville, La., shipyard to begin construction on 39 coal-carrying hopper barges for the Indiana Michigan Power Company, Ft. Wayne, Ind.

John Dane III, president of the Trinity Marine Group that includes Equitable, said the reopening of the Madisonville shipyard is significant because it reflects increased activity in inland waterway transportation, and because it will aid the economy in the Madisonville area with approximately 150 new jobs.

The nearly $8-million pact calls for the construction of twenty-four 175-foot by 26-foot by 11-foot barges, and fifteen 195-foot by 35-foot by 12-foot barges. Construction has begun and all 39 barges will be completed by February 1989. Mr. **Dane** added that negotiations are under way to secure additional business to keep the plant open on a long-term basis.

The Equitable/Madisonville shipyard was opened in the early 1940s. It produced approximately 7,000 barges and boats before its close in 1985 with the decline in the offshore energy industries and inland waterway transportation. At its peak, approximately 600 persons were employed at the facility.

Mr. **Dane** said the Madisonville shipyard is being reactivated because it was designed to produce barges and has all of the manufacturing equipment to meet the high quality standards and production schedules demanded by barge operators.

The barges were designed by Shearer & Associates, a New Orleans naval architecture firm.

The Trinity Marine Group is owned by Trinity Industries, Inc. of Dallas, Texas. In addition to the two Equitable shipyards, the group includes Halter Marine, Inc. shipyards in Moss Point, Miss., and Lockport, La., Moss Point Marine, Inc. in Escatawpa, Miss., and Gretna Machine and Iron Works, Inc. in Harvey, La.

For free literature giving full information,

Circle 2 on Reader Service Card

MarineSafety Awarded Los Angeles Port Study —Literature Available

The City of Los Angeles Board of Harbor Commissioners has awarded a Port Development Study to MarineSafety International, which is headquartered at the National Maritime Research Center, Kings Point, N.Y.

The study effort, to be conducted at MarineSafety's Computer-Aided Operations Research Facility, will use visual navigation simulation techniques to verify entrance channel depth requirements, inner channel entrance width for entry and exit of 300,000-dwt crude petroleum carriers and an inner harbor turning basin. In addition, fully loaded and in-ballast emergency underway strategies will be tested.

The area of the study is the soon-to-be constructed PACTEX, artificial island, petroleum products terminal which is the first project of the World Port LA-2020 Program.

"Our professional staff and simulation facility is ideally suited to working with the Los Angeles Harbor Department in conducting the tests and anlyses required," Dr. **Eugene Guest,** MarineSafety director, said.

MarineSafety International, a wholly owned subsidiary of Flight-Safety International of New York, N.Y., operates ship simulation facilities at Kings Point, N.Y., and Newport, R.I., which are used for port and harbor design assistance, maritime research and training of ships' officers and harbor pilots.

For more information and free literature from MarineSafety International,

Circle 81 on Reader Service Card

Klattenberg Named Sales Agent In US And Canada For Curacao Drydock

Richard R. Klattenberg, formerly vice president, Curacao Drydock (USA) Inc., recently announced that concurrent with the establishment of an agency in his name, he has been appointed sales agent in the U.S. and Canada for Curacao Drydock Company. The shipyard's New York office will remain open for administrative purposes.

Mr. **Klattenberg** also became exclusive agent in the U.S. for Stork Services BV, a supplier of engine spares and reconditioning services; and YVC Bolnes BV, who took over the facilities of the former Boele Shipyard last year; both companies are located in Holland.

For more information, contact him at RR Klattenberg Marine Agency, 17 Grandview Avenue, West Orange, N.J. 07052, phone (201) 731-4018, fax (201) 325-3682, telex 650-3449312.

Stolt Tank Containers Moves New Jersey Office To New Location

Stolt Tank Containers Inc. recently moved its Jersey City office to a new location in Somerset, N.J. This office is responsible for the marketing, operations and accounting for all of North and South America for Stolt Tank Containers.

Hyundai To Build Two Bulk Carriers For Overseas Shipping

Hyundai Heavy Industries (HHI) of South Korea recently received an order from the U.S. shipping company Overseas Shipping Group (OSG) to build two 120,000-dwt dry bulk carriers.

The two bulk carriers are part of a major newbuilding program by New York-based OSG. The company now has 12 vessels totaling about 1.3 million dwt on order. Besides the two recently ordered bulkers, the firm currently has on order: four 40,000-ton products carriers; two 63,000-ton bulk carriers; two 145,000-ton tankers; and two 256,000-ton tankers. All the vessels are being built by HHI, except the two VLCCs, which are being built by Hitachi Zosen.

NOT EVERY VESSEL NEEDS CHEVRON MARINE LUBRICANTS.

Maybe our top-quality marine lubricants aren't for everyone. But if you make your living on the water...on *towboats, workboats,* or *tugs*...you need all the protection you can get. The dependable protection of Chevron oils and greases.

You see, at Chevron we're behind you all the way. Pushing, pulling, pumping, dredging...working the waterways of America, rivermen from coast to coast count on us. *For* our full line of fine marine products. *For* expert advice and service at over 100 ports across the U.S. *For* the kind of commitment you'd expect from an industry leader like Chevron.

Yes, not every vessel may need our marine lubricants, technical support, or reliable service. But if *you* do, contact your Chevron Sales Representative, or write: Chevron USA, 575 Market St., San Francisco, CA 94105.

- Chevron DELO Marine Oils 471, 473 and 194—premium, extra-performance diesel oils for severe-duty service in main and auxiliary engines.
- Chevron AW Hydraulic Oils for gears, compressors, and hydraulic systems.
- Chevron NL Gear Compounds for heavily loaded reverse and reduction gears.
- Chevron Marine Oil 220X for stern tube bearings and open cranks on steam engines.
- Chevron Ultra-Duty, Pinion Grease MS, Dura-Lith Grease EP, and Polyurea EP Greases for bearings, couplings, gears, and deck hardware.

Chevron

Circle 10 on Reader Service Card

MARINE LUBRICANTS

MEETING THE DEMANDS OF NEW AND UPGRADED DIESELS

The trend toward upgrading output and efficiency of marine diesel engines, as well as improving their ability to burn heavy residual fuels with high sulfur content, has placed increasing demands on the petroleum industry to improve their products. The oil producers have responded by offering new and reformulated marine lubricants, including highly alkaline cylinder oils to protect against the acidity resulting from the burning of residual fuels, and improved system oils to meet the severe-service demands of the latest engines.

The following review is based on data supplied by the major U.S. producers of marine lubricants. Free brochures and data sheets giving full details on the formulations and capabilities of these oils are available from all of the producers included in this review. To obtain copies, just circle the appropriate Reader Service Number(s) on the postage-paid card in the back of this issue.

BP MARINE

Circle 33 on Reader Service Card

In a modern motorship, effective cylinder lubrication is vital to successful main engine operation and the role of the cylinder lubricant has been, and still is, fundamental to the development of the low speed marine diesel engine.

As a leading oil formulator, BP Marine believes that for effective cylinder lubrication, the product must possess the following performance characteristics: non-hazardous for safe shipboard use; chemical stability; pumpable at normal storage and handling temperatures; adequate thermal and oxidative stability to minimize coking and degradation; good spreadability properties to enable the oil film to cover the working surface areas of piston rings and liner; good antifriction qualities; adequate film strength and load carrying properties to prevent the occurrence of scuffing and micro-seizure of piston rings and liners under severe conditions of temperature and pressure; adequate acid neutralizing properties to minimize the effects of corrosion; and a high-level of detergency and dispersancy to maintain pistons, piston rings, scavenge ports and scavenge spaces clean to maximize intervals between overhauls.

BP's Energol CLO 50M is formulated specifically to meet these requirements and to neutralize the acidic products of combustion formed by high sulphur fuels. This product provides an outstanding level of lubrication and protection from a balanced combination of high quality base oils, detergent/dispersant and other additives.

There are times when a vessel is tied to a trade route and is required to use "non-standard" fuels with either very high or very low sulphur contents. In these circumstances, BP has a range of special cylinder lubricants which offers economic advantages and can be made available for a whole range of different operating and lubrication conditions.

The BP marine lubrication service is not specific to the engine cylinder and many other oils and greases are offered for shipboard application. The engines are the ship's heart and this important area is particularly well covered for both main and auxiliary engines by products that have been developed by BP, in close consultation with engine and equipment manufacturers worldwide and with their respective approvals.

At the bottom end of the engine, BP's Energol OE-M30 has been formulated to provide, economically, the necessary fluid for lubrication of low speed engines with water-cooled pistons. In addition, a low level of alkalinity provides neutralization should combustion acids enter the system. This offers the engine operator: detergency/dispersancy for improved level of engine crankcase cleanliness; rust and oxidation inhibited performance; excellent water separating properties. Additionally, Energol OE-M30 may used in enclosed stern tube systems and for general lubrication.

BP's Energol DL-MP range can simplify operational requirements and Energol DL-MP30 is recommended for the system lubrication requirement of all types of low speed crosshead engines. In addition, Energol DL-MP30 and DL-MP40 are recommended for the crankcase lubrication requirements of medium speed trunk piston engines burning distillate fuel with up to 1 percent weight sulphur where there is a requirement for a diesel detergency level up to and exceeding API-CD.

Important performance features are: detergency/dispersancy characteristics ensuring a high level of engine and crankcase cleanliness; high thermal and oxidation stability for superior piston cooling performance; alkalinity to neutralize the acidic products of combustion; excellent water rejection characteristics; rust inhibited; and multipurpose shipboard use.

For medium-speed engines burning heavy fuel, BP's Energol IC-HF 303/304 oils have an established reputation. Recent trends however indicate that higher levels of alkalinity will be needed for some engine designs, if engine protection is to be maintained. BP introduced Energol ICHF 404 with a high level of alkaline reserve at 40 mg KOH/g to meet these requirements.

The IC-HF range is therefore recommended for the lubrication requirements of marine medium-speed trunk piston engines operating on residual fuel and is suitable for the lubrication of most reduction gears used with medium-speed engines.

The performance features include: detergency/dispersancy for excellent engine cleanliness and minimum piston deposits; high thermal and oxidation stability to prolong service life; good water separation with minimal additive depletion; rust inhibited; alkalinity to neutralize the acidic products of combustion; and flexibility to match TBN levels with operating requirements.

BP marine lubricants are available at all main U.S. ports as well as worldwide.

CASTROL

Circle 34 on Reader Service Card

Through continuous research and development, Castrol is constantly striving to meet the ever changing demand of today's and tommorrow's marine industry. To meet recent changes in reciprocating engine design and fuel and operating trends, Castrol, after extensive laboratory and in-service testing, has developed three new products to further enhance their wide range of marine lubricants. They are Castrol Marine CDX 30, Castrol Marine MLC 30/40 and Castrol Marine SMS 12.

Castrol's research and development program is designed to continually develop their existing product range. Recent examples of this activity as reported in three research papers, relates to fully instrumented ships working on slow-speed crosshead engine cylinder oils. Also, Castrol's development of a range of fully synthetic diesel engine oils, which requires extensive research, part of which involves a program of cooperation with a major German engine builder. As stated in "Marine Lubrication—Future Thinking," a paper presented by **H.D. Smith** at the Motorship Conference 1988, Castrol does not consider, for technical and commercial reasons will be viable in the current commercial marine market. However, the firm, guided by engine builders and their own development scientists, have accepted the need to be prepared for all future options and possibilities.

The current trend towards unifuel for both main propulsion and generator sets, limits the use of the previously highly successful multipurpose lubricants, which served both the main propulsion engine crankcase and the previously less ardous generator sets. Critical analysis indicated the generator sets, burning poorer fuel (similar to the main engine), require lubricants of 30-40 TBN offered by Castrol's MXD 300 and 400 series oils. This led to the development of Castrol CDX 30, a 5TBN oil, tailored to economically serve the exact needs of crankcase bearing, piston cooling, turbocharger and power take-off (PTO) and power take-in (PTI) units. The carefully selected base oils and functional additives offer: high-temperature stability and good oxidation resistance for piston cooling; excellent water-shedding and good anti-corrosion against water and acidic contaminants; and exceptionally high load and carrying properties for PTO/PTI application.

To provide added safety margin, a 12 TBN Castrol Marine MLC was introduced to service highly rated engine operation on distillate fuel, e.g., for coastal vessel's main propulsion and auxiliary generator engines.

Castrol Marine SMS, a 12 TBN heavy duty semisynthetic lubricant with inherent high-viscosity index and extreme low pour point, is designed to work in unusually ardous conditions and is exceptionally suitable for use in extreme temperature conditions.

CATERPILLAR

Circle 35 on Reader Service Card

Caterpillar engineers have recognized that some marine engine oils currently in use may have become a limiting factor in obtaining longer engine life.

After three years of development and testing by Caterpillar research engineers, Caterpillar is now announcing new lubricant recommendations for Caterpillar marine engines.

These new lubricant recommendations are based on a line of fluid products Caterpillar has developed. These fluid products have been proven to provide the best performance for Caterpillar marine products. This line of fluids includes engine oils, transmission/drive train oils and lubricating greases.

The new Caterpillar CXP diesel engine oil is now the recommended

engine oil to achieve the maximum life and performance in Caterpillar marine engines. CXP diesel engine oil has been specially formulated and tested to minimize piston and ring deposits. These harmful deposits can lead to premature wear and premature failures.

To maximize marine transmission life and performance, it is now recommended to use Caterpillar's CXP transmission/drive train oil. This oil has also been specially formulated to minimize internal wear.

Caterpillar's goal has been and remains to significantly improve the performance and durability of Caterpillar marine products. Caterpillar wants to insure that its customers get every hour out of their Caterpillar engine that was originally designed into the engine.

CHEVRON

Circle 40 on Reader Service Card

Chevron has recently introduced Chevron DELO Marine Oil 477 for the inland marine trade class. It is marketed as Chevron DELO 6170 Oil for customers on the western and eastern seaboard.

Chevron's DELO Marine Oil 477 (DELO 6170 Oil) is test proven, demonstrating superior results in the field for today's new generation high-performance diesel engines. This product is designed especially for use in engines for towboat service where some current lubricants may have limited performance and is compounded to a high alkalinity level, measuring 17 TBN (Total Base Number) by ASTM Method D-2896.

New engine designs require improved oxidation and viscosity control for operating demands of fuel efficient engines with higher combustion pressures and temperatures. Increased alkalinity reserve is required for corrosive wear protection and especially for operations requiring extended drain intervals.

DELO Marine Oil 477 (DELO 6170 Oil) was field tested in marine and locomotive service in GE and EMD engines with full approval from these engine manufacturers. Field testing demonstrated increased oxidation and viscosity control compared to typical Generation 4 lubricants. This increased oil control can allow increased drain intervals for GE engines and due to increased drain intervals, the added alkalinity reserve also provides the ability to extend drain intervals. This superior oxidation stability and viscosity control was also demonstrated in EMD engines modified to run at higher operating temperatures to increase efficiency.

Chevron DELO Marine Oil 477 (DELO 6170 Oil) provides an optimized engine oil formulation for today's service requirements for industrial engine design in marine towboat and ferry service.

CUMMINS

Circle 36 on Reader Service Card

Cummins Engine Company, Inc., Columbus, Ind., offers Premium Blue engine oil for the marine market. The company reports that Premium Blue 15W-40 oil has specially formulated additives selected to maximize the performance of heavy-duty diesel engines.

Since engine oils are mostly base oil stocks, it is the chemical additive package blended into these base stocks that are the key to oil performance. Cummins spent eight years in the lab formulating Premium Blue to optimize performance in their engines.

The additives in Premium Blue include materials that modify base stock characteristics with respect to such factors as viscosity, detergency, dispersancy, wear, oxidation, corrosion, pour point and foam.

SAE Viscosity Grade 15W-40 Premium Blue has a pour point of -30 degrees C, viscosity of 3200 cP at -15 degrees C and 3.6 cP at 150 degrees C.

The company reports that Premium Blue is specially formulated to prevent carbon build-up, which is critical to low oil consumption. Premium Blue contains high concentrations of detergents, dispersents and oxidation inhibitors to reduce the rate of formation of deposit-forming materials. Those materials that do form are suspended in the oil so that they can be removed from the engine when the oil is drained.

Also included are anti-wear addi-

Shipyards

Cadiz
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Fax: (34-56) 27 83 62
25 68 28
Telex: 76021 ASTIL E
76153 AVEN E

Sevilla
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Bilbao
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Telex: 31519 AERS E

Santander
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Fax: (34-42) 54 00 26
Telex: 35810 ASSA E

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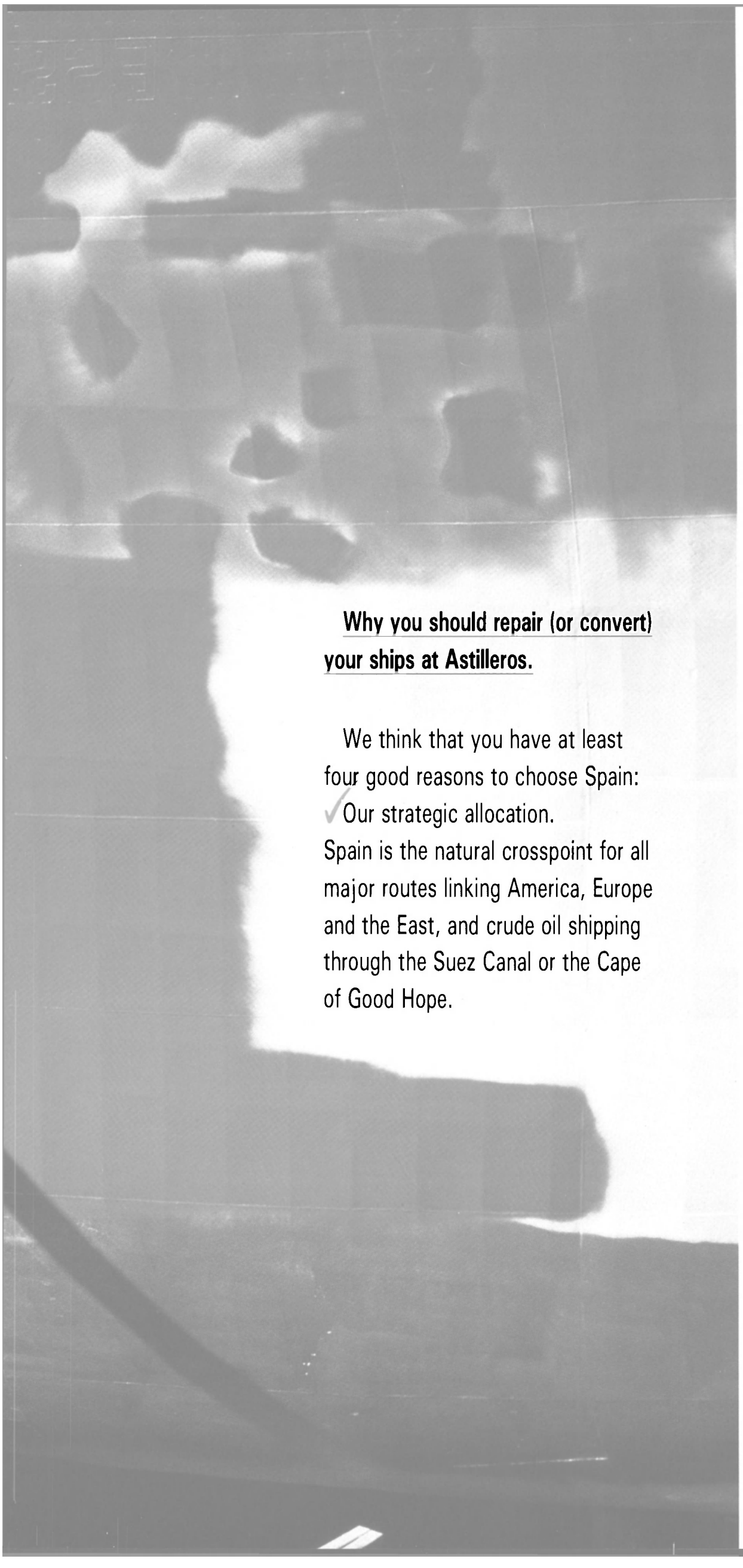

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Circle 184 on Reader Service Card

(continued)

tives to reduce engine wear rates, corrosion inhibitors to control the tendency of critical parts to corrode, pour point depressants to reduce the tendency for the oil to solidify at low temperatures, and antifoam additives to reduce oil foaming on air-entrainment characteristics.

EXXON

Circle 37 on Reader Service Card

The Exxmar™ line of marine lubricants for crosshead and trunk piston diesel engines is the latest generation of superior quality products to be developed by Exxon Corporation. Lubrication properties such as wear reduction, cylinder cleanliness, load carrying capacity and retention of alkalinity in the presence of water contamination have all been greatly enhanced. The Exxmar products surpass the already high performance level of the successful Tro-Mar™ marine lubricants which this line replaces. The Exxmar lubricants will meet the challenges of increasingly harsh operating environments in marine diesel engines, including higher operating temperatures and pressures as well as the use of lower quality fuels.

Field testing of these lubricants in the latest generation of diesel engines showed significant improvements in wear performance over the corresponding Tro-Mar products. Review of operators performance data of the past eight months also supports reduced wear rates and improved engine cleanliness. In crosshead engines, wear of cylinder liners and piston rings was reduced on average by one third in MAN B&W MCE and Sulzer RTA and RLB type engines. These reductions were recorded over a total period of 26,000 hours of testing.

In trunk piston diesel engines, an even greater reduction in wear was recorded with piston ring wear halved in a Pielstick PC 2-6 engine. The Exxmar trunk piston lubricants were also shown to be capable of almost complete (96 percent) retention of their alkalinity (TBN) when subjected to continuous addition of water.

Enhanced system cleanliness and piston deposit control is achieved in both crosshead and trunk piston engines when using Exxmar oils. The high standards of cleanliness and the superior wear control make it possible to extend engine maintenance periods and provide ship operators with an opportunity to realize cost savings.

For crosshead engine cylinders, a 70 TBN oil of outstanding performance is offered as the main grade for high maximum pressures and high stroke-to-bore ratio engines. At the same time, for less highly rated engines of earlier vintages, the customer has the choice of a more economic 60 TBN cylinder oil. A higher TBN (90) and viscosity oil is available for operational conditions where such an oil is required by the engine builder.

For trunk piston engines, high performance 30 and 40 TBN oils are offered for all highly rated engines in severe service. For customers' convenience, a more economic 12 and 24 TBN oil will continue to be available for applications where a lower TBN lubricant is suitable.

The new Exxmar line of products is the result of expertise with formulating marine oils acquired over many years and reinforces the long-standing tradition of Exxon service to the world's shipping industry. Most importantly, Exxmar products are being made available worldwide without an increase in cost to the shipowner.

In addition to the Exxmar product line, several synthetic products are also available: Synesstic™, Synthetic Spartan™ and Polyrex™ Grease, which all provide the lubricating benefits of improved operating efficiency, extended drain intervals and decreased maintenance.

MOBIL

Circle 38 on Reader Service Card

Mobil Oil Corporation has a worldwide network of marine lubricant supply and service points and a long-standing, worldwide lubricant uniformity and availability. In addition, Mobil offers a complete engineered analysis program called Progressive Fast Analysis (PFA) for marine main and auxiliary diesel engines. This engineered analysis program provides a trend analysis of diesel engine oils, on-site evaluation and follow-up, and a new data base of oil analysis results used for more indepth interpretation of analysis vs. equipment make and model, lubricant or fuel in use, contaminants, etc. Trend analysis and interpretation information are reported with periodic service reports or by inquiry.

The Mobilgard series of marine engine oils includes Mobilgard 570, a quality marine diesel engine cylinder oil formulated to provide outstanding performance in high-output crosshead engines with brake mean effective pressures (BMEP) of 14 to 17 bar. These highly loaded crosshead diesels operate on heavy fuel oil with high sulfur content in order to reduce operating costs. Concurrently, advances in engine thermodynamics have permitted decreases in specific fuel consumption from 155 to 125 per bhp-hour. These changes in engine design for greater fuel efficiency, the use of higher viscosity residual fuels, and the need for reduced maintenance have increased the requirements on crosshead cylinder oil.

Mobilgard 570 was developed to provide high load-carrying charac-

teristics, improved spreadability, tenacious film retention, and to minimize port and piston deposits. Because of its high alkalinity (70 Total Base Number or TBN), it provides better protection against corrosive wear by neutralizing large amounts of strong acids. This oil is compatible with oils normally used in the crankcase of crosshead engines.

Mobilgard 300 system oil was also developed especially for modern, high-output, crosshead type marine diesel engines. It is formulated from highly treated paraffinic base oils that are selected for their thermal stability and oxidation resistance. The inherent base oil characteristics are augmented with a balanced additive package including high-temperature oxidation inhibitors, alkaline detergent-dispersants, and defoamants. The formulation has maximum antiwear properties, good rust protection in the presence of salt water, and excellent water separation characteristics.

The Mobilgard 24 series oils were developed originally to meet the requirements of medium-speed, trunk piston diesels used for main propulsion engines on coastal and river vessels. The series was reformulated recently to provide improved performance in the new, higher-output versions of these engines now coming into service.

The Mobilgard 42 series of marine lubricating oils has been developed to supplement the Mobilgard 24 series (30 TBN) oils for the lubrication of modern high-output, medium-speed trunk diesel engines used in oceangoing vessels and ferries.

Mobilgard 42 oils have an alkalinity level of 40 TBN and are therefore particularly suitable for engines that show indication of corrosive wear to cylinder liners and piston rings.

Mobilgard SHC 120 is a 12 TBN synthetic, medium-speed diesel lubricant. It contains a balanced blend of synthesized hydrocarbons and ester-based fluids, with an additive system designed to provide optimum performance in diesel engines. Although its measured viscosity indicates that it is an SAE 40 grade, this oil's inherent high index enables it to perform similar to an SAE 15W-40 viscosity grade diesel engine lubricant. It is formulated for operation in extremes of ambient temperature.

The Mobilgard 12 series oils are intended for marine diesels operating in distillate fuels or light fuel blends. These oils have proven especially effective in small-bore, high-speed trunk engines and automotive-type diesels used in fishing fleets, the new severe service en-

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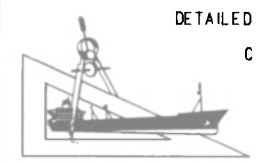

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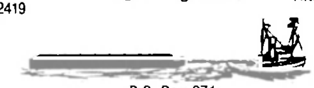

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Marine Lubricants

(continued)

gines and in several types of medium-speed trunk piston engines. The oils come in viscosities of SAE 30, SAE 40 and SAE 50 and have a TBN of 15.

Other marine lubricants are available.

PENNZOIL

Circle 39 on Reader Service Card

Pennzoil, a long-time supplier of lubricant products to the commercial marine sector, offers Pennzoil Supreme Duty Fleet Motor Oil, a premium quality multigrade (SAE 15W40) motor oil which exceeds API Service Classification SF-CC-CD. It is formulated with some of the finest base stocks and the most advanced additives in the industry. Supreme Duty provides unsurpassed protection for both two- and four-cycle high-performance diesel engines.

Supreme Duty provides better fuel economy, less oil consumption, reduced maintenance costs, and significantly longer engine life. According to the company, some of the benefits derived from the use of Supreme Duty include: reduction of ring and cylinder wear; improvement of piston cleanliness; increased wear protection for valve trains; and neutralization of acids from high sulfur fuel.

Supreme Duty Fleet Motor Oil exceeds the performance requirements of all diesel (both two- and four-cycle) and gasoline manufacturers which specify the use of an engine oil meeting API Service Classification SF, CC, CD or any combination such as SF-CD. Supreme Duty is also available in SAE 10W-30, 30, 40 and 15W-40. SAE 10W-30, 30 and 15W40 meet API Service Classification SG/CD and CE. SAE 40 meets API SG/CD and CD-II.

Pennzoil also offers Long-Life Motor Oil, which provides premium quality service in both diesel and gasoline engines. It is specially formulated for heavy-duty service in diesel engines.

Pennzoil Long-Life Motor Oil is available as a single SAE viscosity grade 10W, 20W-20, 30, 40 and 50, and as a multigrade SAE 15W-40. SAE 30 and 15W-40 meet the requirements of API Service Classes SG, SF, CC, CD and CE. All other grades meet the requirements of API Service Classes SG, SF, CC and CD.

TEXACO

Circle 42 on Reader Service Card

Texaco offers a complete line of quality marine lubricants which are available worldwide to meet the needs of all types of marine equipment.

For crosshead engines, Texaco offers TARO Special, a premium quality cylinder lubricant for large, slow-speed diesels burning residual fuels. It is blended from highly refined paraffinic base oils and oil soluble additives to produce a high alkaline reserve (70 TBN) product with good lubricant film strength. It is approved by all of the major crosshead engine builders. It is specially formulated to prevent corrosive wear and minimize ring deposits.

Taro Special EX 85 is a premium quality cylinder lubricant specifically developed to meet the requirements of Sulzer RLB engines. It has provided excellent performance in field tests and is approved by Sulzer for those applications where an 85 TBN product with a viscosity of 24 cst at 100 degrees C is specified.

DORO AR 30 (SAE 30) is a premium crankcase lubricant for large, slow-speed engines. It is blended from highly refined solvent neutral oils and carefully selected additives to produce a moderate alkaline reserve (6 TBN) oil. This product offers unusually good rust and corrosion protection, wear protection and water separation characteristics. DORO AR 30 meets the Sulzer requirement for engines equipped with PTO units.

Texaco offers a complete line of trunk piston engine oils for medium and high-speed diesels. The specific lubricant required would be based on the sulfur content of the fuel being used in the engine. TARO XD oils, with a TBN of 15 minimum, are used in engines burning fuel with a sulfur content up to 1.8 percent. TARO DP oils, with a TBN of 30 minimum, are specifically designed for trunk type engines utilizing fuel with sulfur in excess of 1.8 percent. TARO XD and TARO DP are available in SAE 30 and SAE 40 viscosity grades. TARO XL 40 (SAE 40) is for use in medium-speed engines where the operating conditions or fuel sulfur content requires a 40 TBN product.

All of these oils are blended from carefully refined base oils fortified with specially developed additive packages to give excellent performance even under the most severe operating conditions. They have

(continued on page 64)

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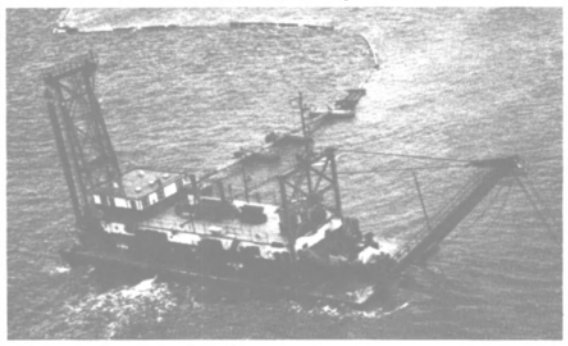

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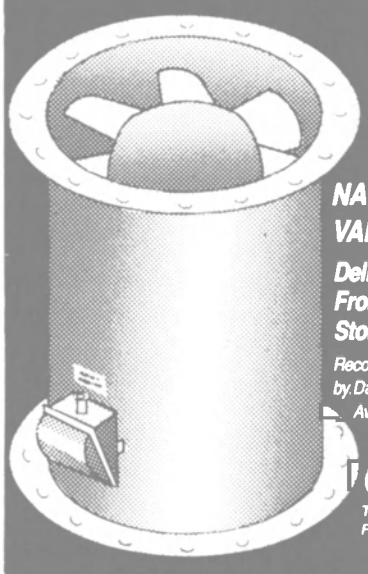

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New 12-Page PBM Catalog On Multi-Port Ball Valves

Pittsburgh Brass Manufacturing Co. (PBM) of Irwin, Pa., has published a 12-page catalog on three-, four-, and five-way multi-port ball valves.

PBM's recently redesigned line of these valves incorporate streamlined investment cast components that, according to the company, increase the pressure and temperature range of the valve. Pressures to 400 psi and temperatures to 550 degrees F are now possible.

Mated to an electric actuator, these valves tie directly into microprocessor-controlled systems through the use of an encoder or resolver. The manufacturer says that one valve/actuator takes the place of from two to four two-way valves and simplifies the piping system and computer programming.

Seventy-three flow patterns are available in valve sizes from ½-inch to 4 inches. Materials of construction include 316 stainless steel, carbon steel, iron, bronze and other exotic alloys.

The multi-port valve catalog, section IV, has been upgraded to include a wealth of engineering data, including Cv charts, pressure/temperature curves and dimensional data.

For more information and a free copy of the catalog from PBM,

Circle 82 on Reader Service Card

Ameron Marine Coatings Offers High-Performance Products For Steelwork Protection

Ameron Marine Coatings Division of South Gate, Calif., features a number of high-performance products for marine steelwork protection, including the well-known and highly successful Dimetcote® and Amercoat® systems.

The range of products designed to protect steel from the severest conditions includes primers and tank linings which deliver long-term, effective performance.

High-build, single coat products for general maintenance and finish-coat applications are also featured, such as Amerlock® and Amershield™.

Amerlock is a versatile high-solids, self-priming epoxy coating for shipboard maintenance which has proved ideal for new steelwork and renewal coatings applications.

Amershield is a new high-solids, high-build urethane coating which provides many important performance features. These include long-term color and high gloss retention, outstanding resistance to abrasion and flexing, plus excellent resistance to direct and reverse impact.

Ameron Marine Coatings' worldwide supply, sales and service network includes more than 50 companies in over 40 countries. Further development of this network has been undertaken during the past year, through the appointment of new licensees and agents.

For more information and free literature on Ameron Marine Coatings,

Circle 70 on Reader Service Card

Established Canadian Firm Designs And Builds Innovative Vessels And Marine Equipment

Lunenburg Foundry and Engineering Ltd. has been providing a wide variety of high quality products since its establishment in 1891. Originally established to serve the local fishing industry, Lunenburg Foundry has evolved into a diverse manufacturing organization with a fully qualified marine engineering department.

Using CAD-CAM technology, naval architect and vice president **Peter Kinley** developed a new 65-foot steel wet fish trawler for the Atlantic Canadian fishery. Future projects include the design and construction of a small harbor tug and installation of a 75-ton marine mobile boat hoist to provide increased service to the inshore fishery.

Another recent development is the design and manufacture of "Aqualife" cages for the fast growing aquaculture industry in Atlantic Canada. These durable 40-foot by 40-foot-square galvanized steel fish rearing cages are proving to be popular among the region's fish farmers.

Other product lines include marine hardware and equipment for both traditional and modern markets. This consists of propulsion systems, traditional cabin and deck hardware, hydraulic and mechanical steering systems, windlasses and hoists, and fishing equipment. The company is the leading Ford Engine distributor in Canada and continually updates their line of Ford "Senator" marine engines.

Marine refits for government, commercial and private vessels are carried out on the company's marine railways. Three cradles are available with a capacity of up to 1,600 metric tons. The firm is able to carry out a full range of ship repairs, refitting and modifications. Facilities also include ferrous and nonferrous foundries, machine shop, welding, electrical and engine departments.

For more information and free literature from Lunenburg Foundry and Engineering,

Circle 65 on Reader Service Card

Marine Lubricants

continued

been extensively tested both in the laboratory and in the field. TARO XD, DP and XL 40 all offer excellent TBN retention and anti-corrosion properties. They are formulated with selected detergent and dispersant additives which minimize piston ring deposits, improve overall engine cleanliness and provide long in-service life.

Texaco supports its marine lubricants with prompt, efficient technical service and the Texlube used oil analysis program for monitoring the condition of the oils in use.

Inventory Locator Service Names Anderson Director, Marketing And Business

Eric E. Anderson has been named director-marketing and business development for Inventory Locator Service, Inc. (ILS), a Ryder System Company.

ILS president **Fred Meyer** said Mr. **Anderson,** who assumes his new post immediately, will be responsible for strategic market planning and directing the company's business development/acquisition programs.

Inventory Locator Service provides a worldwide, computerized parts location and cross-reference database service for the aviation and marine industries.

New Marketing Services Manager For Kelvin Hughes

Kelvin Hughes Ltd., the British radar and navigation equipment manufacturer and supplier, a subsidiary of Smiths Industries PLC, have appointed **Barry Morgan** as their marketing services manager.

Based at Kelvin Hughes Ltd.'s head office in Ilford, Mr. **Morgan** will be responsible for all the company's corporate relation activities, including internal and external public relations, advertising and exhibition organization.

Alan Eldret, the director of the merchant marine division, said:"The appointment of Mr. **Morgan** as marketing services manager will greatly assist the future growth and efficiency of Kelvin Hughes Ltd. by releasing existing sales and marketing staff from their corporate relations activities."

Mr. **Morgan** joined Kelvin Hughes Ltd. from U.D.U. Group Ltd., the Aberdeen-based Sonar manufacturers, where for a number of years he was responsible for corporate relations and product marketing.

American Heavy Lift Names Admiral Peet To Board of Directors

American Heavy Lift Shipping Company recently announced the election of Vice Adm. **Raymond E. Peet,** USN (retired), to its board of directors.

Highlighting Admiral **Peet's** active U.S. Navy career were the positions of acting Assistant Secretary of Defense for **James Schlesinger** (1974) and Deputy Assistant Secretary of Defense (1972-74). The admiral's numerous field commands include Commander, First Fleet (1970-72) and Commander, Atlantic Amphibious Training Command (1968-69).

Admiral **Peet** is currently consultant to the president of Teledyne Ryan Aeronautical Company, and serves as a director for Cubic Corporation and Energy Factors Inc. In addition, he is serving on a volunteer basis as chairman of San Diego's Fiscal Overseers Board.

American Heavy Lift operates four Jones Act product tankers. These vessels are currently under term charters to four major U.S oil companies involved in coastwise petroleum product transportation.

← For literature on Aeroquip products, circle the appropriate number on the reader service card: Hose & Fittings—**Circle 111;** T-J Cylinders—**Circle 112;** Teflon Hose—**Circle 113;** Quick-disconnect Couplings—**Circle 114.**

BUYERS DIRECTORY

This directory section is an editorial feature published in every issue for the convenience of the readers of MARITIME REPORTER/Engineering News. 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/EN assumes no responsibility for errors. **If you are interested in having your company listed in this Buyers Directory Section, contact John C. O'Malley at (212) 477-6700.**

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Adrick Marine Corp., 320 Cantor Ave., Linden NJ 07036
Bailey Refrigeration Co., Inc, 2323 Randolph Avenue, Avenel, NJ 07001
Stal Refrigeration AB, Butangsgatan 16, S-60187 Norrkoping SWEDEN
ANODES—Cathodic Protection
Electrocatalytic Inc., 2 Milltown Ct., Union NJ 07083
Kaiser Chemicals, 7311 E. 41st St., Tulsa OK 74147
BALLAST
Genstar Stone Products, Executive Plaza IV, Hunt Valley, MD 21031
Mineral Research & Recovery Inc., 4565 S. Palo Verde, Ste 203, Tucson AZ 85714
BARGE BUILDING
HBC Barge, Brownsville PA 15417
BARGES—Leasing
McDonough Marine Service, P.O. Box 1825, Parkersburg WV 26101
BASKET STRAINERS
Riley-Beaird, P.O. Box 31115, Shreveport, LA 71130
BEARINGS—Rubber, Metallic, Non-Metallic
Johnson Rubber Co., Duramax Marine Div., 16025 Johnson St., Middlefield, OH 44062
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241
Kingsbury Inc., 10385 Drummond Rd, Philadelphia PA 19154
Lucian Q. Moffitt, Inc., P.O. Box 1415, Akron, OH 44309
Waukesha Bearings Corp., P.O. Box 798, Waukesha, WI 53186
BOILERS
Combustion Engineering, Inc., Windsor, CT 06095
Marketec, Inc., 27 Bowers Lane, Chatham NJ 07928
BOILER CLEANING
Asea Stal, 50 Chestnut Ridge Rd., Montvail N.J. 07645
Infrasonik AB (an ASEA Stal Co.). S-612 20 Finspong, SWEDEN
BROKERS
Captain Astad Company, Inc., P.O. Box 350486, Ft Lauderdale FL 33335; P.O. Box 1093, Houma, LA 70360
Bergeron & Associates, P.O. Box 726, Chalmette LA 70044
Jack Faulkner Inc., 2419 Caddy Lane, P.O. Box 371, Flossmoor IL 60422
Mowbray's Tug & Barge Sales Corp., 35 De Hart St., Morristown NJ 07960
Ocean Marine Brokerage Services, P.O. Box 1257, Port Canaveral, FL 32927
BULKHEADS
The Waugh Co./Rockment (TNF), 5111-6 Baymeadows Rd., Suite 394, Jacksonville, FL 32217
BUMPERS (Crane)
M.E.K. Equipment, P. O. Box 2357, Newport News VA 23602
CARGO ACCESS EQUIPMENT
Morgan Crane Co., Inc. (Hiab SeaCranes and QMC Trident, Ferrari, Fassi marine cranes), 1009 E. Chestnut Ave., Santa Ana CA 92701
CARGO HANDLING SYSTEM
Saab Tank Control, 201 W. Passaic St., Rochelle Park NJ 07662
CASTINGS/FORGINGS
NKS Industria Pesada, Grupo Industrial, Reforma 404, 14th floor, Mexico D.F. 06600 MEXICO
CHAIN
Baldt Inc., P.O. Box 350, Chester PA 19106
Milligan Marine Supply Inc., 5832 Harvey Wilson, Houston TX 77020
CHOCKING COMPOUND
Philadelphia Resins Corp., 130 Commerce Dr., Montgomeryville, PA 18936
COMPUTERIZED INFORMATION SYSTEMS
TIMSCO, P. O. Box 91360, Mobile AL 36691
CONDENSERS/SEPARATORS
Riley-Beaird, P.O. Box 31115, Shreveport, LA 71130
Wright Austin Co., 3245 Wight St., Detroit MI 48207
CONTROL SYSTEMS—Monitoring
ASEA, Inc., 4 New King St., White Plains, NY 10604
Eldec Corporation, 16700 13th Ave. West, P.O. Box 100 Lynnwood, WA 98036
Imo-Deloval, Inc., Gems Sensors Division, One Cowles Rd., Plainville CT 06062
NAMCO Controls, 7567 Tyler Blvd, Mentor OH 44060
Teleflex Inc., 771 First Ave., King of Prussia, PA 19406
Valmet Automation A.S., P.O. Box 130, N-3430, Spikkestad, Norway
WABCO, 1953 Mercer Rd., Lexington KY 40511
CRANES—HOISTS—DERRICKS—WHIRLEYS
ASEA-Hagglund, Inc., 50 Chestnut Ridge Rd., Montvale NJ 07645
The Crosby Group, Inc., P.O. Box 3128, Tulsa OK 74101
Del Gavio Marine Hydraulics Inc., 207 W. Central Ave., Maywood NJ 07607 telex: 132610 DELMARINE
Marine Travelift, Inc., 49 E. Yew St., Sturgeon Bay, WI 54235
Morgan Crane Co., Inc. (Hiab SeaCranes and QMC Trident, Ferrari, Fassi marine cranes), 1009 E Chestnut Ave., Santa Ana CA 92701
J.D. Neuhaus, Hebezeuge, D5810, Witten Heven, West Germany
Pettibone-Tiffin Corp., 235 Miami St., Tiffin, OH 44883
DECK MACHINERY—Cargo Handling Equipment
Braden Carco Gearmatic, P.O. Box 547, Broken Arrow, OK 74013
Gearmatic—see 'Braden Carco Gearmatic' above.
Markey Machinery Co., Inc., 79 S. Horton St., Seattle, WA 98134
McElroy Machine & Mfg. Co., Inc., P.O. Box 4455, Biloxi MS 39535
Morgan Crane Co., Inc. (Hiab SeaCranes and QMC Trident, Ferrari, Fassi marine cranes), 1009 E Chestnut Ave., Santa Ana CA 92701
DIESEL ACCESSORIES—CYLINDER LINERS
Acurex Corporation, Autodata Division, 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039
Colt Industries Inc. Fairbanks Morse Engine Div. 701 Lawton Ave., Beloit. WI 53511
Diesel America Inc., 5217 River Rd., New Orleans LA 70123
FCS Inc., 22 Main St., Center Brook CT 06409
General Thermodynamics Corporation, 210 South Meadow Road, P.O. Box 1105, Plymouth, MA 02360
Kiene Diesel Accessories, 325 S. Fairbanks St., P.O. Box 386, Addison IL 60101
DIESEL ENGINE—Spare Parts & Repair
Bergen Diesel A/S, P.O. Box 924, N-5001 Bergen NORWAY
Bergen Diesel Inc., 2701 Delaware Ave., Kenner LA 70062
Chrome Locomotives, P.O. Box 197, Silvis IL 61282
Colt Industries Inc. Fairbanks Morse Engine Div. 701 Lawton Ave., Beloit. WI 53511
Cummins Engine Co., Inc., Mail Code 40642, Box 3005 Columbus, IN 47202-3005
Goltens, 160 Van Brunt St, Brooklyn NY 11231
MAN B&W Diesel GmbH, Stadtbachstrasse 1, D-8900 Augsburg 1, Federal Republic of Germany
MAN B&W Diesel, 50 Broadway, 18th Fl., New York, NY 10004
Markisches Werk GmbH, P.O. Box 1442, D-5884 Halver 1, Federal Republic of Germany
Sulzer Brothers Inc., 200 Park Ave., New York, N.Y. 10166
DIVING & SALVAGE
Muldoon Marine Services, P.O. Box 3221, Terminal Island, CA 90731
Parker Diving Service Inc., Berth 69, Los Angeles Harbor, P.O. Box 5272, San Pedro CA 90733
ELECTRICAL EQUIPMENT
Eldec Corporation, 16700 13th Ave West, P.O. Box 100, Lynwood WA 98036
SPD Technologies, 13500 Roosevelt Blvd, Philadelphia PA 19116
Ward Leonard Electric, 31 South St., Mt. Vernon, NY 10550
Zidell Explorations, Inc., 3121 S.W. Moody St., Portland, OR 97201
ELECTRONIC INFORMATION SYSTEMS
Inventory Locator Service Inc., 3820 Premier Ave., Memphis TN 38118
ELECTRONIC SYSTEMS
Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217 TX: 125327
ENGINE TEST EQUIPMENT
General Thermodynamics Corp., P.O. Box 1105, 210 S. Meadow Road, Plymouth, MA 02360
EQUIPMENT—Marine
Atlas Copco Rental, 70 Demarest Dr., Wayne, NJ 07470
Thomas Coudon Associates, 6655 Amberton Dr., Baltimore, MD 21227
Kearfott Marine Products, 550 South Fulton Ave., Mount Vernon, NY 10550
Maritime Power Corp., 200 Henderson Street, Jersey City, NJ 07302
Space Machine & Engineering Corp., 2346 16th Ave North, St Petersburg FL 33713
EVAPORATORS
Atlas-Danmark Desalination Systems A/S, Stamholmen 93, 2650 Hvidovre (Copenhagen), Denmark
Equipment Engineering, 666 Baker St., #265, Costa Mesa CA 92626
MECO (Mechanical Equipment), 861 Carondelet St., New Orleans LA 70130
Riley-Beaird, P.O. Box 31115, Shreveport, LA 71130
FANS—VENTILATORS—BLOWERS
Carling Turbine Blower Company, 10 Nebraska St., P.O. Box 88, Worcester MA 01613
Jon M. Liss Associates, Inc., 411 Borel Ave., P. O. Box 5554, San Mateo, CA 94402
Robinson Industries, P.O. Box 100, Zelienople, PA 16063
FASTENERS
Action Threaded Products Inc., 6955 S. Harlem, Bedford Park, IL 60638
Band-It Division, Houdaille Industries Inc., P.O. Box 16307, Denver CO 80216
Hardware Specialties Co., Ships Division, 48-75 36th St, Long Island City NY 11101
Lee Brass Company, P. O. Box 1229, Anniston AL 36202
Mapeco Products, Inc., 725 Glen Cove Ave., P.O. Box 6, Glen Head NY 11545
Non-Ferrous Bolt & Mfg Co., 4085 Nevso Dr., Suite C, Las Vegas NV 89103
Okabe Co., Inc., 175 Lively Blvd., Elk Grove Village, IL 60007
FENDERING SYSTEMS/BUOYS—Dock & Vessel
Intertrade Ltd., Marine Products Div., 15301 Transistor Lane, Huntington Beach CA 92649
Johnson Rubber Co., Duramax Marine Div., 16025 Johnson St., Middlefield, OH 44062
Kohlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241
Milligan Marine Supply Inc., 5832 Harvey Wilson, Houston TX 77020
Schuyler Manufacturing, 16901 Woodinville-Redmond Rd, Woodinville WA 98072
Seaward International, Inc., Clearbrook Industrial Park, P.O. Box 98, Clearbrook VA 22624
FILTERS
Marketec, Inc., 27 Bowers Lane, Chatham NJ 07928
Parker Filter Division, 16810 Fulton County Rd., #2, Metamora, OH 43540
FUEL ADDITIVE
U.S. Borax, Industrial Chemicals, 3075 Wilshire Blvd., Los Angeles CA 90010
FURNITURE
Bailey, Carpenter & Insulation Co., 2323 Randolph Avenue, Avenel, NJ 07001
GALLEY EQUIPMENT
Gaylord Industries, 10900 S W Avery St, P.O. Box 1149, Tualatin, OR 97062
GANGWAYS, LADDERS
American Mason Safety Tread Company, 153 Essex St., Haverhill MA 01830
Rampmaster Inc., 9825 Osceola Blvd., Vero Beach, FL 32960
Westmont Industries, 10805 Painter Ave., Santa Fe Springs, Los Angeles, CA 90670
Wooster Products Inc., 1000 Spruce St., P.O. Box 896, Wooster, OH 44691
HATCH & DECK COVERS—Chain Pipe
American Mason Safety Tread Company, 153 Essex St., Haverhill MA 01830
HEAT EXCHANGERS
Alfa Laval Inc., 2115 Linwood Ave., Fort Lee NJ 07024
ITT Standard Heat Transfer Technology, Buffalo, NY 14240
MECO (Mechanical Equipment), 861 Carondelet St., New Orleans LA 70130
Riley-Beaird, P.O. Box 31115, Shreveport, LA 71130
HORNS/WHISTLES
Kohlenberg Bros Co., P.O. Box 358, Two Rivers, WI 54241
HYDRAULICS
Aeroquip Corporation, 300 South East Ave., Jackson, MI 49203
Cunningham Marine Hydraulics Co., 201 Harrison St., Hoboken NJ 07030
Del Gavio Marine Hydraulics Inc., 207 W Central Ave., Maywood NJ 07607; telex: 132610 DELMARINE
Parker Hannifin Corporation, 17325 Euclid Avenue, Cleveland, OH 44112
INCINERATORS
Teamtec A/S, P.O. Box 100, N-4912 Gjeving, NORWAY
INSULATION—Cloth, Fiberglass
Bailey, Carpenter & Insulation Co., 2323 Randolph Avenue, Avenel, NJ 07001
The Claremont Company, 174 State Street, P. O. Box 952, Meriden CT 06450
Duracote Corp., 350 North Diamond St., Ravenna, Ohio 44266
Soundcoat, One Burt Drive, Deer Park NY 11729
JOINER—Watertight Doors—Paneling—Ceiling Systems
Astech, 3030 S. Red Hill Ave., Santa Ana, CA 92711
Bailey Distributors, Inc., 2323 Randolph Avenue, Avenel, NJ 07001
Dampa Inc., The Gatehouse at North Park, Suite 106-108, Hunt Valley MD 21030
Simpson Timber Co., Third & Franklin, Shelton WA 98584
Walz & Krenzer Inc., 1390 Mt. Read Blvd., Rochester NY 14606
KEEL COOLERS
R.W. Fernstrum & Co., 1716 Eleventh Ave., Menominee, MI 49858
Johnson Rubber Co., Duramax Marine Div., 16025 Johnson St., Middlefield, OH 44062
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241
The Walter Machine Co., Inc., 84-98 Cambridge Avenue, Jersey City, NJ 07307
LIGHTING EQUIPMENT—Lamps, Fixtures, Searchlights
Carlisle & Finch, 4562 W. Mitchell Ave., Cincinnati OH 45232
Phoenix Products Company, Inc., 4769 North 27th Street, Milwaukee, WI 53209
LINE BLINDS
American Piping Products Inc., Box 1056, New Hyde Park, NY 11040
LUBE-OIL CENTRIFUGES
Keith Dixon Warehouse Supplier, Authorized distributor for Spinner II, 650 Whitehead Rd., Lawrenceville NJ 08648
Hamworthy Engineering Ltd., Fleets Corner, Poole, Dorset, BH17 7LA ENGLAND
Spinner II Products Div., T.F. Hudgins Inc., P.O. Box 920946, Houston, TX 77292
MACHINERY MAINTENANCE, REPAIR, OVERHAUL, AND TESTING
AMT, Inc., 2400 NW 39th Ave., Miami FL 33142
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Goltens, 160 Van Brunt St., Brooklyn, NY 11231
In-Place Machining Co., 1929 North Buffum St., Milwaukee WI 53212
MARINE LUMBER
McCausey Lumber Co., P.O. Box 38027-A, Detroit MI 48238
MEDICAL SUPPLIES
Universal Marine Medical Supply, 69-06 3rd Ave., Brooklyn NY 11209
METAL MARKERS/LETTERS
Johnston Brothers Enterprises, Inc., P.O. Box 1138, Patterson, LA 70329
J. P. Nissen Company, P.O. Box 188, Glenside PA 19038
NAVAL ARCHITECTS, MARINE ENGINEERS, SURVEYORS
Advanced Marine Enterprises, Inc., 1725 Jefferson Davis Hwy., Arlington, VA 22202
Aero Nav Laboratories, Inc., 14-29 112 St., College Point, NY 11356
American Professional Captains Association, P.O. Box 350398, Ft. Lauderdale FL 33316
American Systems Engineering Corp., P.O. Box 8988, Virginia Beach, VA 23452
Amirikian Engineering Co., Chevy Chase Center Bldg., Suite 505, 35 Wisconsin Circle, Chevy Chase, MD 20015
Amtech Services, Inc., P.O. Box 84148, Seattle WA 98124
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Childs Engineering Corp., Box 333, Medfield, MA 02052
Crandoll Dry Dock Engrs., Inc., 21 Pottery Lane, Dedham, MA 02026
Crane Consultants, 15301 First Ave S., Seattle WA 98148
C.R. Cushing, 18 Vesey St., New York, NY 10007
Design Associates Inc., 14360 Chef Menteur Highway, New Orleans, LA 70129
Designers & Planners, Inc., 1725 Jefferson Davis Highway, Suite 700, Arlington, VA 22202
E.Y.E. Marine Consultants, Belmont House, 33 Alderney Dr., Suite 350, Dartmouth, NS CANADA B2Y 2N4
Encon Management & Engineering Consultant Services, P.O. Box 7760, Beaumont, TX 77706
Christopher J. Foster, Inc., 16 Sintsink Drive East, Port Washington, NY 11050
Gibbs & Cox, Inc., 119 West 31st Street, New York, NY 10001
John W. Gilbert Associates, Inc., 66 Long Wharf, Boston, MA 02110
The Glosten Associates Inc., 600 Mutual Life Bldg., 605 First Ave., Seattle, WA 98104
Morris Guralnick Associates, Inc., 620 Folsom Street, Suite 300, San Francisco, CA 94107
Hi-Test Laboratories, Inc., P.O. Box 226, Buckingham C.H., VA 23921
C. Raymond Hunt Associates, 69 Long Wharf, Boston MA 02110
Hydrocomp, Inc., 45 James Farm-Lee, P.O. Box 865, Durham, NH 03824
Intramarine, Inc., P.O. Box 53043, Jacksonville, FL 32201
JJH Inc., No. 4 Executive Campus, Culbert Blvd. & Route 70, P.O. Box 5031, Cherry Hill, NJ 08034
R.D. Jacobs & Associates, 11405 Main St., Roscoe, IL 61073
James S. Krogen, 1515 NW 7th St., Suite 124, Miami FL 33125
Rodney E. Lay & Associates, 13891 Atlantic Blvd., Jacksonville, FL 32225
Clyde Leavitt Inc., 13901 Puerto Dr, Ocean Springs MS 39564
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., 1 World Trade Center, New York, NY 10048
MacPherson Maritime Services, 141 Jefferson Ave., Westfield NJ 07090
Fendall Marbury, 9 Neal Street, Annapolis MD 21401
Marine Management Systems Inc., 102 Hamilton Ave., Stamford CT 06902
Marine Power Associates, 1010 Turquois St., Ste 217, San Diego, CA 92109
Maritime Design, Inc., 2955 Hartley Rd., Jacksonville, FL 32217
R.J. Mellusi & Co., 71 Hudson St, New York, NY 10013
Nelson & Associates, Inc., 610 Northwest 183rd St., Miami, FL 33169
Nord Marine Inc., P.O. Box 305, Fair Haven NJ 07701
Northern Marine, P.O. Box 1169, Traverse City, MI 49685
Ocean Oil International Engineering Corp., 3019 Mercedes Blvd, New Orleans LA 70114
Capt. H.L. Olsen, Marine Surveyors Company, P.O. Box 283, Port Jefferson NY 11777
Omega Marine Engineering Systems Inc., 11757 Katy Freeway, Suite 390, Houston TX 77079
Pyrotech Technical Institute, Delgado Community College, New Orleans, LA
Q.E.D. Systems Inc., 4646 Witchduck Rd., Virginia Beach, VA 23455
M. Rosenblatt & Son, Inc., 350 Broadway, New York, NY 10013 and 667

Daewoo Receives Order Worth $81 Million For Three Bulk Carriers

Daewoo Shipbuilding of South Korea recently received an $81-million order from Czechoslovak Ocean Shipping (COS) to construct three 64,000-dwt bulk carriers.

COS, which operates a fleet of 13 general cargo ships and bulk carriers and is the deep-sea line of Czechoslovakia, is said to be the first Eastern European country to order tonnage from a South Korean yard.

Two of the ships are expected to be delivered in December 1989 with the third scheduled for April 1990. All the ships will be constructed at Daewoo's Okpo Shipyard.

Teekay Bahamas Orders Tankers From HHI, 3. Major

Teekay Bahamas recently ordered two 114,000-dwt crude carriers from Hyundai Heavy Industries (HHI) of South Korea. The ships would be the fifth and sixth vessels of a series constructed at HHI for Teekay Bahamas.

In addition, Teekay is negotiating with 3. Maj Shipbuilding of Rijeka, Yugoslavia, to build a third 110,000-ton tanker for service in 1990. The company already has two tankers of the same type on order at 3. Maj for delivery in August 1988 and August 1989.

At present, the four tankers from the original contract with HHI are in service. The ships are the Namsan Spirit, Frontier Spirit, Pioneer Spirit and Pacific Spirit.

Mission St., San Francisco, CA 94105
Sargent & Herkes Inc., 611 Gravier St., New Orleans, LA 70130
STV/Sanders & Thomas, Inc., 7900 Westpark Dr., McLean VA 22102
Sea School, 3770 16th Street North, St. Petersburg, FL 33704
Seaworthy Systems Inc., P.O. Box 338, Essex, CT 06426; 17 Battery Pl., New York, NY 10004; P.O. Box 205, Solomons MD 20688; 2 Skyline Pl., 5203 Leesburg Pike, Falls Church VA 22041.
Seaworthy Electrical Systems, 17 Battery Pl. N.Y. N.Y. 10004
George G. Sharp, Inc., 100 Church St., New York, NY 10007
T.W. Spaetgens, 156 W. 8th Ave., Vancouver BC CANADA V5Y 1N2
R.A. Stearn, Inc., 253 N. 1st Ave., Sturgeon Bay, WI 54235
Systems Engineering Associates (SEACOR), 200 East Park Dr., Suite 600, Mt Laurel NJ 08054
TIMSCO, P. O. Box 91360, Mobile AL 36691
F.L. Torstenson, 107 Oakleaf Dr., Statesboro GA 30458
Tracor Hydronautics, Inc., 7210 Pindell School Rd., Laurel, MD 20707
VSE Corporation, 1417 No Battlefield Blvd, Chesapeake VA 23320
Thomas B. Wilson, Associates, 1258 North Avalon Blvd., Wilmington, CA 90744

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Atkinson Dynamics, 10 W Orange Ave., So San Francisco CA 94080
Comsat Maritime Services, 950 L'Enfant Plaza SW, Washington DC 20024
Furuno U.S.A., 271 Harbor Way, S. San Francisco, CA 94080
General Electric Company, Mobile Communications Division, Lynchburg, VA 24502
Harris Corporation, RF Communications Group, 1680 University Ave., Rochester NY 14610
Henschel Corporation, 9 Hoyt Dr., P.O. Box 30, Newburyport MA 01950
ITT Mackay, 441 U.S. Highway #1, Elizabeth, NJ 07202
Kelvin Hughes Ltd., New North Rd., Hainault, Ilford, Essex 1G6 2UR England
Mackay Communications, 441 US Hightway #1, P. O. Box 331, Elizabeth NJ 07207
Naval Electronics, 5417 Jetview Circle, Tampa FL 33634
Ocean Satellite Televion Ltd., Avmar House, 61 Brushfield St., London E1 6AA ENGLAND
Petroleum Communications Inc. (Petrocom) Head Office: 5901 Earhart Expwy., New Orleans LA 70123; 556 Jefferson St., Suite 100, Lafayette LA 70501; Allied Bank Plaza, Suite 5440, 1000 Lousisian St., Houston TX 77002
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Radio-Holland USA, Inc., 6033 South Loop East, Houston, TX 77033
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Bergen Diesel A/S, P.O. Box 924, N-5001 Bergen NORWAY
Bergen Diesel Inc., 2701 Delaware Ave., Kenner LA 70062
Boston Metals Co., 313 E. Baltimore St., Baltimore, MD 21202
Burmeister & Wain Alpha Diesel AS, DK-1400 Copenhagen K, Denmark
Caterpillar In., Engine Division, 100 N E Adams, Peoria IL 61629
Cincinnati Gear Co., 5657 Wooster Pike, Cincinnati, OH 45227
Colt Industries Inc. (Fairbanks Morse Engine Div.), 701 Lawton Avenue, Beloit, WI 53511
Combustion Engineering, Inc., Windsor, CT 06095
Deutz Corp., 7585 Ponce de Leon Circle, Atlanta, GA 30340
Fincantieri, Diesel Engines Division—GMT, Bagnoli della Rosandra 334, Trieste, ITALY
GE Naval & Drive Turbine Systems Department, 166 Boulder Dr., Fitchburg MA 01420
General Motors, Electro-Motive Division, LaGrange, IL 60525
KHD Canada Inc., 180 Rue de Normandie, Boucherville, Quebec J4B 5S7, Canada
Kahlenberg Bros. Co., P.O. Box 358, Two Rivers, WI 54241
Lips Propellers, 3617 Koppens Way, Chesapeake, VA 23323
Marine Gears, Inc., P.O. Box 689, Greenville MS 38707
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MAN B&W Diesel, 50 Broadway, New York, NY 10004
MAN B&W Diesel A/S, Ostervej 2, DK-4960 Hoelby, 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-8900 Augsburg 1 Germany
MAN High Performance Diesels (Nurnberg), 160 Van Brunt St., Brooklyn NY 11231
Michigan Wheel Corp., 1501 Buchabab Ave., SW, Grand Rapids MI 49507
MTU of North America, 10450 Corporate Dr, Houston TX 77478
North American Marine Jet P.O Box 1232 Benton, AR 72015
Northwest Marine Services Corp., 6452 So. 144th St., Tukwila WA 98168
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Sulzer Brothers, Dept. Diesel Engines, CH-8401 Winterthur, Switzerland
Sulzer/Escher Wyss, Ravensburg WEST GERMANY
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Ulstein Propellers, N-6065 Ulsteinvik, NORWAY
Ulstein Trading Ltd. A/S, N-6-65, Ulsteinvik, Norway
J.M. Voith GmbH, Marine Division, Postfach 1940, 7920 Heidenheim/Brenz, WEST GERMANY Voith Schneider America Inc., 121 Susquehanna Ave., Great Neck, NY 11021
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Mock Manufacturing Inc., 777 Rutland Rd., Brooklyn, NY 11203

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MAN—GHH, P.O. Box 110240, D-4200 Oberhausen 11, West Germany
NEI Syncrolift, Inc., 8970 S W 87th Ct., Miami FL 33176
Portable Gun Drilling Systems Inc., P.O. Box 123, Auburn WA 98071

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Bollinger Lockport & Larose, P.O. Box 250, Lockport LA 70374
Burmeister & Wain Skipsvaerft A/S, P.O. Box 2122, Refshaleoen, DK-1015 Copenhagen, DENMARK
Curacao Drydock (U.S.A.) Inc., 26 Broadway, Suite 741, New York, NY 10004
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Equitable Shipyards Inc., Trinity Marine Group, Box 29266, New Orleans LA 70189
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Hyundai Corporation, ShipSales Dept., 140-2 Kye dong, Chongro-ku, Soeul, KOREA
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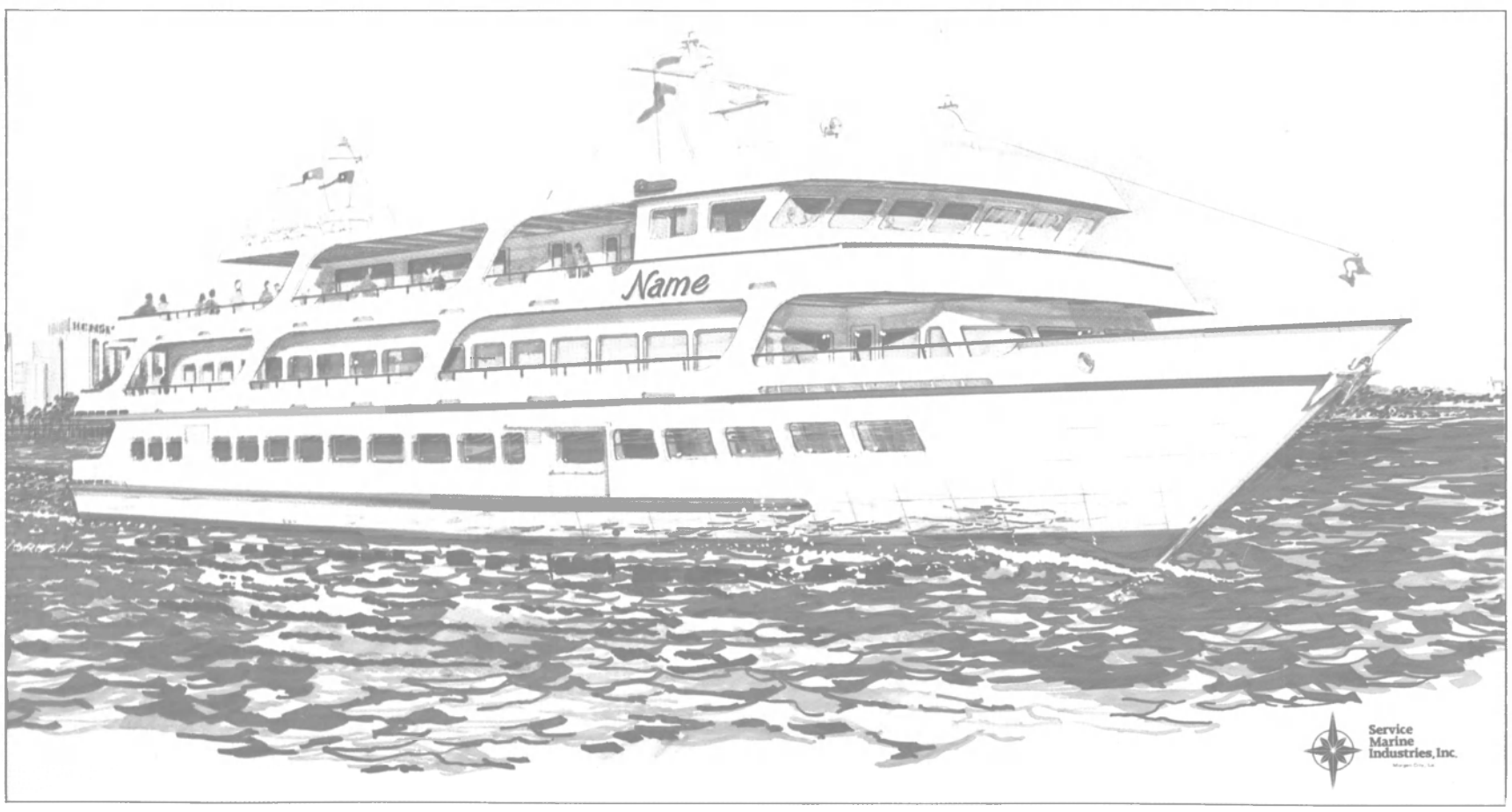

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