

Bright Future For Hamburg & Hartmann Tug Agreement/Page 4



MAN Diesel Central To Power-Ship Concept

Dual-fuel/HFO order covers temporary power needs

MAN Diesel has signed a contract with the Turkish company Karadeniz Powership Company Ltd., worth over 100 million euros.

The Augsburg-based manufacturer of large-bore diesel engines is to supply up to a total of 24 engines, together with electromechanical equipment needed for the generation of electricity. The contract includes twenty-one 18V51/60DF dual-fuel engines and three type 14V48/60 HFO engines, with a total output of 400 MW. The large-bore diesel engines are to be installed on board four power ships, the first of their kind to be used in the world.

The ships in question are former freighters which are to be convert-

ed into floating diesel power plants. Thanks to their mobility, they can be connected to local power grids to temporarily cover demands whenever onsite power plants are insufficient or new power plants cannot be built quickly enough. Unlike so-called 'power barges' – power plants on pontoons – the 'power ships' are equipped with their own propulsion engines and therefore do not need to be towed. They are expected to be used in Africa, Pakistan and other regions in the Middle East and around the Mediterranean.

The MAN Diesel dual-fuel engines are characterised by the fact that they can be powered by either liquid fuels or gas. "Our dual-fuel engines are ideal for this purpose.

The ships will be able to use whatever the infrastructure available at the site on which they are needed – regardless of whether they are fuelled by oil or gas," says Dr. Stephan Mey, head of the power plant business at MAN Diesel. A further advantage of dual-fuel engines is that when powered by gas, in particular, they ensure extremely low-emission and therefore ecologically friendly combustion.

The 51/60DF engine was first used on liquid gas tankers, on which evaporated gas from the cargo tanks can be used to power the engine. MAN Diesel DF engines have been gaining in popularity in the power generation

Continued on page 2

Two-Stroke Variants Developed for Chinese Market

MAN Diesel has developed two new engine variants specially targeted at the busy Chinese coast and river segment that represents some of the world's heaviest trafficked shipping lanes.

The new, state-of-the-art S35MC-C9 and S40MC-C9 variants are based on the considerable experience gathered from MAN Diesel's existing range of well-proven, mechanically operated, two-stroke, low-speed engines.

By nature, low-speed engines lend themselves to direct coupling of the propeller, which contributes to their high efficiency, increased reliability and low maintenance costs.

The optimal ship size for this Chinese segment ranges from 10-20,000 dwt with a propulsion plant

that generates between 5-8,000 kW at an approximate engine speed of 140 rpm.

The MC-C9 design represents an upgrade on previous marks and offers improved operational economy, flexibility and manoeuvrability. For ease of installation, MAN Diesel also provides the engines with a built-on lube oil filter.

The new MAN B&W MC-C9 engine variants have a stroke-bore ratio of 4.4:1 to facilitate the low propeller speed that corresponds to 142 and 136 rpm respectively for the S35MC-C9 and S40MC-C9 engines.

Similarly, the MAN S35MC-C9 and S40MC-C9 engines display mean effective pressures of 21 and 21.4 bar, respectively.

Continued on page 2

Leiv Eiriksson Takes a Mega-Hop
Record dredger sets sail

> Page 3

Continuing a Great Tradition
PrimeServ's Portuguese voyage

> Pages 6-7

ME-B Retrofit Promises MC-C Benefits
Bow Cecil's key role in engine development

> Page 9

Frederikshavn Visit Peps Up
Jette Kristine Upgrade delivers huge-bollard-pull increase

> Page 12



MAN Diesel

Two-Stroke Chinese Variants

Continued from front page

The new MC-C9 engines offer optimal engine performance in a powerful, economic, weight-saving and future-oriented diesel engine design, ensuring that they will remain market leaders for decades to come. Based on diesel technology that has been well-proven over many years, the engines are tailored to meet the market requirements for:

- fuel economy
- higher power reliability
- longer time between overhauls
- lower propeller speed
- better manoeuvrability
- very low life-cycle costs

MAN B&W MC-C9 Main Data		
	S35MC-C9	S40MC-C9
Number of cylinders	5-6-7-8	5-6-7-8
Stroke (mm)	1,550	1,770
MEP (bar)	21	21.4
Engine speed (r/min)	142	136
Mean piston speed (m/s)	7.34	8.02
Power (kW/cyl)	740	1,080
SFOC (g/kWh) Tier II	179	178

Source: MAN Diesel. The optimal ship size for this Chinese segment is 10-20,000 dwt with a 5-8,000 kW propulsion plant and an approximate engine speed of 140 rpm



Front and rear views of the MAN B&W S35MC-C9 engine. It has been developed for the Chinese coast and river segment along with the larger-bore S40MC-C9

Chinese Connection Grows Apace

MAN Diesel has carefully cultivated its Chinese business for many years and can report many recent successes in the country.

DMU

Earlier in 2009, the renowned Dalian Maritime University (DMU) chose an MAN B&W 5S35ME-B9 engine for its maritime laboratory to strengthen the practical tuition of its student body. The university undertook to establish a fully functional, shore-based engine room at its Dalian campus, where its maritime science faculty already consists of a training dock and over 40 laboratories for teaching, training and research.

SMU

About the same time, the prestigious Shanghai Maritime University (SMU) selected an MAN B&W 6S35ME-B9 engine as a practical teaching-aid. The engine is destined for its newly established maritime laboratory to enhance the excellence of its practical and electronic tuition in maritime hardware for China's next generation of marine engineers. To accommodate the engine, SMU will establish a fully functional, shore-based engine room at its new campus. Both university engines are scheduled to be built in Korea by MAN Diesel licensee STX Engine Co., Ltd.

PrimeServ Scholarships

PrimeServ also started a scholarship programme in 2009 to annually sponsor students and teachers within the field of marine engineering from DMU and SMU.

Overall, the combination of scholarship programme and exposure of students to MAN Diesel two-stroke engines will provide invaluable support and practical experience at grass-roots level in China's maritime universities.

For a detailed view of the above article's graphics and other, interactive features, visit:
www.mandiesel.com/dieselfacts



Power Ship Concept

Continued from front page

industry for some time now, thanks to their efficiency, fuel flexibility and environmental benefits – all of them factors which have enabled this relatively new engine to quickly establish itself on the market. MAN Diesel has recently received similar orders from Brazil and Australia.

The Brazilian engine is destined for Manaus, in the heart of the Amazon rainforest, to replace a conventional power plant engine. It will be used in a base-load power plant, which generates electricity round the clock for the city of two million inhabitants.

Further 51/60DF engines are bound for the Australian Outback where the first natural-gas power plant to be operated exclusively with dual-fuel motors from MAN Diesel is being built in Owen Springs. The three 51/60DF engines will supply the regional centre, Alice Springs, 25 kilometres away and the power plant's energy output will be 33 MW. ■



Illustration of a 'power ship'. Freighters will be converted into floating diesel power plants that can be connected to local power grids to temporarily cover demands whenever onsite power plants are insufficient or new power plants cannot be built quickly enough. Unlike so-called 'power barges' – power plants on pontoons – the power ships will be capable of self-propulsion



The Leiv Eiriksson pictured during construction at La Naval shipyard in Sestao, Spain

Leiv Eiriksson Takes A Mega-Hop

Sister to record-setting suction dredger sets sail from Spanish shipyard

October 2009 saw the launching in Spain's Basque country of the dredger "Leiv Eiriksson".

A sister ship to the record-breaking "Cristóbal Colón" that was launched in July 2008, the vessels share common specifications, each featuring two MAN 16V48/60B medium-speed main engines and complete propulsion trains.

The two vessels were ordered by Dredging and Maritime Management S.A., a subsidiary of leading dredging contractor, the Jan de Nul Group, based in Luxembourg. Construction took place at the La Naval shipyard in Sestao, Spain, part of Spanish shipbuilder Construcciones Navales del Norte.

World-class dredging

The Leiv Eiriksson and Cristóbal Colón are, by some distance, the largest trailing suction hopper dredgers in the world. With a hopper capacity of 46,000 cubic metres and 78,000 tons of deadweight, the new, mega-hopper suction dredgers are capable of sailing at speeds of up to 18 knots. For both propulsion and working functions, the dredgers are powered by two MAN type 16V48/60B

main engines, each rated 19,200 kW at 514 rpm. These drive twin, controllable-pitch propellers via single input and output shaft-reduction gears, as well as two 18,500 kW shaft generators located on power-take-offs on the reduction gears.

The shaft generators will cover electrical power for working functions during dredging, at berth or at anchor. This also includes the hotel load for the 46 crew members and is supplied by a generator

Leiv Eiriksson/Cristóbal Colón Main Parameters

Length overall	223 metres
Length between perpendiculars	196 metres
Breadth (moulded)	41 metres
Depth (moulded)	20 metres
Dredging draught (moulded)	15.15 metres
Deadweight	78,000 dwt
Max. Speed	18 knots
Dredging depth	Up to 142 metres
Max. Payload	46,000 m ³ hopper capacity
Crew	46

Source: MAN Diesel

set based on an MAN Diesel inline nine-cylinder type 9L27/38 engine, rated 2,970 kW at 720 rpm.

The vessels have an overall length of 223 metres, a breadth of 41 metres, a loaded draught of 15.15 metres, and are capable of dredging down to 142 metres using a 1,300 mm suction pipe.

Prime-movers of choice

The MAN Diesel 48/60B engine type is prime-mover of choice in the dredging sector as these two

reference dredgers have proven.

The type 48/60B diesel has a standard rating of 1,200 kW per cylinder at 500 and 514 rpm, and is offered in 6-, 7-, 8- and 9-cylinder inline and 12-, 14-, 16- and 18-cyl-

inder vee-configuration versions. These MAN four-stroke, medium-speed engine models are appreciated in these types of dredging applications because of their robust, load-acceptance characteristics. ■

Propulsion Plant Particulars

Engine	2 x type MAN 16V48/60B
Fuel	HFO
MCR	19,200 kW at 514 rpm
Overall length	13,100 mm
Dry mass	236 t
SFOC	173 g/kWh; ISO Conditions 85 % MCR
Reduction Gears	Single input/single output with PTO for shaft generator
Propeller	MAN Alpha CPP: in nozzle 6.0 metres, 115 rpm

Onboard Electrical Supply

Auxiliary Engines	1 x type MAN 9L27/38
Fuel	HFO
MCR per Engine	1 x 2,970 kW at 720 rpm
Shaft Generators	2 x 18,500 kW

Source: MAN Diesel

Cover Story

Anchor Handling Tug Service Agreement

PrimeServ Hamburg and Hartmann Offshore sign maintenance deal

Six AHTs (Anchor Handling Tugs), each powered by four MAN 6L32/40 engines, are set to commence offshore activities worldwide between late-2009 and mid-2010.

This activity is covered by a service/maintenance agreement signed by Hartmann Offshore GmbH, Leer, and MAN Diesel PrimeServ, Hamburg. The contract comprises the monthly assessment of engine-operating parameters as well as planned maintenance operations at 15,000 and 30,000 operating hours. The engines will be inspected by PrimeServ Hamburg superintendents at the relevant times.

The "UOS Atlantis", pictured here, was delivered by Fincantieri Shipyard in Muggiano, Italy in February 2009 and has a maximum speed of 17 knots.

Hartmann Offshore is a member of the Hartmann Group with interests in the complete maritime spectrum. The delivery of UOS Atlantis marks the start of the group's operations in the offshore sector. ■



The Hartmann tug "UOS Atlantis"; like the other five tugs covered by the agreement, its four 6L32/40 engines produce an impressive 180 ttp (tons bollard pull)

Breaking the Waves in Antarctica – A Korean First

Launched in June 2009, the 'Araon' is the first-ever Korean icebreaker.

Weighing in at 6,950 tonnes, the vessel is designed for operation in one-meter-thick ice conditions at a speed of 3 knots, and has twin Azimuth propulsion units driven by a diesel-electric propulsion plant, comprising two MAN 7L32/40 main engines. Araon's bow is made of special steel with a thick-

ness of 4 cm to cut through the ice.

The vessel can accommodate up to 85 people, including 25 crew members, with the majority of spare bunks intended for polar marine researchers. The ship will facilitate research in the polar regions and, to this end, Araon comes equipped with 100 different kinds of state-of-the-art marine research equipment, as well as a helipad and hangar. Araon can navigate

the ocean for up to 70 consecutive days between bunkering. The Korean government invested 103 billion won (\$81.6 million) in building the vessel, whose construction took six years.

After a test voyage, the ship leaves for Antarctica in late-December 2009 to explore locations for a second, Korean station in the South Pole. It will also actively participate in supplying provisions

for the existing polar research stations at King Sejong Station in the Antarctic and Dasan Station in the Arctic.

The word 'Araon' is a compound word made up of the Korean words

'ara' that means ocean and 'on' that means 'whole'. The Koreans are hoping that the new icebreaker will open a whole, new chapter in the history of Korea's polar research and exploration. ■

Araon Principal Figures	
Dimensions	111 x 19 x 7.6 m
Disp (tons)	9,066
G/T	7,487
Propulsion	2 x MAN 7L32/40 (2 x 5,000 kW)
Speed (knots)	16



In the Antarctic, the Araon will supply the existing Korean polar-research station and scout locations for another



The Araon's propulsion plant comprises two four-stroke MAN 7L32/40 type main engines similar to this L32/40 propulsion version from Frederikshavn, Denmark

Green Ship of the Future Project

Innovative, Danish initiative promotes clean technology in maritime environment

A group of Danish maritime companies initiated the Green Ship of the Future project to develop and demonstrate green technologies within shipping and shipbuilding to reduce air emissions.

This unique initiative has been met with great interest globally and received the International Environmental Award from the Sustainable Shipping organisation in July 2009 for being the most environmentally friendly shipping initiative.

The following is a summary of the particular projects MAN Diesel is involved in. More details can be found at: www.greenship.org.

Exhaust gas scrubbers

Future regulations regarding sulphur emissions from ships demand the use of low-sulphur fuel. However, exhaust gas scrubbers are accepted as an alternative.

Aalborg Industries' newly developed scrubbing system can in principle be compared to a large shower cabinet placed in the funnel of a ship. This makes it possible to reduce sulphur emissions to as low a level as if low-sulphur fuel had been used, but in a more economic fashion.

Even lower SO_x levels can be achieved through the use of low-sulphur fuel that complies with the existing environmental legislation. Another benefit of using this type of fuel is that it also results in a significant reduction in the amount of particle emissions.

The scrubbing system underwent extensive testing during the winter of 2008/09 at MAN Diesel's test facility in Holeby, Denmark with good results; it was possible to remove almost 100% of the sulphur and up to 80% of the particles from exhaust gas. The first scrubber installation is currently being installed aboard a DFDS Ro-Ro cargo vessel with completion and commissioning expected later this winter.

Lower ship speeds within certifications

The majority of main engines aboard ocean-going ships are low-speed, two-stroke diesel engines designed for a certain power output corresponding to ship speed. As propulsion power decreases, fuel-oil consumption drops, lower-



Installation of an exhaust gas scrubber aboard a DFDS ferry in Bremerhaven, Germany

ing CO₂ emissions and improving the engine's overall performance. This leads to optimised low-load operation of the engine but affects the environmental certification of the engine, especially with regards to NO_x.

This project has found two solutions with the potential for low-load optimisation of the existing vessel fleet within the current certifications. The first is sailing at low-load using electronically controlled engines. This enables optimum sailing at far lower speeds than normal, reducing fuel consumption and air emissions accordingly.

The second solution involves cutting out a turbocharger on ships with multiple turbocharged engines; this can be used on both electronically controlled engines and mechanical engines.

Turbocharger cut-out has already been implemented on the A.P. Moller – Maersk Line 8,000 TEU container ship Maersk Salalah with a MAN B&W 12K98ME main engine. Tests show that lower ship speeds cut CO₂ emissions by 25% per sailed nautical mile, while turbocharger cut-out contributes another 3% reduction.

MAN Diesel engine auto-tuning

Currently, ship engines are tuned manually to enable safe running within recommended load limits, but leaving a margin for performance optimisation because operating conditions and fuel-oil properties change over time. Auto-tuning enables this margin to be harvested continuously and automatically,

resulting in reduced fuel consumption, CO₂ emissions as well as lower carbon particle counts.

The auto-tuning concept is based on online measurements of the combustion pressures in the cylinder chambers. An engine control system has been developed that constantly monitors and compares measured combustion pressures to the reference value. The control system then automatically adjusts the fuel-injection timing in accordance with the deviation between the measured value and the reference value to reach the optimal combustion pressure during the next firings.

Auto-tuning reduces fuel consumption for an average vessel by over 1%, with a potential reduction of over 3% for some vessels. Installing auto-tuning on the more than 10,000 MAN Diesel two-stroke engines in service would reduce total fuel consumption by an estimated 2 million tons, equivalent to 5 million tons of CO₂, or about 10% of the total annual Danish emission of CO₂.

Emission reduction using exhaust gas recirculation

MAN Diesel has developed an Exhaust Gas Recirculation (EGR) system for low-speed, two-stroke engines that can reduce harmful NO_x emissions from ships by 80%.

The EGR system reduces NO_x by directing part of the exhaust gas back into the engine's scavenge air. This reduces the oxygen content of the air in the combustion chamber, thereby reducing the

ing a ship for a service test of the prototype EGR system, with the system currently being installed aboard the container ship "Alexander Maersk".

Optimisation of CO₂ Emission and Fuel Efficiency

This project combines MAN Diesel's Variable Turbine Area (VTA) turbocharger with an MAN B&W ME-B main engine with electronically controlled fuel injection.

Unlike a conventional turbocharger, the VTA turbocharger's turbine area can be continuously controlled to increase the scavenging air pressure at part-load. This offers significant improvements in fuel efficiency and typically leads to a reduction in soot and smoke.

The MAN B&W ME-B main engine combines electronic fuel-injection control with mechanical control of exhaust valve timing. As such, the engine provides a very flexible solution with regards to fuel optimisation and the meeting of emission regulations.

The first installation of a MAN B&W 6S50ME-B8, combined with a MAN TCA66 with VTA turbocharger, took place in conjunction with TORM, the Danish shipping company. The initial engine performance test showed an improvement in SFOC at part-loads where the VTA can be optimised. Based on an average load profile, this equates to an annual saving in fuel oil of 95 tonnes, and reduced CO₂ emissions of some 300 tonnes. ■



An EGR system ready for installation



Feature

Continuing a Great Tradition

PrimeServ's voyage into Portuguese waters starts with favourable winds



The great mariner himself would be impressed by Lisbon's Ponte Vasco da Gama. On this day, however, DieselFacts is struggling to see anything of Europe's longest bridge; its 17-km length shrouded in a thick sea fog rolling in off the Atlantic below.

The gloom lifts on the far side of the Tagus and DieselFacts speeds the 40 kilometres south to Setúbal, the country's third-largest port and home of PrimeServ Portugal. In 1492, King John II of Portugal sent da Gama here to seize French ships in retaliation for peacetime attacks on Portuguese shipping. Thankfully, things have quietened down a bit since then, and the atmosphere is decidedly relaxed and bathed in warm sunshine when

DieselFacts meets the local Managing Director, Jesper Bak Weller.

The Great Dane

A tall, bearded, 36-year-old Dane, Weller saw service with the Danish navy, DFDS the Danish ferry and freight company, and A.P. Møller-Mærsk before joining MAN Diesel in 2001 as Regional Sales Manager for South East Asia. Armed initially with a degree in marine engineering, he has since added an MBA in executive management to his credentials.

When asked what tasks his role as Managing Director typically involve, he replies: "Lots of different things! I make coffee, I buy office supplies. I conduct strategic discussions and negotiations on be-

half of the company. I do product development. I'm on the phone a lot with clients and headquarters in Germany and Denmark. I'm on-board discussing issues directly with clients. In a mid-sized operation like this, we all have to be extremely flexible and give a hand where needed and not pay too much attention to titles and formal positions."

PrimeServ Portugal

PrimeServ Portugal's new premises occupy 1,800 m², include a crane of 32 m span capable of lifting up to 10 tonnes, and offer all types of repairs, overhauls and inspections of all MAN Diesel engines and turbochargers. However, the new service centre sees

itself as an add-on service provider and accordingly focuses generally on value-adding, retrofit products such as the Alpha Lubricator, the Diesel Switch, the COL (Controlled Oil Level) sealing system, and main-bearing monitoring. Much of this business is driven by modern emission regulations that are forcing the shipping community to adapt its older engines.

Besides the main facility, PrimeServ also runs a turbocharger workshop of some 300 m² nearby on the premises of Lisnave shipyard. In total, the local operation currently numbers 20 employees, including three superintendent engineers.

Beginnings

PrimeServ Portugal was officially established in November 2008 although, for the 12 years prior to that, MAN Diesel was actually represented by Jan Dyreby, another Dane who now works as Technical Manager in the new operation and whose knowledge of the local market has proven invaluable. A marine engineer, Dyreby's multi-tasking role includes assigning jobs, supervising the workshop and answering technical questions.

Weller says: "The plans to expand had already been finalised before I arrived in February 2008. The company was legally established the following November so we used the intervening period to investigate the right location for a workshop, the market for our products, how to enter the market for turbocharger repair and how to conduct the normal, daily business – at this point, our services were being invoiced from Copenhagen. We also built contacts with lawyers, accountants, the local authorities, and searched for employees. Basically, we took care of all practical and strategic considerations prior to the establishment of the legal entity."

Location and Lisnave

Portugal is the 10th such PrimeServ service centre to officially open in 2009, testimony to the after-sales division's impressive rate of growth. In regard to the location, Jesper Bak Weller says: "Strategi-

cally, we wanted to be able to cover the entire western side of the Iberian peninsula, including the Strait of Gibraltar. Setúbal is ideal in that respect with excellent facilities available locally."

Lisnave is a prime example of this. The local shipyard bases its appeal upon a spacious, well-equipped facility and a climate that enables outdoor work year round. Lisnave forms part of PrimeServ's business locally and the company has several cooperation agreements with the yard.

One of the most interesting of these is a retrofit model where Lisnave supplies the muscle and most parts, while PrimeServ Portugal supplies supervision and specialised parts. This successful model has attracted the attention of other PrimeServ service centres and is a sure sign of the new service centre having hit the ground running.

Communication

Weller says it's extremely important to maintain close communication with clients: "Only from direct contact and meeting clients face to face can we learn their needs and concerns and respond accordingly. MAN Diesel understands that a local presence is vital for success and, as a local set-up, we are our company's eyes and ears in the local market."

PrimeServ Portugal builds personal relationships with 90% of its Portuguese clients through frequent visits and updates on new developments, services and products. Its domestic clients are distributed all over the country, including the islands of the Azores and Madeira. At the same time, MAN Diesel's worldwide network helps make contact with international clients and passing, international shipping-traffic also forms a significant part of business.

Another way of building relationships involves PrimeServ's overhaul of the main engine of the 'Sagres', a nationally famous, naval training ship built in Germany in 1937. PrimeServ has agreed to cover the costs of restoring the original MAN W8V30/38 engine (580 rpm/750 hp) so it can



Aerial view of the Lisnave complex, just south of Setúbal, taken by Antonio Penaforte Rodrigues of PrimeServ Portugal. Penaforte is a keen pilot and photographer in his spare time

be placed on display in the naval museum in Lisbon. In lending its expertise to supervise this project, MAN Diesel is restoring a piece of marine history while also passing on the principles of diesel engines to the Lisnave and naval apprentices working on the project.

Market movement

When asked how the market has developed since PrimeServ Portugal opened, Weller says: "We opened when the global, economic crisis started!" and laughs at the irony of the timing. He continues: "We established the company on the date that the crisis officially began so, from a global point of view, the market has been decreasing. But, from a local point of view, we have been able to grow our business here constantly over the time we have existed."

He says: "We will only know

the true market picture when the economic crisis has passed. However, the market for ship repair and service is generally increasing because more and more engines have come into operation in recent years. As the nature of our engines changes from being mechanically to electronically controlled, the nature of repairs will change accordingly and will change the daily business for a service-based company like us. Whereas we had to be very strong on mechanics in the past, the future means we will have to be strong on electronics, automation and hydraulics as well because the make-up of the engines is changing."

Weller also points out MAN Diesel PrimeServ's obvious advantage in being the original engine designer: "We have the expertise, the know-how and the tools. In the current market, it is more important

than ever to pay attention to costs, and costs can be limited by preventing minor issues from becoming big problems. As the engine designer, we are the best in the world to foresee and maintain the equipment we design ourselves. If you care for your machinery, the natural choice is MAN."

Dog day afternoon

DieselFacts has politely declined an invitation from company secretary, Cristina Coelho, to come inside the office so as to sit outside and enjoy the winter sunshine. A good decision is rewarded by the sight of PrimeServ's unofficial guard dog sprawled in the sunshine and blocking the entrance, preventing Paula de Castro, Sales and Supply Manager, from driving in. In scenes of increasing farce, Paula tries to coax the dog out of the way from her car, then gets out to move the

mutt, and then struggles to pull it off her leg as said mutt begins to enjoy this new game.

The PrimeServ Portugal team is a likable group. Antonio Penaforte Rodrigues, PrimeServ's Senior Manager Sales and Marketing, comments on how well the PrimeServ team here works together, with everyone willing to chip in to get the job done. Penaforte worked for BP, among other companies, for many years before joining PrimeServ where he spends his days making bids on jobs, engines and spare parts, as well as fielding phone calls with customers and other PrimeServ locations.

He picks out Sines, a deep-water port in the SW of the country, as offering major possibilities for PrimeServ Portugal in the future. With the Port of Lisbon reaching its natural capacity, Sines is an obvious candidate to take the pres-

sure off the capital and its growth should have a positive, knock-on effect on PrimeServ Portugal's bottom line. Sines also happens to be the birthplace of a certain Vasco da Gama.

Common thread

From the great squares and magnificent buildings of Lisbon, built with the riches garnered by maritime exploration, to the lyrics of 'A Portuguesa', the national anthem, to the fantastic seafood in Setúbal, the influence of the sea is a common thread running through Portuguese culture. Despite the current, hard, economic times, PrimeServ Portugal has made a good start bedding itself in to both country and after-sales market, and is set to play its role in the maritime life of this proud nation of sailors. ■



Jesper Bak Weller, Managing Director of MAN Diesel PrimeServ Portugal, discussing tactics with Manuel Marques, one of the local superintendent engineers



(Left to right) Setúbal's Praça do Bocado main square; apprentices working on the restoration of the Sagres engine; the turbocharger workshop at Lisnave

MAN 8L32/44CR Explores New Waters

Playa de Azkorri application represents entry into specialist fishing segment

MAN Diesel entered a new industry segment this October with the launching of the tuna-freezing purse seiner "Playa de Azkorri" in Spain's Basque Country.

The vessel, considered by experts as one of a kind, features an MAN 8L32/44CR medium-speed main engine.

Astilleros de Murueta, S.A. Shipyard

The vessel was ordered by one of the companies of the PEVASA Group, headed by Pesquería Vasco Montañesa, S.A., one of the top tuna-fishing companies in Spain. Construction took place at the Astilleros de Murueta shipyard in Murueta, Spain, close to Bermeo, the birthplace of the world tuna industry. Since the construction of the first tuna ship, more than 200 such vessels have left the Murueta yard, with the result that it is known worldwide as a specialist builder of tuna fishing-freezer vessels. A well-known example of this is the 100-metre tuna vessel "Txori-Argi", launched in 2003, followed now by the construction of the state-of-the-art "Playa de Azkorri" vessel.

The owner: PEVASA

Pesquería Vasco Montañesa, S.A. (PEVASA) was established in 1961. Its corporate headquarters lie in Bermeo from which it currently operates five modern, tuna fishing-freezer vessels from 75 to 85 metres in length and with capacities ranging from 1,200 to 1,400 tonnes. The vessels fish the Atlantic and Indian Oceans, fishing tuna using the purse-seine method and freezing it by means of immersion in brine (seawater with added salt) cooled to -18 degrees Celsius.

The ship: Playa de Azkorri

"The Playa de Azkorri is the best tuna vessel in the world!", said Mr. Borja Soroa, managing director of



The Playa de Azkorri pictured at berth in northern Spain

PEVASA, during launching.

The birth of this project dates back to 2005 when the technical department of PEVASA had to face the twin challenges of 1) optimising fishing while simultaneously reducing operation and maintenance costs; and 2) reducing the vessel's environmental impact by reducing atmospheric emissions.

The PEVASA inspectors, Aguirre and Okamika, addressed this by analysing the company's own fleet and thoroughly reviewing existing, state-of-the-art solutions. At this stage, MAN Diesel emerged as the obvious candidate with its common-rail (CR) injection technology that permits independent and separate control of injection pressure and timing. Fuel is fed into the rail (pressure accumulator) by an electronically controlled high-pressure pump and stored there for each injection. The result is highly effective combustion (particularly in the

low-load range) and, consequently, significantly lower NO_x and CO₂ emissions.

The Playa de Azkorri is powered by one MAN type 8L32/44CR main engine, rated 4,480 kW at 750 rpm. This drives a controllable-pitch propeller via single input and output shaft-reduction gear, as well as, one 2,500 kW shaft generator located in the power-take-off on the reduction gear. This shaft generator was installed to reduce consumption, emissions and maintenance for the generator units. The shaft generator also helps to cover electrical power during fishing manoeuvres as well as freezing.

The design

Preliminary project stages devoted significant time to the study, analysis and optimisation of the ship's hydrodynamics. Basic and classification design has been carried out by the recognized and experi-

enced Spanish ship designers Cintranaval-Defcar, S.L.. As such, the Playa de Azkorri displays certain, distinctive characteristics, that include:

- Hull-form optimisation: hull lines were designed for optimal hydrodynamic efficiency. To that end, successive potential flow calculations using the non-linear CFD code RAPID were carried out by MARIN (Maritime Research Institute). A model test program (testing resistance, propulsion with stock propellers and cavitation) was then developed by CEHIPAR (Canal de Ensayos Hidrodinámicos de El Pardo). The resulting characteristics include a lower block coefficient with reduced fuel consumption, a special counter design and bulb aft to ease entrance flow to the propeller, and a "goose neck" bulb forward.

- Seakeeping has also been improved by means of a passive stabiliser tank.

The combination of hydrodynamically optimised shapes and the 8L32/44CR engine has led to reductions in both fuel consumption and emissions. At the same time, the ability for high-speed navigation was maintained as this parameter is of paramount importance during the operation of such fishing vessels.

Innovation

The Playa de Azkorri also features other, innovative technical improvements.

- Ship stability has been improved for all fishing conditions by making the vessel less top-heavy. This was achieved through using aluminium to build the superstructure, while the booms and mast are made of high-resistance, AH40 steel.
- As a significant amount of energy is utilised aboard this type of ship when freezing the fish, refrigerator performance was improved by means of frequency controllers using high-performance evaporators and a new coil system in tubs, so-called "impressed circuits". This equipment reduces fuel-oil consumption and speeds up the freezing process, which also results in a better quality fish product.
- Special "self-supporting" tanks, fixed with a resin grout and without hull contact, were designed to reduce cool leakage in the storage tanks.
- Improved fishing activities that enable the crew to make faster and safer manoeuvres.

The Playa de Azkorri has an overall length of 87 metres, a beam of 14.2 metres, and a design draught of 6.3 metres. The vessel has a top speed of 18 knots and can accommodate 30 crew members. ■



Hydraulic crane aboard the Playa de Azkorri



The tuna-freezing purse seiner is powered by an MAN 8L32/44CR medium-speed main engine

ME-B Retrofit Promises Benefits for MC-C Engines

Bow Cecil continues to play key role in engine development

Bow Cecil has played a key role in the development of MAN Diesel's electronically controlled ME concept for two-stroke engines, starting with the MAN B&W ME-C type, and now the ME-B.

ME component and system refinements have been thoroughly tested in service on the 37,500 dwt chemical tanker's six-cylinder MAN B&W L60 main engine since November 2000 under an agreement between the engine designer and Norwegian owner Odfjell.

Originally designed and installed as a mechanically controlled L60MC engine, the 60-cm bore model was later converted to an L60ME-C configuration with electronic control of fuel injection and exhaust valve systems. The retention of the camshaft, however, enabled the engine to be operated in either MC or ME mode.

An agreement signed by Odfjell and MAN Diesel in September 2008 covered a further rebuilding of the engine from L60ME-C to the latest L60ME-B specification, a project planned for execution in two stages with the technical support of MAN Diesel's Operations department.

ASRY's shipyard in Bahrain was the venue for the first stage of the conversion in October 2008, which was carried out during a standard drydocking. The project was completed on 1 August 2009 at a lay-by berth in Rotterdam – with only one day off-hire – and subsequently at sea.

The main tasks in the second stage of the project were to remove the original Engine Control System (ECS) and install an ME-B system and a main operating panel in the engine control room console. Fitting cables from the ECS cabinet to engine safety and alarm systems also formed a major part of the work.

Work on the hydraulic system called for removal of the ME system hydraulic pumps, and the overhaul and upgrading of two electro-hydraulic pumps from 45 kW to 65 kW capacity. The control valves and actuators for the exhaust valves were removed and sealed off; and a new type of control valve for the fuel pump fitted. The MC-mode camshaft was retained for exhaust valve actuation in the ME-B configuration.

An ME-B type hydraulic control block was also fitted (the ME version featured electronically controlled washplates, while the ME-B has hydraulically controlled washplates). In addition, minor

refinements to the pneumatic system were required for communication with the new engine control system.

Bow Cecil swiftly resumed her role without problems as a member of an Odfjell fleet of over 90 ships deployed in the regional and global transport of chemicals and other speciality bulk liquids. Some are engaged in round-the-world trading, servicing ports in Europe, the USA, Asia-Pacific and Africa. Flexibility and inter-changeability of tonnage between trades have always been an important factor in the business.

Always seeking to sharpen its competitive edge, the Bergen-based group was the first operator in the world to specify an electronically controlled MAN B&W ME engine for a newbuilding, its

37,500-dwt chemical tanker Bow Firda entering service in 2003 with a seven-cylinder S50ME-C model.

Valuable experience gained from the Bow Cecil project will enable MAN Diesel PrimeServ to offer ME-B conversions to operators of ships with appropriate MC-C engines, improving fuel economy and emissions performance. Longer times-between-overhauls, enhanced ship manoeuvrability, control reliability and lower life-cycle costs are further benefits.

The physical dimensions of the S46- and S60ME-B model bedplates, in particular, are identical to those of their MC-C engine counterparts, thus facilitating retrofits within the same footprint.

MAN B&W ME-B engines are offered in 35-, 40-, 46-, 50- and 60-cm bore sizes covering an out-

put range up to 19,040 kW. Development was stimulated by a perceived market requirement for the lowest possible propeller speed in relation to bore size, leading to the adoption of stroke/bore ratios up to 4.4:1.

ME-B engines feature an electronically controlled fuel injection system but retain the camshaft-operated exhaust valve arrangement of the MC design programme. Electronic fuel injection enables ME-B engines to meet the IMO Tier II NO_x emission as well as other national and regional environmental requirements.

Fuel injection is performed by one fuel booster per cylinder, similar to the established ME engines.

The pressure boosters are mounted on hydraulic cylinder units (HCUs) – two on each unit – with

hydraulic oil supplied to the HCUs via a single oil pipe enclosed in the camshaft housing. In addition to the pressure boosters, the HCU is equipped with two ELFI (electronic fuel injection) valves and two Alpha Lubricators featuring a very low cylinder-oil consumption.

Two electrically-driven pumps mounted at the engine front end provide hydraulic power for the fuel injection system; in the event of one pump failing, more than 50% engine power will remain available, enabling 80% ship speed to be maintained.

Exhaust valves are activated by a light, small-diameter camshaft driven by a chain located at the aft end of the engine, this mechanical solution contributing to a significant reduction in the number of computers involved.

The ME-B series was headed into production by a six-cylinder S40ME-B engine built by Korean licensee STX Heavy Industries which passed type approval tests back in December 2007. Developing 6,810 kW at 146 r/min, the engine is now successfully powering a 25,000 dwt multi-purpose cargo ship. At this moment in time, some 100 ME-B engines of all bore sizes are in service or on order. ■



Chemical tanker Bow Cecil has contributed greatly to the development of MAN Diesel's electronic engine range since 2000

PrimeServ Settles Into Seattle

Opening of new service centre extends MAN Diesel's reach in North America

MAN Diesel celebrated the official opening of its newest service centre in Seattle, Washington, USA in October to further expand its PrimeServ network in North America.



Jesper Th. Petersen, Technical Director of MAN Diesel PrimeServ Seattle

Years of planning, eight months of searching for a suitable location, three months negotiating the lease, and four months of preparing the new facility, not to mention the sorting out of numerous, last-minute details, finally paid off on October 27th last for PrimeServ Seattle at its Grand Opening.

Outside, the notoriously wet Seattle weather was on its best behaviour, meaning umbrellas were only necessary to avoid the shower of wood chips made by the chainsaw artist that fashioned a bear out of a tree trunk to the amusement of arriving guests.

Welcome to cabaret

Inside, the new facility offered quieter, more calming fare with a trio of classical musicians providing entertainment in the lobby. The workshop was transformed into a cabaret-like dinner setting for the occasion, with tables decked out in company colours and im-

pressive floral decorations, interspersed with evergreen trees symbolising the beautiful nature of the Pacific North West. Local seafood and beverages, including some legendary Seattle coffee, formed the backbone of the celebratory meal with local music and song rounding the evening off.

The Grand Opening took place in front of a well-attended audience of customers, suppliers and business partners from, among others, Alaska Boat Company, COSCO,

Polar Tankers, Rebecca Irene Fisheries, Sause Bros Inc., TOTE, Westwood Shipping Lines, DNV, LR, US Coast Guard, Chris-Marine Sweden, HECO International. Staff from MAN Diesel's other North American locations, including Poul Korsgaard, President of MAN Diesel North America, also took part in proceedings while guests of honour included the local Honorary German and Danish Consuls, MAN Diesel's Dr. Stephan Timmermann, Member of the Executive Board, and Mayor Suzette Cooke of the City of Kent.

The facility

The newly renovated, 1,800-m² workshop and 400-m² office space will handle customer requests for all basic repair and service requirements, and include complete overhaul facilities for fuel equipment and turbochargers. Plans are already in place to grow the size of the facility in accordance with customer demand.

"This location in the North West Pacific area is an important step in further extending MAN Diesel's ability to reach customers on the US West Coast," said Jesper Th. Petersen, Technical Director of MAN Diesel PrimeServ Seattle. "From Seattle, we can easily reach all kinds of vessel, from small fishing boat to large container ship, calling at any port from Portland, Oregon to Alaska's Aleutian Islands, and provide a timely and professional after-sales service."

This easy accessibility also applies to PrimeServ Seattle's IT systems. Crucially for prospective clients, the new hub has spent a lot of time and money ensuring it has the latest and best computer systems to provide instant access to all manners of vital, technical data stored at MAN Diesel's Euro-

pean headquarters. This effectively dispenses with the time difference between the two continents and is yet another marketing advantage for the new service centre.

Petersen continued: "We are located in Kent, midway between the ports of Seattle and Tacoma and just a 30-minute drive from each, while we are only 15 minutes from Seattle-Tacoma International Airport. Furthermore, the major ports of Vancouver and Portland, Oregon can be reached in 3-4 hours.

The PrimeServ Seattle team of engineers and mechanics has significant service experience,

ranging from 10 to over 25 years, representing a valuable asset for all MAN Diesel customers in the North West Pacific area.

PrimeServ can now provide its customers with service over the full range of its two- and four-stroke engines, as well as for all MAN Diesel turbochargers and propeller gears," Petersen concludes.

With the opening of MAN Diesel PrimeServ Seattle for business, MAN Diesel now operates five service centres in North America, joining the existing facilities in New Jersey, Fort Lauderdale, Houston and Los Angeles. ■



E-commerce Improves Efficiency

MAN Diesel PrimeServ recently launched a common e-commerce solution. In cooperation with professional e-commerce provider ShipServ, PrimeServ can now offer customers a state-of-the-art entrance to all spare-part sales departments through one common address - ShipServ TradeNet id 52471.

The new system enables customers worldwide to send all requests for quotes (RFQs) and spare-part orders directly to a single PrimeServ entrance. Based on engine or turbocharger type, the RFQ is sent to the relevant sales location.

E-commerce increases efficiency in the global shipping industry. ShipServ has established a huge trading community of 130 ship managers and owners, representing 4,500 ships, while PrimeServ's present e-commerce customer portfolio includes over 100 major shipping companies worldwide, and includes A. P. Møller-Mærsk, Norwegian Cruise Lines, MSC, CMA-CGM and Anglo Eastern Ship Management.

By encouraging its customers to adopt ShipServ, PrimeServ can utilise its SAP system facilities to improve response times for RFQs. There are also future plans to improve and expand the e-commerce solution at MAN Diesel's different locations. An example of this is in Copenhagen where plans are afoot to: upgrade to MTML 2.0 to allow electronic invoicing via ShipServ's TradeNet; OCR scanning of e-mails and faxes transferred into a MTML format; and the sending of invoices by PDF, enabling customers to use OCR scanning.

Pictured above are Arnt Lund (GIW1), the architect behind the e-commerce solution and Peter Rehwaldt (AI-AUG) in a relaxing moment during the planning of the Augsburg integration.



MAN Diesel PrimeServ Seattle is located in Kent, Washington State, USA



Suzette Cooke, Mayor of the City of Kent, cuts the ribbon to officially open MAN Diesel PrimeServ Seattle watched by (from left to right) Dr. Stephan Timmermann, MAN Diesel Executive Board, Jesper Th. Petersen, Technical Director PrimeServ Seattle, Petra Heussner-Walker, German Honorary Consul and Poul Korsgaard, President MAN Diesel North America

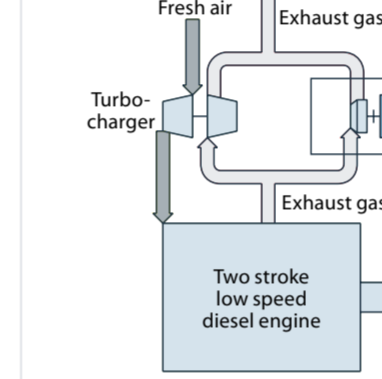
London Green Energy

MAN B&W engines form basis for power plants

Blue-NG, the UK-based renewable power company, has ordered two MAN B&W 7K60MC-S engines to power two environmentally friendly power plants in London.

Each sister plant, located in the Southall and Beckton districts, will have an MAN B&W 7K60MC-S engine at its heart, manufactured by MAN Diesel's Polish licensee H.

Cegielski - Poznan S.A. Each engine develops 13.9 MW at 150 rpm and is installed with an Organic Rankine Cycle (ORC) turbine and Turbo Compound System (TCS) for increased efficiency.



Two-stroke, low-speed diesel engine of MAN B&W design in combined cycle

The heat from the two plants will be used in the gas pre-heating process, which is a necessary part of the pressure reduction process for liquid natural gas, and will

supply renewable electricity, corresponding to the consumption of up to 100,000 homes. Blue-NG signed a turnkey construction contract with Land & Marine Project Engineering Ltd. for the design and construction of the power plants in June 2009.

The engines represent the latest generation of the popular, two-stroke, low-speed MAN B&W K60MC-S engine and will run on crude rapeseed oil. In general, the development of this latest generation has targeted lower heat rates and lower CO₂ emissions. The table shown here illustrates the K60MC-S's performance improvement since its introduction in 1989.

Blue-NG is a renewable power company that builds and operates generating plants that produce electricity and heat locally. The company is a joint venture between the National Grid, the UK's gas and power-distribution company, and 2OC Ltd., a company well known in geothermal energy and natural-gas pressure-reduction station projects, applying proven technology to generate



A similar MAN B&W 7K60MC-S engine pictured at the two-stroke power plant in Cheju, Korea after an SCR retrofit

carbon free electricity.

Land & Marine Project Engineering Ltd. is a Wirral-based, international engineering and contracting company with business activities in

many segments, including commercial and industrial CHP (Combined Heat and Power) plants and direct injection and co-fired biomass plants. ■

MAN B&W K60MC-S	1989 parameters	2009 parameters including TCS
Bore (mm)	600	600
Stroke (mm)	1,650	1,740
rpm	136.4	150.0
Output (kW/cyl)	1,720	1,980
ISO 3046 (efficiency %)	48.5	51.6
CO ₂ emission* (g/kWh)	600	560

*when running on HFO

Improved Supply As Singapore Opens for Business

MAN Diesel PrimeServ recently opened its new spare-parts facility in Singapore in October at a well-attended ceremony.

The new facility aims to deliver spare-parts directly to the large, local market, dispensing with the need to dispatch parts to Asia from PrimeServ stocks in Europe. A new SAP system enables PrimeServ to drive its spare parts business from multiple locations.

The opening of the Singapore facility fits with the overall Prime-

Serv strategy of locating its services as close as possible to where needed. PrimeServ continuously opens new service centres globally along main shipping routes and in areas rife with diesel power-plants.

At the ceremony, Otto Winkel, Senior Vice President MAN Diesel PrimeServ, described the opening to the assembled audience of employees and guests as: "a dream that has come true."

Winkel said: "We are now able to serve all vessels trading in Asia with spare-parts for our entire en-

gine population without having to send the parts from Europe. This saves a lot of time and transportation costs. Despite a significant drop in world trade and shipping, I am convinced that this strategic initiative in the long term will be beneficial to MAN Diesel as well as to the marine industry."

Winkel also said that the process of choosing a location for the new site could have been made easier just by looking at a world map and seeing where ships trading between East Asia and the Atlantic

and Indian Oceans have to pass. He went on to praise Singapore's expansive shipping infrastructure of terminals, bunker facilities, brokers and repair yards.

He concluded: "Establishing a warehouse of this nature has been quite a challenge. To overcome these difficulties, you need a strong project management team. I thank all involved for their efforts in making it happen and [who] found

good solutions whenever a new problem or obstacle surfaced."

PrimeServ has had a presence in Singapore for many years where it retains an experienced crew of superintendent engineers and fitters. Its workshop has a large machine capacity and offers a full range of after-sales services. The new, adjacent warehouse fills around 12,000 square metres and holds around 12,000 spare-parts. ■



Pictured in Singapore (from left) Patrice Mauer, Managing Director MAN Diesel Singapore Pte. Ltd.; Jeroen Lagarde, Senior Vice President MAN Diesel SE After Sales; Sia Kheng Yok, Guest of Honour and Director, Transport Engineering, Singapore Economic Development Board; and Otto Winkel, Senior Vice President MAN Diesel



Katrin Saady, Regional Logistics Manager and responsible in great part for setting up the new facility addresses the assembled guests

Visit to PrimeServ Frederikshavn Puts Pep Back Into Jette Kristine's Step

Upgraded Alpha propeller/nozzle gives impressive 23.5% bollard-pull increase

October 12th was the day when the propeller designers and PrimeServ staff at MAN Diesel Frederikshavn, Denmark, had extremely big smiles on their faces.

A full-scale, bollard-pull test and measurement of the Esbjerg, Denmark-based fishing vessel "Jette Kristine" showed an impressive, pulling-power performance increase of 23.5% compared to a 'pre-test' performed two weeks earlier on the same vessel with exactly the same engine output as well as the original propeller and nozzle installation.

The big increase in performance is a reflection of the great benefit offered by the type of propulsion upgrade that Frederikshavn is able to offer.

The preconditions for both tests and location in Frederikshavn's harbour basin were the same, with the same water depth below keel, and the same draft and trim of the vessel – ensuring the best possible conditions for relative and comparative bollard-pull recordings.



Jette Kristine pictured during the bollard-pull test in Frederikshavn's inner harbour

emissions. The environmental benefit of lower consumption and general, green impact is also a significant side-effect of such upgrades.

In the case of the Jette Kristine, and in similar cases with other fishing trawlers, offshore vessels, tugs and dredgers, bollard pull is the key performance parameter. MAN Diesel's upgrade solutions can include bollard-pull optimised propeller blades alone, or bollard-pull optimised blades in connection with a propeller-nozzle upgrade.

Optimised, propeller-blade profiles applied together with the newly designed, highly efficient AHT (Alpha High Thrust) nozzle represent the ultimate solution in this field.

Optimising for bollard pull

Advanced CFD tools (Computational Fluid Dynamics) were used to develop MAN Diesel's new AHT propeller-nozzle series. The nozzle displays a superior performance compared to the '19A' propeller nozzles that are common standard in the marine industry today.

The increased bollard-pull achieved using the AHT nozzle is not only a result of the optimised nozzle profile, which is double-curved on both the inner and outer

diameter. Other contributing factors are the nozzle length/diameter ratio, nozzle support, aft-ship lines, and tilting and azimuthing of the nozzle.

MAN Diesel has addressed these topics and refined them into a new, systematic method, whereby bollard pull can be increased

considerably compared to solutions that feature 19A nozzles. The success of this approach has been amply demonstrated both in various model and full-scale tests.

In the case of the Jette Kristine, the physical replacement and upgrade operation was performed over the course of 14 days at MAN

Diesel's slipway in Frederikshavn.

A happy customer

Two fishing trips later, and Niels Arne Hounisen, Jette Kristine's owner, gave a measured evaluation of the propeller-and-nozzle upgrade based on its performance in real-life operational conditions.

He expressed his satisfaction: "MAN Diesel has fulfilled my request for more pulling power, and they have delivered more than promised. Plus 23.5% is remarkable, considering the fact that Jette Kristine was equipped with ordinary propeller equipment in good condition – nothing outdated!"

Hounisen continues: "When steaming, it has given me approx. 0.5 knot extra top speed, and in trawling conditions, I have experienced a clear difference with better control of my fishing gear. Most important is a reduction in fuel consumption of more than 15% recorded at trawling speed."

"Regarding the onboard noise levels below deck and in the accommodation, my crew members have stated that they experience much better conditions now – and this is not something they say just to please me", concludes a satisfied Hounisen. ■

Jette Kristine's bollard-pull test results

Before (pre-test)	19.1 metric tonnes
After (post-upgrade)	23.6 metric tonnes
Comparative increase	23.5%

Potential for greater efficiency

Propellers designed more than 10 years ago normally offer great potential for improvement in retrofit projects, where reductions in fuel consumption of up to 12.5% for free-running propeller upgrades have been reported. Often, this is simply achieved by exchanging the existing propeller blades for a modern, optimised and advanced design.

As such, a propeller upgrade represents a relatively small investment with a short payback time that has a radical impact on a ship's operational economy, fuel consumption and exhaust-gas

Jette Kristine principal data

Name and home port	Jette Kristine, E 727, Esbjerg, Denmark
Owner	Niels Arne Hounisen
Yard	Johs. Kristensen Skibsbyggeri ApS
Yard number	178
Year built	1986
Gross tonnage	638
Length oa	43.3 metres
Breadth	9.60 metres
Engine type	MAN 8L23/30-D
Engine output	1,080 kW (1,470 BHP) at 825 rpm
Gearbox type	MAN 39KV11
Reduction ratio	825-214 rpm
Propeller type	MAN Alpha VB740
Propeller diameter	2, 650 mm

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