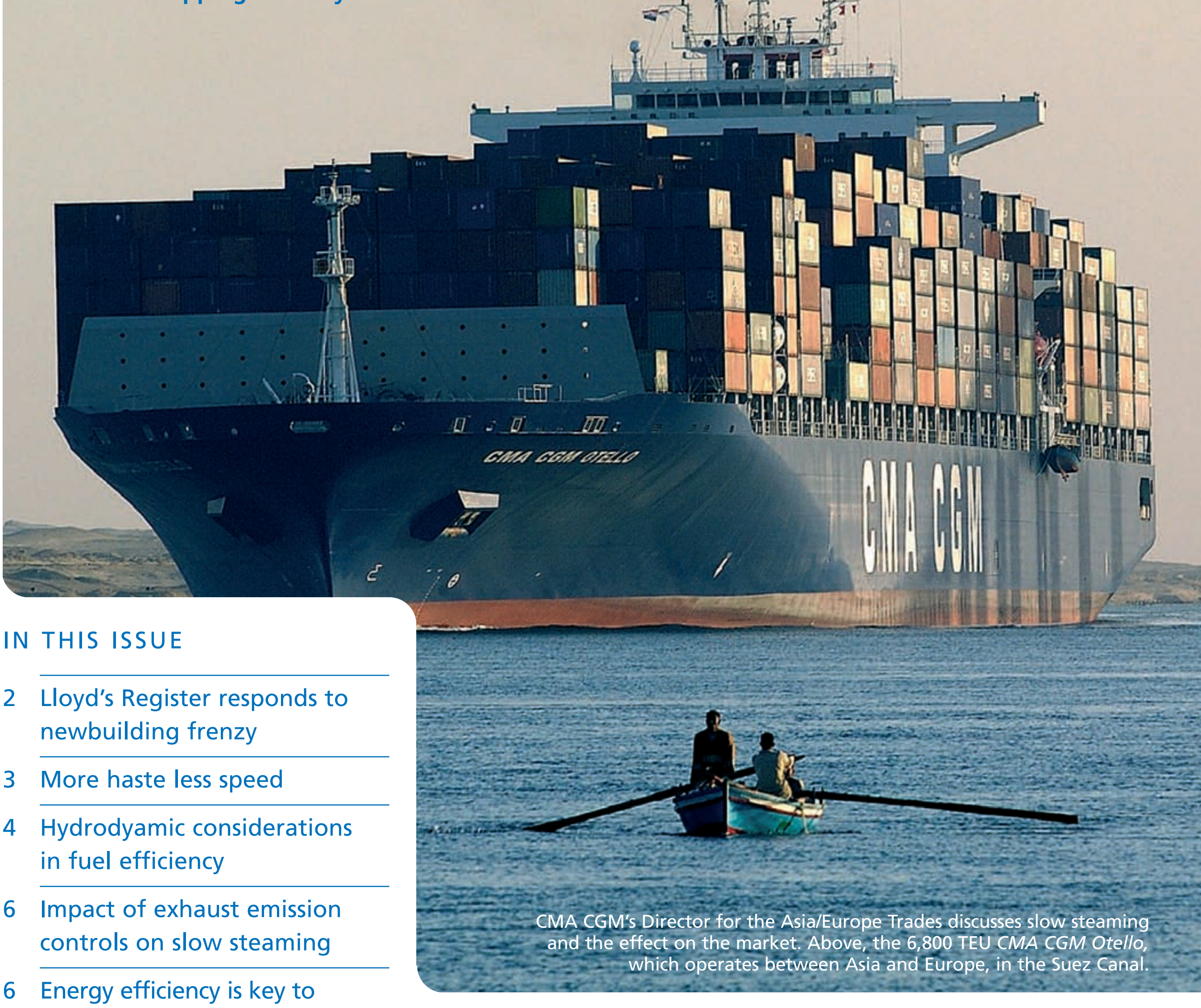
– CONTAINER SHIP FOCUS

TECHNICAL NEWS AND INFORMATION ON CONTAINER SHIPS

SEPTEMBER 2008 Issue 5

Welcome to the fifth issue of *Container Ship Focus*, a technical publication produced by Lloyd's Register exclusively for the container shipping industry.



CMA CGM's Director for the Asia/Europe Trades discusses slow steaming and the effect on the market. Above, the 6,800 TEU *CMA CGM Otello*, which operates between Asia and Europe, in the Suez Canal.

IN THIS ISSUE

Lloyd's Register

Rising to the challenge! Lloyd's Register responds to megaship building frenzy

An astounding 200 plus ships totalling 2.6m TEU are on order in the post-10,000 TEU size range of container ships. Orders are still being placed, and specifications modified, but thankfully the rate of contracting has slowed significantly. Many orders have been "upsized" as owners manoeuvre to find the optimum ship for the future.

The successful introduction by AP Møller-Mærsk of the *Emma Mærsk*, and her sisters, has demonstrated that on some trades - provided the market holds up - "big is best". Over the past few months a number of contracts have been upsized to exceed the new panamax (NPX) width limit (maximum 49m beam for the new locks), mostly settling on 51.2m beam.

The development plans of the Panama Canal Authority continue to complicate the new construction business. The ability of much larger vessels, including container ships, to transit the Panama Canal once the new approach channels and locks come into service in 2014 will radically alter the trading patterns of the container fleet.

As container ships increase in size, so does the magnitude of the technical challenges associated with their design and construction. The region towards the front of the engine room attracts special attention. Here, where the hull is beginning to taper towards the aft end, there is a reduction in bottom modulus and, in addition, warping (torsional) stresses peak in this region. The combination of bending, shear and warping loads causes high stresses and susceptibility to buckling – for these reasons this region has always been subject to special attention by Lloyd's Register, both during design appraisal and during survey while the ship is under construction.

Add to this the consequences of increased bunker prices, encouraging slow steaming, and the prospect of carbon trading, global recession and a plethora of other external factors and it becomes clear why ship owners are not having an easy time.

Furthermore, there are the technical and corporate image issues associated with container ships and their cargoes. Today, a relatively small number of containers, in percentage terms, are lost at sea, but that is small comfort if one of those containers is loaded with your precious goods, or if you are unfortunate to hit a partly-submerged container when sailing your prized new yacht. Public attention is turning its head towards container shipping, helped on its way by high profile incidents such as the MSC Napoli which spent many months under public gaze on a beach in southern England.

Calculating the forces in lashing rods and twistlocks, whether semi-automatic or fully-automatic, and the stresses and strains imposed on the containers themselves is extremely complex. This is an area in which Lloyd's Register has been working since the development of the first generation of container ships, calculating and testing to ascertain what is actually happening to container stows at sea. Further, we are active in the assessment of the capabilities of the containers themselves. This important aspect must be taken into account – a container stow comprises stacks of flexible boxes held together by fittings with inherent clearances which allow both vertical and horizontal movement before they start to take effect; the stack is held in place by lashing rods, which may or may not have pre-tension, and the entire assembly is sitting on a flexible platform – the ship – which twists and distorts with each wave. David Tozer, Lloyd's Register's Business Manager – Container Ships, says (see Lloyd's List, 14 May) "This problem will not be solved mathematically. We need a practical solution, not an academic one." That is not to say we should give up. Of course, Lloyd's Register is not alone in continuing to research container securing matters in depth and this work must continue if we are to maintain confidence in the Rules and procedures which help to ensure that containers, if properly stowed, will be delivered safely. But these investigations must always be backed by empiricism – the years of experience which give us confidence in what we do.

Lloyd's Register has been supporting the container shipping business since its inception decades ago. It is our long pedigree which underpins our work and gives customers the confidence in what we do – *enhancing the safety of life and property at sea, on land and in the air.*

More haste less speed

Container shipping lines have struggled to cope with the new financial reality following the doubling of bunker prices through the course of a year. Nicolas Sartini, CMA CGM's Director for the Asia/Europe trades, describes the effectiveness and the possible development of slow steaming, the industry's response to rising fuel costs.

Slow-steaming was introduced last year as shipping lines sought to counter rising fuel costs, from around $350 to $700/tonne between July 2007 and July 2008, but CMA CGM's director for the Asia/Europe trades Nicolas Sartini believes that ships could slow down even more in future.

The company could not say whether the current climate that allows lines to benefit through slow steaming will persist. No-one can "predict the future" said Sartini, though a majority of observers forecast that fuel prices will remain high in the long term and the lines are planning for a prolonged period of high fuel costs.

"Under these circumstances there is no other way than to continue slowing down the vessels. At this point in time, there is much more focus on trying to find technical solutions permitting us to run ships even slower. Customers understand this situation and will adapt to slightly longer transit times. Today we are talking of two-three days more but it could be five-six days in the future" said Sartini.

He added, "Our customers understand the logic for slow steaming, so they accept the idea of an additional two-three days in transit time."

Sartini pointed out that slow steaming should also result in much better scheduling as an additional buffer will be created to long transits. "This is beneficial for customers and for terminal operators", he said as terminal operators can plan better to meet the shipping lines' demands in terms of equipment allocation, this means terminals are better optimised… offering customers better visibility and reliability in their supply chain. So this is another advantage of slow steaming."

Running vessels more slowly could save owners up to $70,000/day. Sartini explains that "In certain cases, the difference in daily bunker consumption can reach up to 100 tonnes, at US$700/tonne; the cost calculation can be quickly done". Outlay for a ninth vessel on the Asia-Europe trades "is more than offset by the saving in bunker expenses achieved from slow steaming," said Sartini.

Nicolas Sartini - "Customers understand the logic of slow steaming"

In a frank admission Sartini also said that the over-supply of vessels in the crucial Asia/Europe and Pacific trades offered the lines a "conveniently timed respite".

He added, "What is striking, however, is that most lines have ordered batches of eight vessels for Asia/Europe and they are now looking actively for a ninth. Interestingly the most recent orders have now been made on the basis of nine ships. This is a genuine sign that this is the only viable economical way forward."

CMA CGM placed its orders before the fuel costs forced the company to slow steam. So its orders were made in batches of eight ships for Asia/Europe and five vessels for the Transpacific. "A recent order made by UASC was made for nine 13,000 TEU ships. This is probably the first concrete example of this new tendency."

He went on to say large companies or alliances have been able to source from their own fleet. "At CMA CGM, we used the *MOL Creation* last year in the FAL1 service as a ninth vessel and taking this vessel as a VSA. We now do the same with *Hyundai Brave*, also in the FAL1. Some lines have been unable or unwilling to fix the ninth vessel and have simply decided to have a blank sailing every 9 weeks," he added.

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Hydrodynamic Considerations in Fuel Efficiency

In keeping with earlier periods in which fuel costs for shipping lines have risen, prices for marine bunkers have shown significant increases in the last few years. However, unlike the 1970s and 1980s, the background of international economics suggests there is little expectation that marine fuel prices will not continue to exhibit a generally increasing trend.

However, there are hydrodynamic options for operators of existing tonnage and designers of new ships to minimise the impact of high fuel prices.

When selecting a suitable hydrodynamic strategy the impact of whatever modifications are contemplated on the overall ship propulsion problem must be taken into account. The overall propulsion efficiency is the product of the hull, propeller open water and relative rotative efficiencies. This, in turn, implies the ship's apparent wake and afterbody pressure fields and propeller design all influence the cost of propelling the ship. Consequently, the influence of any proposed efficiency measure must be contemplated in relation to all of these parameters and not in isolation as it may adversely affect the others.

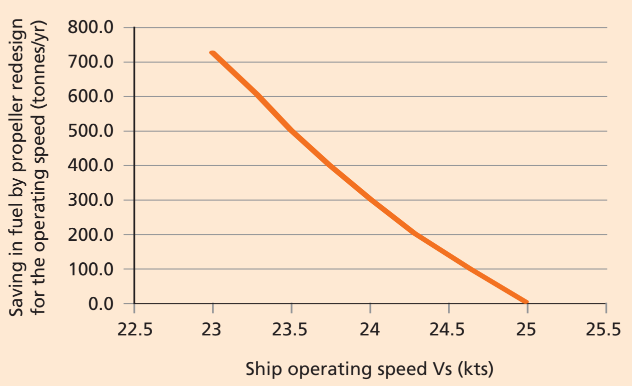

Figure 1 Fuel Cost Saving with a Re-designed Propeller for a Reduced Operating Speed

In the case of an existing ship one option relates to a reconsideration of the ship's operating profile, which could include a sustained reduction in ship speed and that could mean a redesigned propeller may prove beneficial. In the case of a large container ship, for example, the benefit of redesigning a propeller for a reduced speed operating condition, as distinct from the speed for which the ship was originally designed, is shown by Figure 1.

Smoothing out the rough edges

A further propeller related consideration is the roughness of the blades. During normal service the propeller blades will either retain their original general roughness topology, and in a limited number of cases become smoother over time, or roughen. If the latter and more common situation arises then the influence of blade roughness on performance should be considered. For example, in the case of a 5.5m diameter propeller if the roughening were concentrated beyond the 0.7R radius then this may account, after the accumulation of roughening for one year, to a 2-3% increase in fuel consumption. Should the entire blade be affected then this might rise to around 6%.

Such characteristics can, recognising the sensitivity of the blade profile to small deviations in geometry particularly in the leading edge region, be negated by light grinding of the blade surfaces. However, the predicted efficiency gains need to be considered in relation to other vessel performance data.

Hull roughness, in both its temporary and permanent forms, also plays an important role in maintaining low ship resistance. Since only limited action can be taken with permanent roughness the focus of attention has to be on the temporary roughness component.

A number of coating solutions are being evolved for use in the post biocide era with various benefits claimed. In the case of container ships a potential solution for the hull may lie in the silicone-based elastomeric coatings, since large container ships tend to be high speed and spend the majority of their time at sea: conditions which favour the use of such coatings. Silicone coatings tend to prevent marine life from adhering to the hull surface provided the ship maintains speeds above around 17-18 knots. Moreover, some advantage in terms of a reduced turbulent flow wall shear stress is also likely.

Many energy saving devices were marketed during the 1980's due to soaring oil prices. In the case of container ships not all of the devices are appropriate as many apply only to particular hull forms and propulsion arrangements. Over the range of container ship types, including feeder ships which are perhaps fuller and slower, the following six energy saving options could be applied.

The Schneekluth wake equalising duct aims to enhance the overall propulsion efficiency of the ship by reducing the amount of separation over the ship's after-body; to establish a more uniform flow into the propeller disc and minimise the propeller in-plane velocity field.

	Wake equalising duct	Asymmetric stern	Grouthues spoilers	Propeller boss fins	Additional thrust fins	Rudder bulb
Wake equalising duct		C		C	C	C
Asymmetric stern			C	C	C	C
Grouthues spoilers				C	C	C
Propeller boss fins					PC	PC
Additional thrust fins						PC
Rudder bulb						

Note: C and PC refers to compatible and partially compatible respectively.

Table 2 Guide to Energy Saving Device Compatibility

Asymmetric sterns endeavour to attenuate separation over the ship's after-body if it is influenced significantly by the action of the propeller. This can enhance hull efficiency, although it has been observed from model tests that in some cases efficiency gains are predicted where significant separation has not occurred.

In contrast, Grouthues spoilers, applicable only in instances of high bilge vorticity, are an arrangement of curved fins placed forward of the stern aperture to prevent cross flow in the vicinity of the hull from reinforcing a bilge vortex and its consequent energy loss.

In the case of devices operating behind the propeller, propeller boss fins are designed to reduce the energy loss associated with the propeller hub vortex and consequently aim to develop a small efficiency gain consistent with the vortex energy loss.

Additional thrusting fins are positioned on the base of the rudder horn at an incidence angle to the mean propeller slip-stream direction allowing them to generate additional thrust from the lift generated on the fins. And the Costa bulb minimises the loss due to flow separation and vorticity behind the propeller boss.

As many of these arrangements operate in relatively high velocity fields, cavitation and its attendant risk of erosion of the structure must be guarded against.

Energy saving by design

The ability of energy saving devices to operate satisfactorily and return a significant energy saving varies from case to case. Consequently, it is necessary for each ship to assess the probability of success through a design study supplemented by a computational fluid dynamics analysis. Fluid dynamics analysis can be particularly useful because many of these devices are embedded deep within the boundary layer of the ship and propeller slipstream where Reynolds effects are significant and are not fully accounted for in model test procedures.

Energy saving devices operate on the flow field either ahead or astern of the propeller station. This raises the concept of compatibility between the applications of a number of these devices to the same ship. Table 2 offers some general guidance in this respect.

Much of the foregoing discussion relates to existing ships, but there is no substitute for a well designed hull that maximises propulsion efficiency. Analysis by computational fluid dynamics procedures has matured significantly in the last few years and is yielding good quantitative estimates of resistance, enabling the designer to gain insights into the flow field around the ship.

Notwithstanding the advances in these mathematical modelling techniques, they should not replace the conventional model testing procedures for which much correlation data exists: rather they should be used to complement the design approach by allowing the designer to gain insights into the flow dynamics and develop remedial measures before the hull is constructed.

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Impact of Exhaust Emission Controls on

The cyclical nature of shipping results means there is a recurring need for slow steaming in order to cut unit costs. One factor that makes the current trend for slow steaming different from those that have gone before is that this time it is occurring in a world where there are exhaust emission controls, in particular MARPOL Annex VI with regard to the emissions of nitrogen oxides (NOx).

MARPOL Annex VI requires that engines over 130 kW (other than those used only for emergency purposes) installed on ships constructed on or after 1 January 2000 are certified in accordance with the mandatory NOx Technical Code. As at July 2008 the Annex has been ratified by 51 of IMO's 167 Member States; nevertheless it should be recognised that these signatories represent over 80% of the world's gross tonnage as well as many of the key shipping centres in Europe and the Far East. A notable exception to this list has been the US. However, with the signing into law of the necessary legislation in July 2008 this will soon change. Hence compliance with these requirements is an essential prerequisite to operate.

NOx Technical Code certified engines each have a Technical File which includes the applicable survey regime, termed the Onboard NOx Verification Procedure. All engines as built use the Parameter Check method as the particular form of Onboard NOx Verification Procedure applied. This effectively stipulates the engine components and range of settings to be adopted which ensure that the NOx emissions, under reference conditions, will be retained within the certified value. Of the NOx critical components these broadly divide into three groups, the combustion chamber (including piston, cylinder cover and liner) the charge air system (turbocharger and charge air cooler) and the fuel injection system (fuel pump, injection nozzle and timing cam) while in terms of settings these will principally be either the maximum permitted combustion pressures across the load range or the fuel oil injection timing.

Energy efficiency is key to reducing soaring

Recent increases in the price of ship's fuel have prompted owners to reduce their costs by reducing vessel speeds, decreasing fuel consumption as a result.

However, decreasing speed will increase the voyage length, but there would be a net reduction in fuel consumption. For example, it takes about 10.5 days for a 6,800 TEU container ship loaded in the Middle East to sail to Tokyo at 25 knots consuming around 192 tonnes/day of HFO. If the speed is reduced by three knots, fuel consumption is reduced by an estimated 61 tonnes/day. This will in turn add 1.5 days to the voyage hence giving a net fuel saving of about 434 tonnes including the added average fuel consumption for the extra 1.5 days.

Based on today's average price for HFO of around $600 per tonne and average charter rates of $50,000 per day, the net saving through slow steaming is about $185,000 for the voyage. Speed reduction to 22 knots will reduce the engine power by about 30% (from 85% to 55%MCR). Further speed reduction to 20 knots will bring the engine power to below 45% MCR.

Below 75% engine load, exhaust gas temperature before the economiser will be around 260°C. Considering that sulphur condensation temperature rises with fuel sulphur content (at 4% sulphur content condensation temperature is 145°C), and sulphur condensation has a corrosive effect on the economiser, it does not seem wise to risk damage to the economiser unless financial gains justify it or the engine is occasionally operated at higher loads in order to prevent excessive soot accumulation.

In order to benefit from the engine's fuel consumption efficient range (i.e. 65% to 85% load) and to avoid the side effects of steaming at lower power range (below 60%), power reduction would be limited to about 65% maximum continuous rating (MCR). As the engine's normal continuous rating is normally 90%

Slow Steaming operating costs

Consequently, while this NOx certification still allows for an engine to be operated at any load point within the available range, including that corresponding to slow steaming, it does severely restrict the ability to have the engine re-optimised for lower powers than used for the initial certification. This is particularly apparent in the case of the fuel oil injection nozzle, a key NOx critical component, but one which previously would have been readily changed for a 'slow steaming' version with no wider implications. For a NOx certified engine, such alternative components can only be fitted if approved within the requirements of the NOx Technical Code. In the case of alternative fuel injection nozzles for example, the process would require the running of a full emissions test which would normally need substantial input from an engine builder. Therefore, shipowners must ensure that any changes to the NOx critical components or settings are duly approved prior to installation in order to avoid invalidating an engine's certification.

The alternative option would be the change from the Parameter Check method for Onboard NOx Verification Procedure to the Direct Measurement and Monitoring method. In this the engine is reduced to a 'black box' with inputs of fuel and air and outputs of power and exhaust emissions. Under such an arrangement the NOx critical components and settings may be changed provided that the engine is shown by the application of the Direct Measurement and Monitoring method to still be compliant with the relevant NOx emission limit. This is not without its omplications; apart from the cost of such systems, which will need to be approved for each installation, there are the questions of reliability and robustness of the equipment and crucially whether the engine has any margin to exploit alternative components and settings and still remain compliant.

An additional factor from the Annex VI NOx controls is their potential application to engines installed on ships constructed before 1 January 2000. Any changes to an engine which would be termed 'major conversion', as defined, would cause it to require NOx Technical Code certification, no easy task. Hence shipowners will again need to be extremely cautious to ensure that any steps taken to modify such engines do not have the effect of compromising the ship's Annex VI status.

MCR, the actual power reduction would be at most 25%. Any further reduction in power below 60% could have adverse effects on the engine, turbocharger and economiser performance.

Taking into account the power~speed relationship, speed reduction on ships with higher service speeds (i.e. 25 knots) would yield more benefits as compared to those having lower service speeds.

Estimates show that in the short term, slow steaming is financially beneficial (based on current charter rates) where the container ship's service speed is above 18 knots.

In the long term, the solution is to build container ship engines with more than one optimum point in order to provide flexibility, taking advantage of the possibilities now becoming available with the change from mechanical to electronic control.

The LR classed *Safmarine Nakuru* and *Nuba,* both 2,478 TEU, are built with Man B&W 7L70ME-C engines with electronically controlled fuel injection and exhaust valve actuation which keeps engine temperatures below critical levels. Above Berlinda Oduru-Owusu, who named one of the vessels (see page 12) gets a tour of the engine room.

Sixty years of shipbuilding shapes German yard

Aerial view of Volkswerft Stralsund with SAFMARINE container ships, hulls 469 and 470

Lloyd's Register and Volkswerft Stralsund GmbH shipyard have developed a working relationship that is based on many years of co-operation and that is set to last with more work in the pipeline.

Celebrations for the 60th anniversary of the Volkswerft Stralsund shipyard took place in June with the double naming ceremony of two Lloyd's Register classed Safmarine ships, the 2,478 TEU *Safmarine Nakuru* and *Safmarine Nabu.*

These vessels are the latest ships lowered down the yard's shiplift following an industrious 60 years of shipbuilding which began with the construction of fishing vessels in the late 1940s.

The yard now has orders for another 11 container ships and a series of six anchor handling tug supply vessels all Lloyd's Register classed, built for Maersk Supply Services. These orders have ensured the future of the yard and its continued co-operation with Lloyd's Register.

With so much business Lloyd's Register Germany has a permanent presence at the shipyard with a site team of three surveyors along with plan approval and new construction surveyors. Lloyd's Register also provides training for the yard covering topics like future IMO legislation, ballast water management/treatment and the IMO performance standard for protective coatings.

Currently owned by the Hegemann-Group, the yard began its life building fishing vessels, delivering its 350th lugger in the spring of 1956. By the early 1960s, the yard was modified to allow it to build bigger fishing vessels of up to 100 m, and this was extended further to allow for ships of 120 m some 10 years later.

By 1975, Volkswerft Stralsund was ranked first in Lloyd's Register's world fishing vessel construction statistics and in 1990, a company restructuring established Volkswerft GmbH, a limited company and heralded a turbulent decade for the yard.

By July 1992, a 327,000 GT limit of annual new building capacity for East German shipyards was imposed by the council of ministers of the European Union, with Volkswerft being allocated a total of 85,000 GT of this limit.

In December 1996, the shipbuilding hall, with a length of 300m, width 108m and a height of 74m, at that time the largest shipbuilding hall in the world, was commissioned. July 1997 saw the commissioning of a shiplift with a net lowering capacity of 21,735 tonnes.

The ownership of the yard was to change with the Danish AP Moeller Group taking over the yard in February 1998, some four months before it celebrated its half-century in shipbuilding.

Danish interests controlled the yard for nine years before it changed hands in August 2007, finally being acquired by Detlef Hegemann. Today, Volkswerft Stralsund is a subsidiary of the Hegemann-Group and, together with two other shipyards, Peene-Werft GmbH in Wolgast and Detlef Hegemann Rolandwerft GmbH & Co. KG in Berne, forms the Hegemann-Group of yards.

Production restrictions, limiting the construction output, are no longer in place in Stralsund allowing significantly increased fabrication and improved efficiency. As a result, all five container ships for Safmarine were delivered within six months. Name-giving ceremonies are a common sight at Volkswerft Stralsund GmbH these days with more to come.

CNCo's Lloyd's Register classed design is shipping's flexible friend

The China Navigation Co (CNCo), the deep-sea ship-owning arm of the Swire Group, has chosen Lloyd's Register class for their first newbuilding order in more than a decade, opting for six state-of-the-art multipurpose ships from the Chinese builder, Nantong Mingde Heavy Industry.

CNCo believes the 40,000dwt vessels, acquired for an aggregate cost of about US$360 million, will be built with the right blend of new technology, client input and trade forecasting to offer cleaner operations, greater flexibility and unit cost-savings.

Designed in partnership with the Shanghai Merchant Ship Design and Research Institute, their wider beams (32.2m) will provide 10,000dwt more capacity than comparable ships in service, while their de-rated Wartsila 6RT Flex 58T-D engines and larger propellers will drive fuel efficiency and lower emissions.

"We are confident that the low operating cost of these vessels coupled with their increased cargo-carrying capacity will see this design gain popularity among other owners, making it an industry standard for the multipurpose sector," said CNCo Director Martin Cresswell – General Manager Fleet. "We think this design will become the future standard given its carrying capability, flexibility across all cargo types and large advances in fuel efficiency."

Cresswell says the 40,000dwt vessels – which have a nominal container capacity of 2,321 TEU – are expected to burn about 30 tonnes of fuel a day at 14.5 knots, compared with the 52 tonnes a day consumed by 30,000-dwt ships at 17 knots. "At US$700 per tonne for bunker fuel, this represents a large step in cost-efficiency for the operator," he says.

Benefits also will be derived from the ships' meticulously drafted hull forms, the dimensions of which (LOA: 199.8m; draught 11m) were carefully selected to maintain calls at the world's conventional break-bulk ports as well as Swire's liner trade ports. "The hull form is being very carefully designed and model tank testing will be carried out in the Hamburg basin," says Cresswell. "The testing will be conducted with and without propeller wake ducts and a combined propeller cone and rudder torpedo bulb to find the optimum design with lowest fuel consumption per tonne-mile."

Aside from its environmental mandate, the antifouling paint system also will meet strict criteria for providing the least hull resistance.

The ships' four deck cranes, which have a lift capacity of 250 tonnes at 12 metres from the side when twinned, will be electronically controlled, reducing power-consumption and the spill potential of their hydro-electronic counterparts. However, the environmental and unit-cost improvements will not been achieved at the expense of operational flexibility.

Included in the myriad of cargo-specific design enhancements, the vessels' five-hold nine-hatch configuration will feature strengthened tank tops for loading two tiers of steel coils, while the hatch covers will be flush to handle long pieces of project cargo such as blades for wind turbines, boilers and pre-fabricated construction modules. The ships are designed to carry 30-tonne steel coils, a feature which is unique among current and on-order bulkers or multipurpose vessels. It equates to a deck strength of approximately 28 tonnes per square metre, compared to current bulkers with an average strength of about 18-20 tonnes per square metre or less," Cresswell says. "Based on input from our clients, we believe that steel coils will get larger and heavier over time to align with truck axle strengths and local road haulage rules."

Long term solutions needed for high costs

The past two years have witnessed a surge in oil prices that has been directly passed on to marine bunker prices and this is having far-reaching implications for the container liner markets in terms of vessel size, type and speed.

To date, these changes have been primarily manifested in slow steaming, as operators seek to absorb excess capacity as well as reduce fuel charges, and also by means of sharp increases – where applicable – in bunker adjustment factors, which push the worst effects of higher fuel prices onto the shippers.

These are only short term tactical moves. Designing a container vessel that was optimised for a range of fuel prices - and speeds - would be the obvious long term solution. Unfortunately, this is not possible, short of constantly changing the propeller.

Bunker Prices and Container Ship Speeds

The container shipping market is highly vulnerable to changes in the price of fuel. If you look at the development of average Heavy Fuel Oil prices for the period since 1976, it is clear that bunker fuel prices are highly uncertain. The peaks following the first and second oil price hikes in 1973 and 1979/80 were followed by a period of declining prices, prior to renewed upward pressures from the beginning of the current decade. Since then, prices have increased into uncharted territory.

Given that it is very risky to design a vessel for a particular fuel price regime, a degree of operational flexibility makes design sense. Analysis of design speed for the container fleet at different times of construction reveals an interesting relationship with bunker prices. The surge in IFO prices has been reflected in a reduction in design speeds from an earlier average of between 22-23 knots in the mid-1970s to below 20 knots over 1983-84.

This reflects also the time lag between ordering and vessel delivery. The cheap energy prices for the period between say 1986 and 1999 were reflected in a gradual increase in speed to around 24 knots. Most of the vessels trading and on order today have been optimised for relatively low fuel prices. This is likely to change.

Bunker Prices and Ship Trading Costs

Under current bunker price regimes for large container ships, fuel is by far the most significant cost sector, with charges At Sea calculated at $138,400 for a 8100TEU vessel and around $198,200 estimated for the ULCS when trading at 25 knots. However, if for example, an 8100TEU vessel were to cut trading speed from 25 knots to 23 knots it would result in a daily fuel saving

The *Emma Maersk* takes on fuel at Rotterdam port.

of $29,920 under current prices. The necessity of slow-steaming in this environment is clear. Of course, a review of daily charges only provides a partial understanding of the position. Trading vessels at a higher speed means that they can undertake more voyages per annum and, therefore, potentially generate considerably higher freight earnings. Indeed, in a climate of low energy prices, this has been a major motive in the development of ship design.

Under the bunker cost regime that was dominant for most of the 1990s, it is clear that there was very little to choose between the annualised costs for vessels trading at between 20-25 knots. That is to say, the higher bunker charges for increased speeds were offset by the greater annual transport capacity generated. Indeed, between 20 and 22 knots, vessels were actually cheaper.

Under current prices the position has radically altered. There is a significant increase in costs between 23 and 25 knots (this is estimated at some $26 and $34 per TEU for 8100TEU and ULCS vessels, respectively). Also, the economics of faster operation become rapidly more problematic.

Conclusion – implications for vessel design

It is uncertain what the price regime for bunker fuels will be in the coming period. Great volatility can be expected. The economics of liner shipping (and specifically deepsea trading) are highly vulnerable to changes in this specific cost. It is likely, therefore, that over the life of a modern large vessel there will be pressures to trade at considerably different speeds. It is extremely unlikely that sound economic arguments will be developed for trading speeds much in excess of 26 knots and service demands mean that operation at below 20 knots is unlikely.

The main conclusion is that liner operators will be seeking vessels that can be optimised for trading at speeds between these extremes. Considerations of installed power, hull form and other issues should be informed by a need to meet these requirements.

It might be concluded that the optimum vessel for deepsea container operations would be a very large vessel trading slowly between major hub ports. Indeed, this has been the concept brought forward by some shipyards in the recent past. In reality the position is considerably more complex and although there are thought to be no technical issues prohibiting the construction of a 20,000TEU – or larger – vessel, the likelihood of their introduction is limited for the following reasons:

The physical berthing of such a vessel at major container terminals would be highly restricted.

The only trade where such units could theoretically be deployed - Asia to Europe – would throw up physical transit problems, especially around Suez and in the Malacca Straits. Such vessels would be far too large for the new locks at Panama.

There is a lack of shiprepair capacity for such vessels at the global level and certainly in the European and North American markets.

The consignment sizes for such vessels would be enormous. Even the largest and fastest terminals would have difficulty in turning such a vessel around in under five days. Resulting vessel charges would soon eat into the scale economies of the vessel at-sea.

Filling the vessel would become problematic in all but the very largest ports. In order to generate sufficient demand, a further increase in transshipment - as high as around 50 per cent of the total container volumes – would be necessary. This would place further pressure on the terminals and generate concerns about feeder availability. Also, direct calls with current large vessels would remain an alternative and could well undermine the strategy.

These vessels would have to be considerably slower than those currently operating. Although a reduction in the number of port calls offered might well mitigate these effects, it is likely that overall container transit time would be higher for such services. This would be a negative marketing feature.

On this basis, it is concluded that the optimum vessel for deepsea container trading is likely to remain in the 14,000TEU+ size range, with a single engine that offers a range of trading speeds and is typically operated at 21-22 knots, with scope to go faster to meet port windows. Design, operational and marketing factors all point to this overall configuration.

This article was written for Container Ship Focus by Andrew Penfold of Ocean Shipping Consultants Ltd.

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Entente admirable! Chancellor's yard visit highlights Lloyd's Register's German links

Chancellor Dr. Angela Merkel (MdB), Germany's first female chancellor, and Berlinda Oduro-Owusu, daughter of Nana Oduro-Owusu, the Managing Director of the Ghana Cocoa Marketing Company, UK, honoured Safmarine in June by naming two Lloyd's Register classed vessels the *Safmarine Nakuru* and the *Safmarine Nuba*.

The 210.54m *Safmarine Nakuru* and the *Safmarine Nuba* and three other sister vessels have been constructed in accordance with Lloyd's Register's Rules and Regulations for container ships.

The sister ships have capacities of 2,478 TEU and were built by Germany's Volkswerft Stralsund GmbH shipyard which also celebrated its 60th anniversary with the double name-giving ceremony.

The ships, each with the capacity to carry 352 reefer containers, were delivered to the AP Moeller subsidiary Safmarine this year.

The reefer capacity of the vessels reflects high levels of reefer cargo exported from South Africa.

Volkswerft Stralsund delivered the first ship of the series, the *Safmarine Ngami,* to the owners Safmarine on 26th February 2008.

The *Safmarine Nakuru* and the *Safmarine Nuba* are the latest in a long history of container ships constructed by the Volkswerft Stralsund shipyard since it opened for business in June 1948.

In addition to five ships of VWS 2500.3 design, hull nos. 466 – 470 for Safmarine Container Lines NV, Belgium, a further five, hull nos. 471 – 475 are under construction at the shipyard for The Maersk Company Ltd, United Kingdom.

Class notation.

Hull notation	**✠100A1 CONTAINER SHIP *IWS, LI, ShipRight (SDA)**
Machinery notation	**✠LMC, UMS**
Descriptive Notes	**Part Higher Tensile Steel, ShipRight (BWMP (S), SCM)**

CONTAINER SHIP FOCUS

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