Evolution of Handysize design and performance – Jay K Pillai

Fuel Prices, Volatile Markets, Air Pollution Focus

Designers, Yards, Owners & Operators have been innovative and thinking ahead…

•Designers and Yards have been more receptive lately to Owners and focus on building "operational and eco-friendly ships"

We have a "two tier market"

a)In-water tonnage and new ships not offering fuel savings – higher opex

b)Eco-friendly ships – lower opex due to lower fuel oil consumption

Eco friendly Designs

•Improved hull form: research & innovations to address root cause

•Repeated testing of model on computer (CFD tests) and physical test (tank tests)

•Use of fuel saving devices such as:

•larger propeller, optimized propeller and rudder, de-rated engines

•use of Main engine with electronic fuel injection (instead of mechanical injection in the in water tonnage)

•low friction coating etc.

Fuel - New Building Vs In Water Tonnage

Savings of 15-25% in Fuel Oil Consumption (FOC) achieved on newbuildings

•Japan – FOC on a 37K dwt NB and in water 32K is same, while the NB carry 16% more cargo (5,000 mt)

•China – FOC on 37K dwt NB is about 13% less (3.5mt) while carrying 16% more cargo (5,000 mt)

•Some designers claim up to 19 mt (about 5 mt less FOC) on newbuildings, though not yet tested during speed trial and heavy weather at sea

Managing our In-Water Tonnage

•Hull form can't be changed; By adding fuel saving devices, we can achieve better efficiencies of about 5-8%

•Use of combustion catalyst, PBCF, Weather routing, Coating hull with A/F up to summer draft mark, besides maintenance and condition monitoring

•"Slow steaming with Right Speed" to save energy and reduce emissions, when schedule permits

DNV – Bulk Carrier Update

Mewis Duct

The MD is a combination of a vertically offset mounted duct positioned right in front of the propeller and an integrated asymmetric fin arrangement. For full-form slower ships. Combines the effect of a wave equalizing duct and pre-swirl fins.

Rudder profile

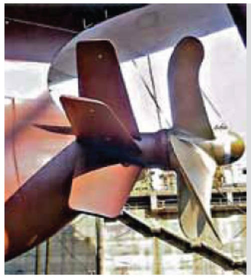
Thinner rudder profiles have less drag but are more likely to develop separated flow and cavitation. The twisted leading edge rudder from Becker Marine Systems is a more refined profile. High lift profiles can give significant power savings.

Propeller Boss Cap Fin

The PBCF consists of small fins attached to the propeller hub. The number of fins equals the number of propeller blades. The aim is to reduce the energy loss due to hub vortices.

Propeller design

The main propeller characteristics determining the open water efficiency are the diameter, rotational speed, pitch ratio, number of blades and blade area ratio. The main parameters may be optimised and selected on the basis of experimental data from propeller series such as the Wageningen B-series. High efficiency is achieved by a large diameter, low number of blades, low blade area ratio and low RPM.



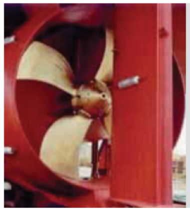
Pre-Swirl Stator

The PSS is a set of blades positioned right in front of the propeller, with an asymmetric configuration. It works by introducing pre-swirl ahead of the propeller to reduce rotational losses and thus improve propulsion efficiency.

Hull shape

The hull lines and ship speed determine the lower limit of the vessel's resistance. Traditionally there has been a large focus on design speed in the optimisation of hull lines, but new flexibility requirements mean that a vessel must perform well over a range of drafts and speeds. For low Froude number bulk carriers, a high block and maximum draft help reduce the dominating viscous resistance. Detailed aft ship optimisation that takes the propeller into consideration is required to achieve maximum performance.

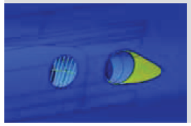
DNV – Bulk Carrier Update



Propeller nozzle

An efficiency improving propeller nozzle changes the flow field in and around the propeller and divides the thrust force between itself and the propeller. A nozzle can also be used to improve cavitation and noise properties.

Openings – arrangement and design



Openings in the hull are needed for sea chests and bow/stern thrusters. The detailed configuration of these openings is important for resistance and possibly noise and vibration. The efficiency of the thrusters depends on the shape of the tunnel.

Contra-Rotating Propeller

A CRP is a highly efficient means of propulsion, but is also complex and costly. A two-digit improvement in efficiency is possible compared to a traditional propeller.

Main engine

Generally, larger bulk carriers have two-stroke diesel engines installed. The most common type of engine is mechanically controlled, while electronically controlled engines are becoming more common for newer vessels. Typically the de-rating of the main engine, engine control tuning for electronically controlled engines and low load optimisation using the variable turbine area and exhaust gas bypass can be done to reduce the specific fuel oil consumption (SFOC).

Propeller rudder transition bulb

There is a variety of solutions involving bulbs fitted to the rudder in order to reduce hub vortex losses. Such solutions are typically a central part of a modern high efficiency rudder.

Auxiliary engine

Auxiliary engines on board bulk ships that are not geared usually mainly supply electrical power to the accommodation and machinery systems when under way. The most common setup is to have three auxiliary engines of the same size. This allows one engine to be out for maintenance while still complying with the redundancy requirements. Generally all the measures that may be applied to the main engine in order to reduce the SFOC may be applied to the auxiliary engines.

Pre-duct

A pre-duct is fitted to optimise the propulsion properties by improving the flow into the propeller. It can also improve manoeuvrability and reduce hull vibrations. Some pre-ducts also produce thrust.

Waste heat recovery system

Waste heat recovery has the largest potential to improve the efficiency of traditional two-stroke engines, but there are challenges related to exploiting this potential. Both the complexity and cost of the system have made these types of systems rare on bulk carriers.