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no. 27

Above: Suction side with pressure and wall shear stress vectors of constant length – **semi-spade rudder**

Above: Suction side with pressure and wall shear stress vectors of constant length – **Becker full spade rudder**

SEMI-SPADE RUDDER vs. FULL SPADE RUDDER

Benefits of a Becker full spade KSR rudder compared to a conventional semi-spade design

Shipyards traditionally rely on semi-spade rudders as the manoeuvring solution for just about any type of vessel. Semi-spade rudder technology has been in use for decades and many shipyards have developed their own semi-spade designs following this approach. Arguments that semi-spade rudders are the best solution for slow speed vessels have been brought forward for many years.

There are, however, a few substantial drawbacks to using semi-spade rudders, even at slower speeds. A modern, full spade rudder such as the Becker full spade KSR (King Support Rudder) design transforms a much higher proportion of propeller thrust into lift than a conventional semi-spade rudder. The fixed rudder horn installation used in the semi-spade design is not actively involved in the steering process and does not generate any lift. By contrast, the entire leading edge of a full spade rudder is actively involved in steering and generating lift, giving captain and crew an added measure of comfort and safety from significantly improved manoeuvrability. The slim profile of a Becker full spade KSR rudder also reduces drag, thereby saving fuel.

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MEMBER OF STAFF: DETLEF KAGELMANN

Head of Quality Management for Becker Marine Systems in Hamburg

Detlef Kagelmann joined the Becker team as Head of Quality Management in April 2014. He is responsible for the quality assurance activities at Becker's manufacturing partners, the development and maintenance of the ISO 9001 certified quality system and control of non-conformities (customer complaints and warranty claims). Detlef Kagelmann has acquired 25 years of industrial experience, beginning his career in aviation and later working in the maritime sector at an offshore windmill production site. Ensuring consistently high product quality and implementing our customers' quality requirements along our international supply chain are the Becker QM team's prime objectives. Continuous improvement of products and processes and the integration of new business developments into Becker's quality system are a constant challenge. Becker is also preparing for certification of its environmental management system in accordance with ISO 14001.

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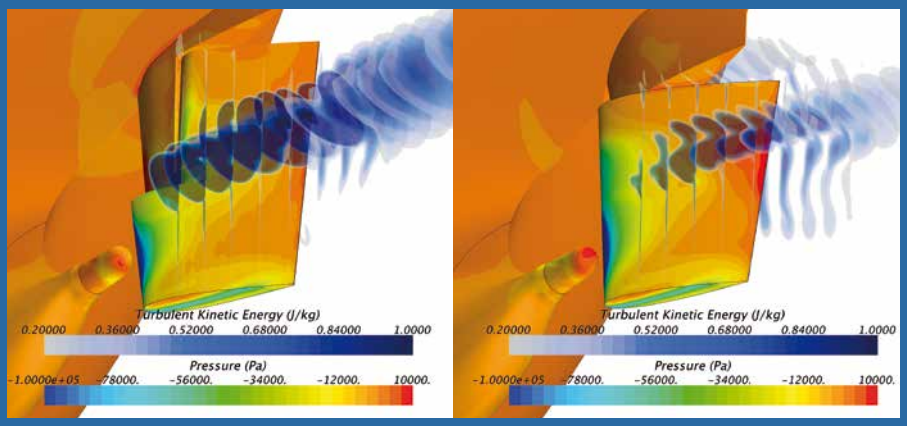
SEMI-SPADE RUDDER vs. FULL SPADE RUDDER

(continued from page 1)



Computational Fluid Dynamic comparison of turbulent kinetic energy and pressure (left **semi-spade rudder,** right **full spade rudder**)

The stability and sturdiness of its design is one of the major benefits of a Becker full spade KSR system. The point of attack of the acting forces is nearly at the centre of the rudder, reducing bending torque to a minimum. The integrated rudder trunk and the KSR design's neck bearing direct the forces acting on the rudder to the aft ship steel structure.

Due to its sturdy design, there is no need to modify the aft ship steel structure to accommodate a Becker full spade KSR rudder. By contrast, the integration of a rudder horn is more complicated and requires a strengthened aft ship to compensate for the torques and forces acting on a conventional semi-spade rudder.

The alignment of a Becker full spade KSR rudder is much easier due to its lower number of bearings. A conventional semi-spade rudder has three bearings, whereas the Becker solution requires only two (the neck and carrier bearing).

Becker focusses on sturdy designs with as little need for maintenance as possible. To achieve that all Becker Rudders are made of forged and conventional ship building steel, allowing ship owners uncomplicated maintenance compared to cast material.

Becker full spade KSR rudder in brief:	
Manoeuvrability	✓✓
Efficiency	✓✓
Energy savings	✓✓
Aft ship structure integration	✓
Service	✓
Maintenance	✓

SERVICE: RUDDER CONVERSION FOR THE *NORWEGIAN EPIC*

Becker Flap Twisted Leading Edge Rudders installed

Last year Becker was awarded the order to upgrade Norwegian Cruise Line's (NCL) *Norwegian Epic* cruise liner by installing energy-saving Becker Flap Twisted Leading Edge Rudders with rudder bulb and customised propeller end fairing caps.

Computational Fluid Dynamics (CFD) calculations were very promising and indicated a significant manoeuvring improvement and remarkable energy-savings due to the flow-optimised Becker rudder profile. The CFD tests also revealed that with the new Becker system the original rudder offset from neutral position could be lowered from four to only two degrees of rudder angle.

In order to provide a cost efficient upgrade major components of the original non-flap rudder system (e.g. trunk, rudder stock and steering gear) remained unaltered. The new rudder blades including the linkage system of the rudder flap had to be adapted to the present aft ship configuration.

The Becker Service Team set out to install the new rudder system at the Damen Brest Shipyard in France, facing the challenge of timing complex tasks such as rudder alignment and in-situ machining of the link system on a tight shipyard schedule. But the Becker Service Team's expertise and planning once again produced a very satisfying result by completing installation of the new rudder systems two days ahead of schedule.

Following installation Becker sent out a manoeuvring trainer to familiarise the crew with the new manoeuvring performance of their vessel resulting from the rudder conversion. The significant improvement in manoeuvring indicated by CFD calculations were verified and confirmed during IMO test runs. The *Norwegian Epic* is back in service and our client is very pleased with the fact that the change of rudders generates remarkable energy-savings in daily operation.

Picture © Norwegian Cruise Line

BECKER PRODUCTS: RECENT ORDER HIGHLIGHTS

Product: **Becker Flap Rudder Twisted with bulb**
Ordered by: **Wärtsilä**

Becker has just received a rudder order to equip a 45,000 m³ LNG carrier currently under construction for Saga LNG Shipping at China Merchants Heavy Industry. The vessel design by LNG New Technologies is based on the LNT A-BOX™ containment system with excellent volume utilisation. Becker delivers a customised Becker Flap Twisted Leading Edge Rudder with bulb optimised for the Wärtsilä propulsion system. The order for this rudder is yet another example of the success of the on-going cooperation between Wärtsilä and Becker.

Product: **Becker Mewis Duct®**
Ordered by: **Krey Schiffahrt**

Despite the currently low prices for fuel, ship charterers and owners are responding to changes in market conditions by upgrading existing vessels, improving the efficiency of their fleets. Krey Schiffahrt has decided to equip their 12,500 dwt MPP vessel *BBC Ontario* with an energy-saving Becker Mewis Duct®. Studies of efficiency conducted before and after installing Becker's energy-saving device show energy savings six percent lower than the *BBC Ontario*'s sister ships that have yet to be upgraded.

Product: **Becker Flap Rudder (Heracles)**
Ordered by: **Hamburg Port Authority**

Hamburg Port Authority (HPA) took delivery of two new ice breakers, the *Johann Reinke* and the *Christian Nehls*, able to break through 35 cm of solid ice at the port of Hamburg while travelling a speed of 2 knots. As a part of HPA's fleet modernisation program, the new ice breakers are replacing older vessels built more than five decades ago. HPA ordered sturdy Becker Flap Rudders with closed linkage (Heracles) for best manoeuvrability possible. Two additional ice breakers will also be equipped with Becker rudders in the near future.

Product: **Becker Performance Package**
Ordered by: **Thenamaris / Sungdong SY**

Becker has received an order to deliver Becker Performance Packages (Becker Twist Rudders with bulb combined with Becker Mewis Ducts®) for four 115k COT Aframax tankers under construction at the Sungdong shipyard in Korea on behalf of Greek ship owner Thenamaris. This will be one of the first installations of a full spade Becker Twist Rudder with bulb on an Aframax tanker. Model tests indicated significant energy savings of the Becker Performance Package, demonstrating the advantages of combined Becker products.

Imabari Shipbuilding Co.,Ltd.

Product: **Becker Twist Rudder**
Ordered by: **Imabari**

The Japan-based Imabari Shipbuilding Group recently awarded Becker Marine Systems a follow-up order for delivery of five additional Becker Twist Rudders. These rudders follow the ten Becker Twist Rudders previously ordered by Imabari for a series of fifteen 14,000 TEU container ship newbuildings. The Becker Twist Rudder is well-known amongst shipyards and owners for maximum efficiency combined with improved manoeuvring performance and significantly reduced rudder induced cavitation.

Product: **Becker Rudder**
Ordered by: **Japan Marine United Corporation**

Japan Marine United Corporation (JMU) and Becker Marine Systems are joining forces for the first time. Becker will provide their King Support Rudder (KSR) technology for a new ferry project. The KSR technology enables the design of virtually any size of full spade rudder. Becker is designing a special rudder profile meeting JMU's specific requirements. The Becker Rudder with KSR is yet another advantage of the new ferry design with its highly efficient propulsion arrangement with contra-rotating propeller.

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Manoeuvring Systems | Energy-Saving Devices | LNG Hybrid Concepts

SIGNIFICANT: STAR ISTIND

One of the first Becker Mewis Duct® installations

The ongoing success story of our top-selling energy-saving device would not have been possible without the pioneering spirit of our valued customers.

Grieg Star, the Norwegian owner of the 47,000 dwt open hatch carrier *Star Istind*, invested a lot of confidence in the Becker Mewis Duct® at an early stage of product development.

The *Star Istind* was retrofitted with a Becker Mewis Duct® in September 2009 – and the new product paid off with energy savings of approx. 6.0%.

SIGNING CEREMONY: MoU WITH ADNATCO-NGSCO

Memorandum of Understanding underscores excellent relationship

In October 2015 Becker Marine Systems received an invitation from ADNATCO & NGSCO in Abu Dhabi to a signing ceremony for a Memorandum of Understanding (MoU) for the delivery of 22 Becker Mewis Ducts®. The signing took place on 10th November 2015 as part of ADIPEC 2015 (International Petroleum Conferences).

ADNATCO is a government-owned company and has ordered the Becker Mewis Ducts® for the entire fleet (22 ships). The fleet comprises vessels from 105k COT and 57k bulk carriers to 135,000 m³ LNG carriers. Becker was awarded the first order in January 2015. By the end of 2016 all ships will have been equipped with a Becker Mewis Duct® at the Dubai Drydocks shipyard.

Following the ceremony Henning Kuhlmann said: "We are very proud to be a partner for ADNATCO & NGSCO's energy-saving systems. Our top-selling Becker Mewis Duct® is the perfect energy-saving system for ships such as LNG carriers and is thus the best choice for ADNATCO & NGSCO's ships. Becker Marine Systems is happy to underscore the excellent cooperation with ADNATCO & NGSCO by signing this MoU."

BMVI PROMOTES LNG POWERPAC®

The German Federal Ministry of Transport and Digital Infrastructure (BMVI) presented Becker notification of a grant to fund a containerised concept for the alternative supply of power to ships at port. As a result, the world's first special containers of their kind (LNG PowerPac®) will be deployed aboard container ships in the near future.

During layovers at port the power for container ships is currently being supplied by onboard auxiliary diesel engines using fuel oil (Marine Gas Oil). By doing so, these container ships account for the majority of harmful emissions at ports worldwide.

The LNG PowerPac® is a compact unit the size of two 40-foot containers, intelligently combining a gas-powered 1.5 Megawatts generator and an LNG tank. The new concept is a safe, environmentally-friendly and economical power supply to container ships at port. Compared to operation of the ship's auxiliary engines, the LNG PowerPac® represents a significant reduction in harmful emissions.

UPCOMING EXHIBITIONS

SHIPPING 2016	CMA Shipping, booth #L4, Hilton Hotel, Stamford, Connecticut, USA 21st - 23rd March 2016
SEA JAPAN	Sea Japan, joint booth with our agent Nakashima Propeller, Tokyo Big Sight/East Hall 1&2, booth no. JPN-39 Tokyo, Japan 13th - 15th April 2016
INLAND MARINE EXPO	Inland Marine Expo, booth #1022, St. Louis, Missouri, USA 10th - 12th May 2016
Posidonia Ποσειδώνια	Posidonia, joint booth with our Greek agent Intership Maritime, hall 1, booth 1.327, Athens, Greece 6th - 10th June 2016

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Schilling® Rudders are available in Japan only under the designation Becker SHARC Fishtail Rudder.