



Improved Propulsion with tuned rudder systems

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RUDDERS: FLAP NACA TWISTED SCHILLING KORT NOZZLE STEERING GEAR MATERIAL HANDLING

The Paper

- Efficiency gain through rudder systems
- The earlier the better, how to integrate rudder systems in design
- Experience with full spade rudders for largest container vessels
- Outview to future developments



Efficiency Gain = Fuel Saving?

- Slow down Speed
- Optimised Routing
- Modern Prime Movers
- Efficient Ship design
- Optimised Propulsion system
- Hydrodynamic Tuning (Nozzles, Fins, etc)
- Efficient Rudder system



Fuel Saving, Potentials

| | New Buildings | Existing ships |
|-----------------------------|---------------|----------------|
| Slow down Speed | 10% | 10% |
| Optimised Routing | 10% | 10% |
| Modern Prime Movers | 5-10% | X |
| Efficient Ship Design | 5-10% | X |
| Optimised Propulsion System | 2-8% | 2-5% |
| Schiffbauliches Tuning | 2-5% | 2-5% |
| Efficient Rudder System | 2-8% | 2-5% |



The efficient Rudder System

- Will never break
- Offers highest Manoeuvrability
- Reduces the ship's price
- Reduces the Fuel Consumption
- Is of extreme light weight
- Is easy to install
- Needs no maintenance
- Is available globally



The efficient Rudder System

- Slim and low drag Rudder Profile
- High lift at small rudder angles
- Tuned against Ship's Propeller
 - Bulb
 - Twist
- Light Weight
- Smooth Surface, special Anodes
- Easy to Survey / Maintain



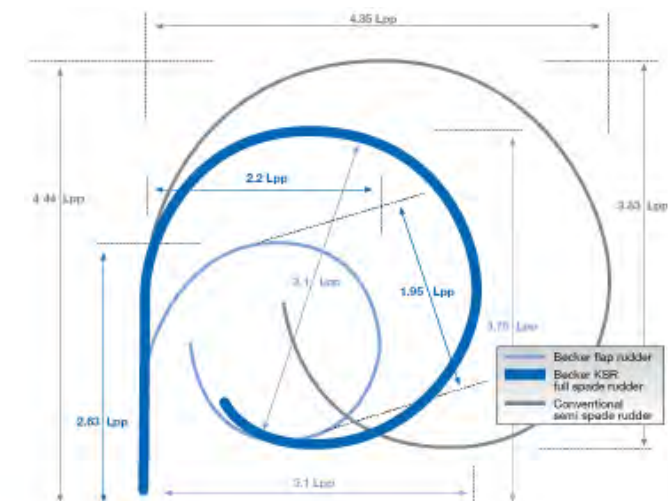
The earlier the better, how to integrate rudder systems in design

- Owners Interest (Save during Newbuilding or Operation?)
- SY Interest (Save, Save, Save)
- Operators Interest (Low Fuel Consumption, Manoeuvrability)

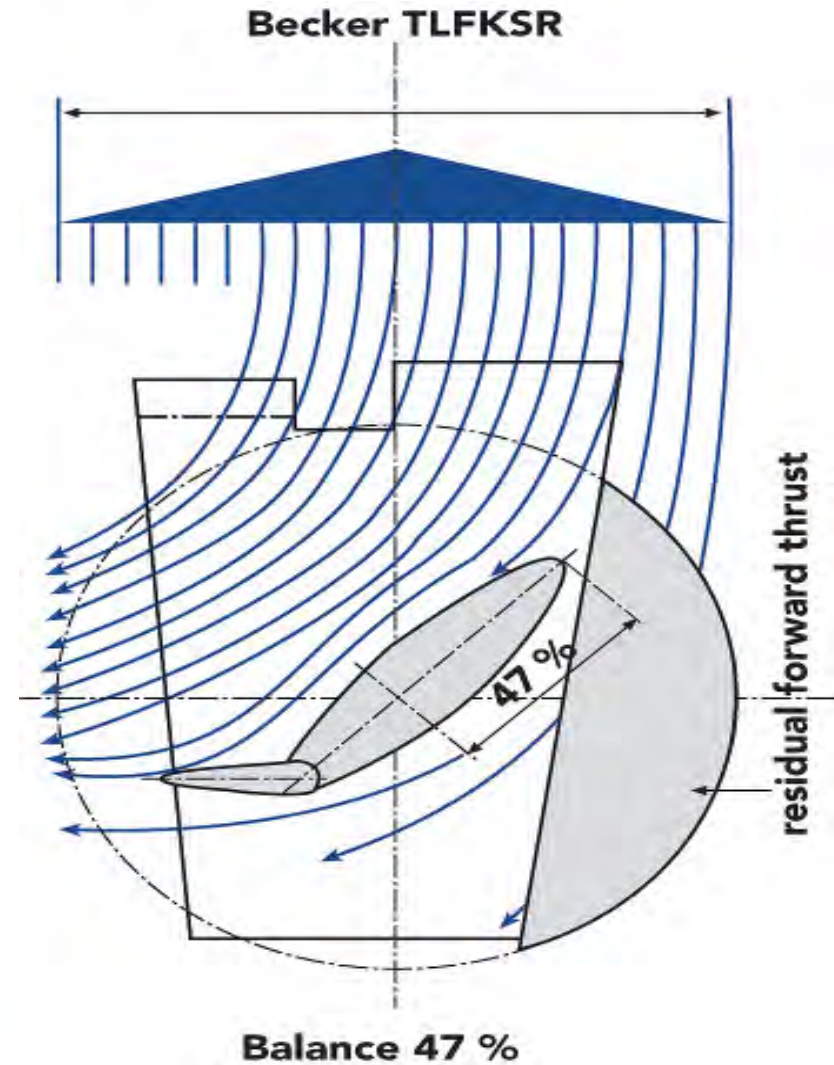


„Good“ Manoeuvrability ?

- At what Speeds?
 - Good Course Keeping -- High Agility
 - Slow Speed Turning -- Large Rudder Areas
- Stern Thruster vs Flag Rudder
- Dynamic Positioning?
- One- or Two Propellers
- Rudder with movable Parts or not?



Manoeuvrability at small rudder angles



Necessities

- Owners must specify their needs
- Yards and Designers have to design accordingly
- Modelltests with Rudder(s) are important
- SY, Designer, Propeller Maker and Rudder Maker have to sit together

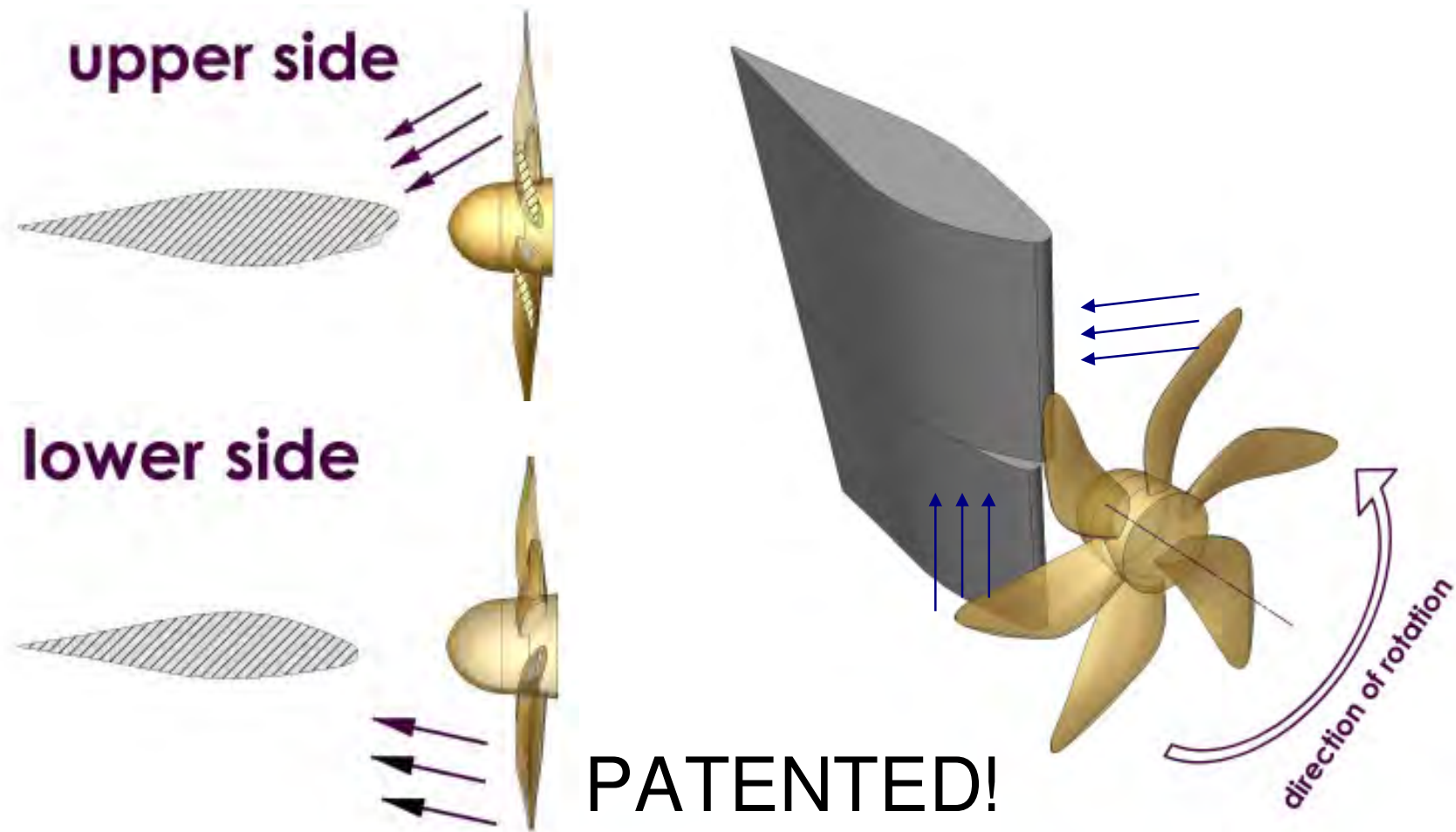


Experience with full spade
rudders for largest container
vessels

Success of TLKSR[®] Twisted
Leading Edge Technology



Twisted Leading Edge Technology



Solution by KSR Full Spade – Twisted Leading Edge for Fast Vessels



PATENTED!



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Experience after 2 Years

- > 100 TLKSR® rudders delivered
- In some cases erosion in twist area due to propeller hub vortex
- No sheet cavitation erosion
- No Gap Cavitation
- Excellent manoeuvrability



Ready Installed



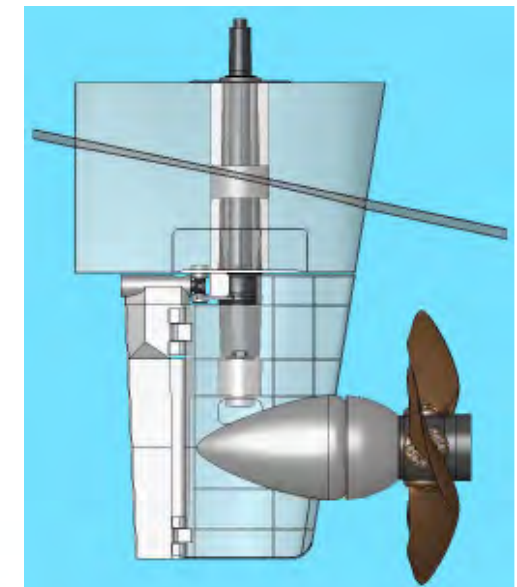
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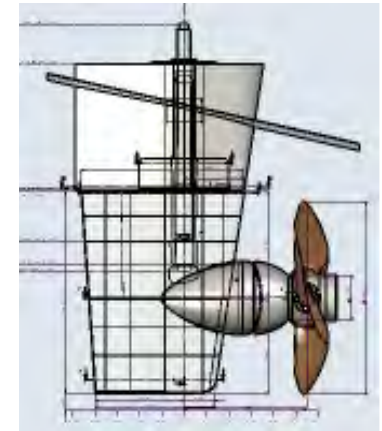
Efficiency Rudder Technology For the Future

- Rudder / Propeller Packages
- Light Weight Materials
- 3D Profiles



Rudder / Propeller Packages

Becker and Wärtsilä teamed up
in a Cooperation for
High Efficiency Rudders

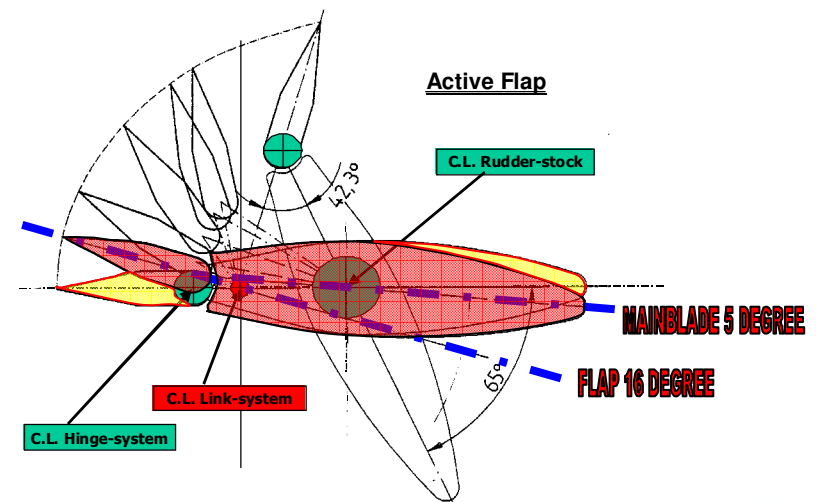


Shipyards integrate Efficient
Propulsion / Rudder Combinations



Flap Rudders

- Need small rudder angles for course keeping
- Provide unbeaten slow speed manoeuvrability



To Peene Werft, BMS has supplied ~50
Flap Rudders for Container ships 1200 – 1400 TEU



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WÄRTSILÄ High Efficiency Rudder



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Introducing the „Torpedo“

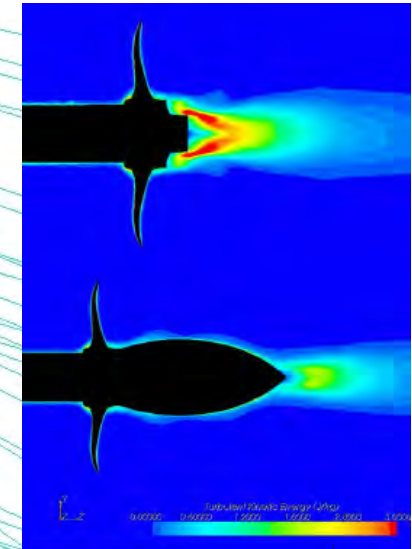
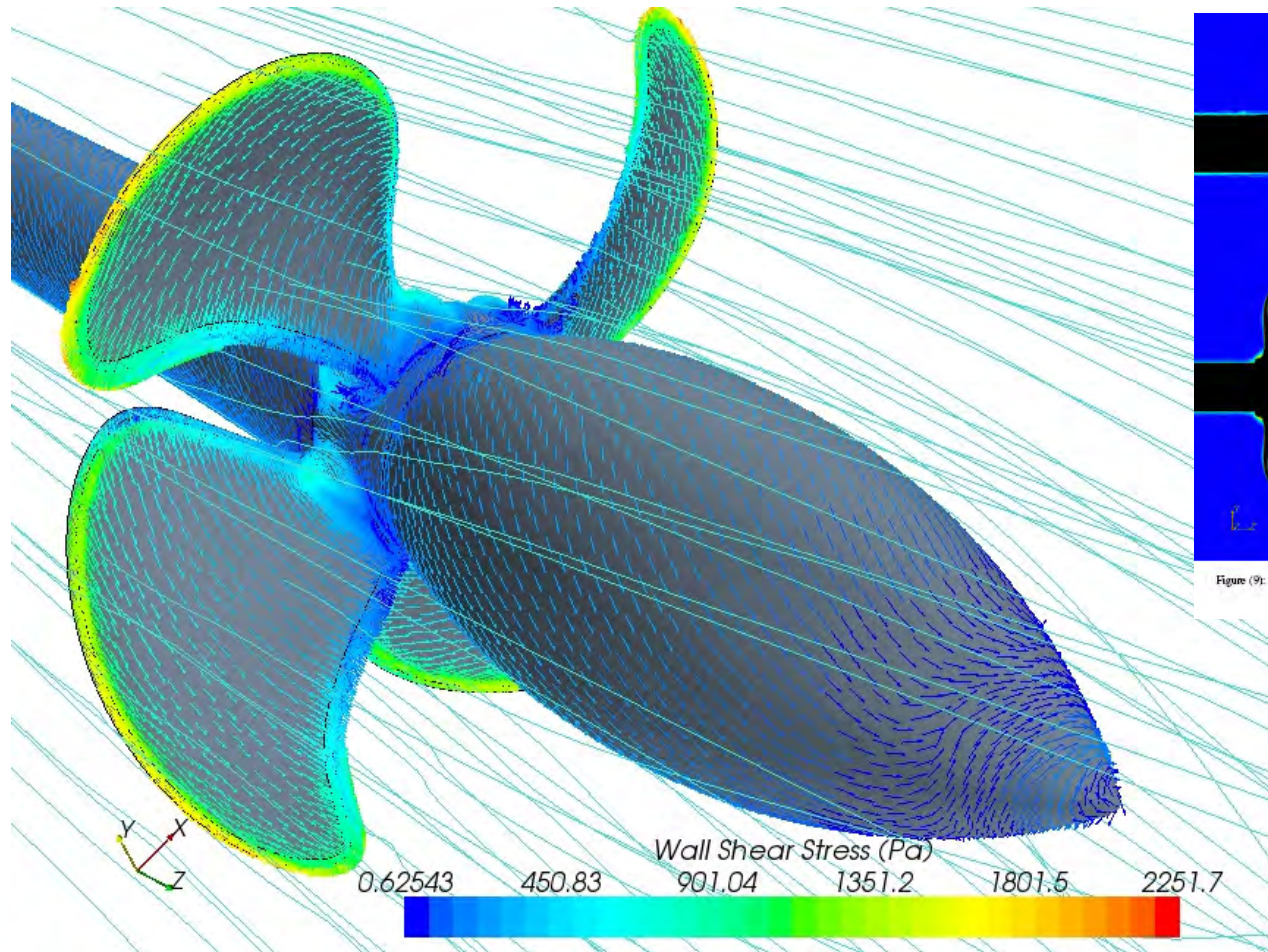
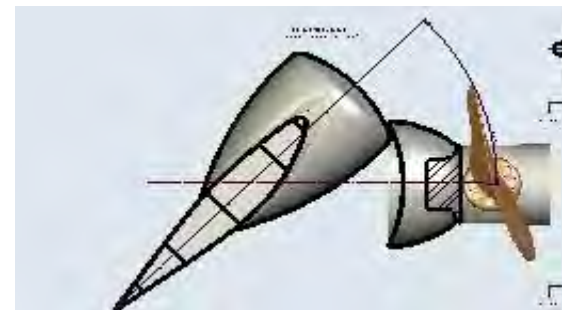
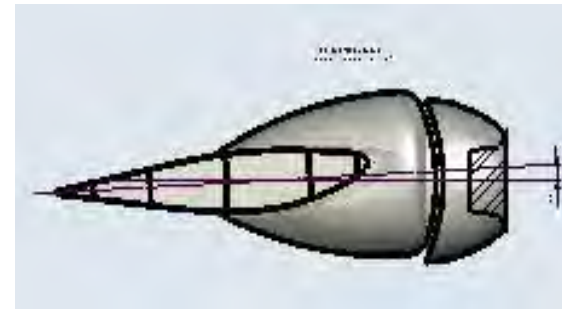
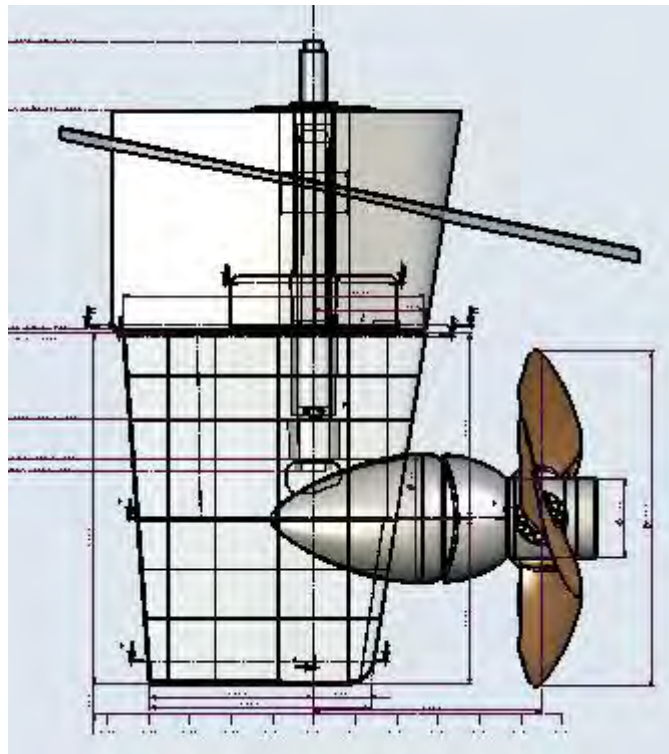


Figure (9): Comparison of turbulent kinetic energy with and without bulb
Vertical scan plane on shaft centreline
Inlet speed 10m/s, refined mesh #3



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Wärtsilä / Becker High Efficiency Rudder



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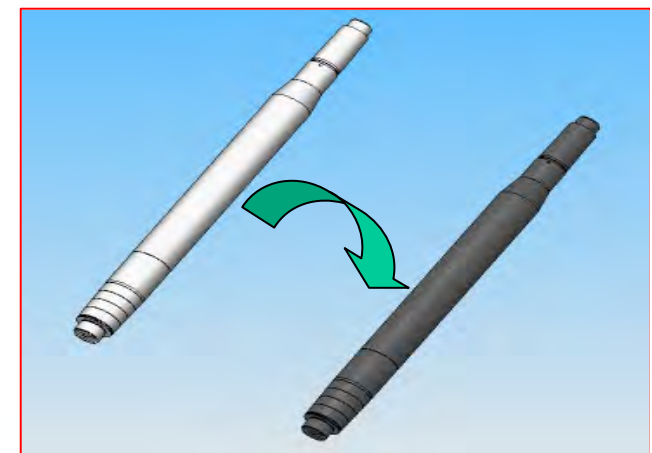
Lightweight Structures

- Substitute Steel
- Use of Alternatives
 - Synthetic Bearings
 - Reinforced Fiber Materials instead of Steel plating
 - Carbon Fiber instead of Forged Steel



Composite Rudder Stock

- For large Ships / Rudders
- Weight saving f.e. 10,000 TEU ship approx 30t
- Less Transportation Costs
- Shorter Delivery Times
- Higher Availability
- Easier Installation
- Same Price as off today

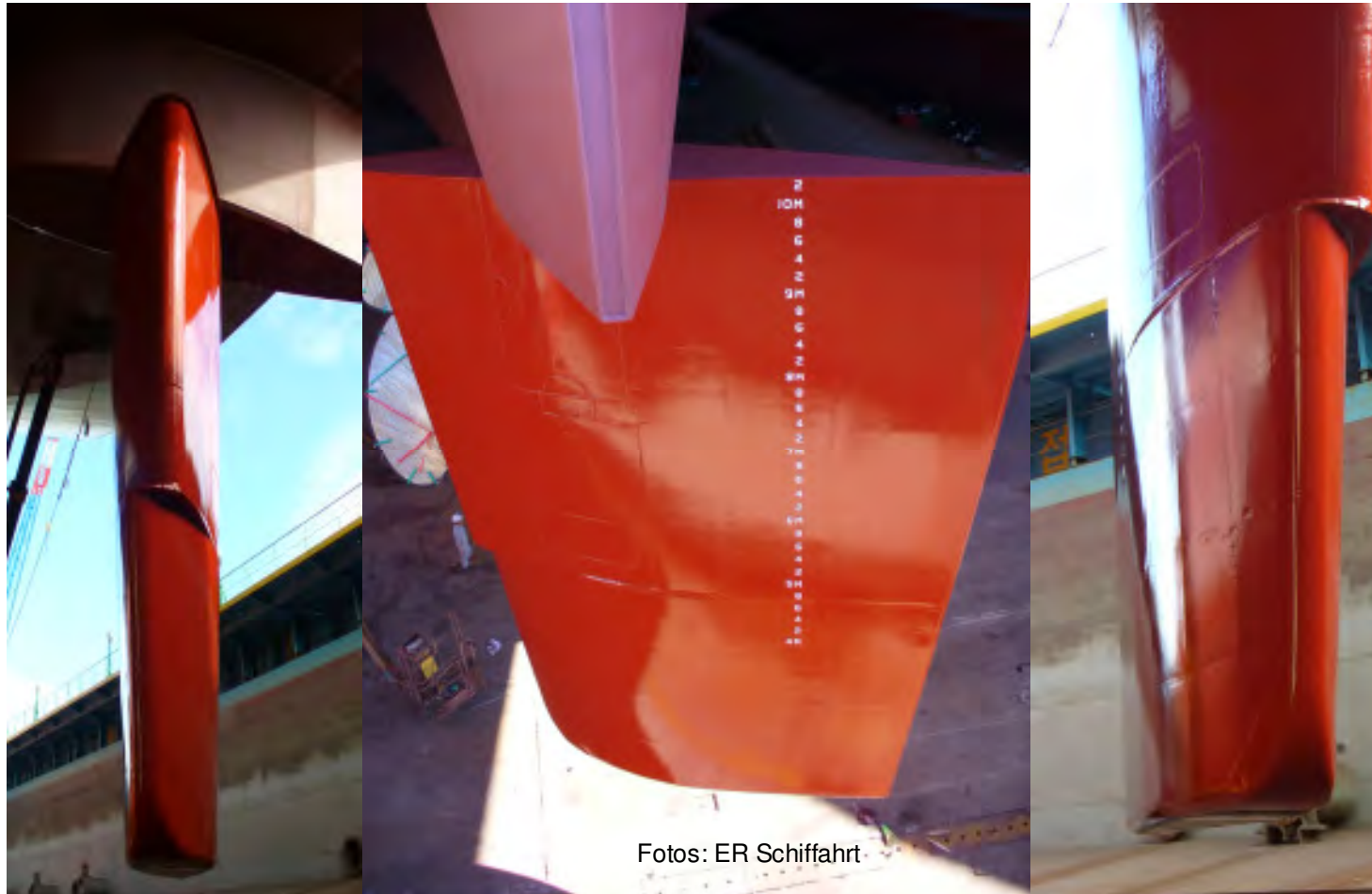


Conclusion

- Ruder Systems have great Influence on Efficiency
- Efficient Rudder Systems Save Fuel
- Owners have specify for it
- Model tests are mandatory
- Investment costs will increase



Danke für Ihre Aufmerksamkeit



Fotos: ER Schifffahrt



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SHIP EFFICIENCY

by STG

