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DYNAMIC POSITIONING CONFERENCE
October 9-10, 2012

DESIGN AND CONTROL SESSION

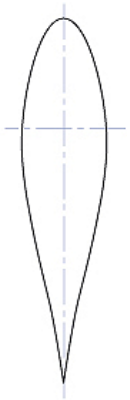
Station Keeping with High Performance Rudders

Joerg Mehldau
Becker Marine Systems GmbH & Co

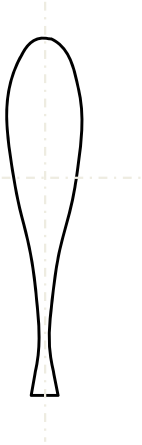
Rudder - Profiles and types

NACA

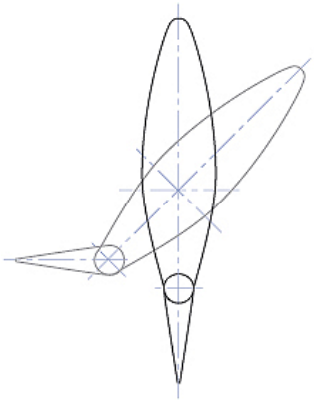
Hollow profile



Schilling



Flap type



(Conventional use)

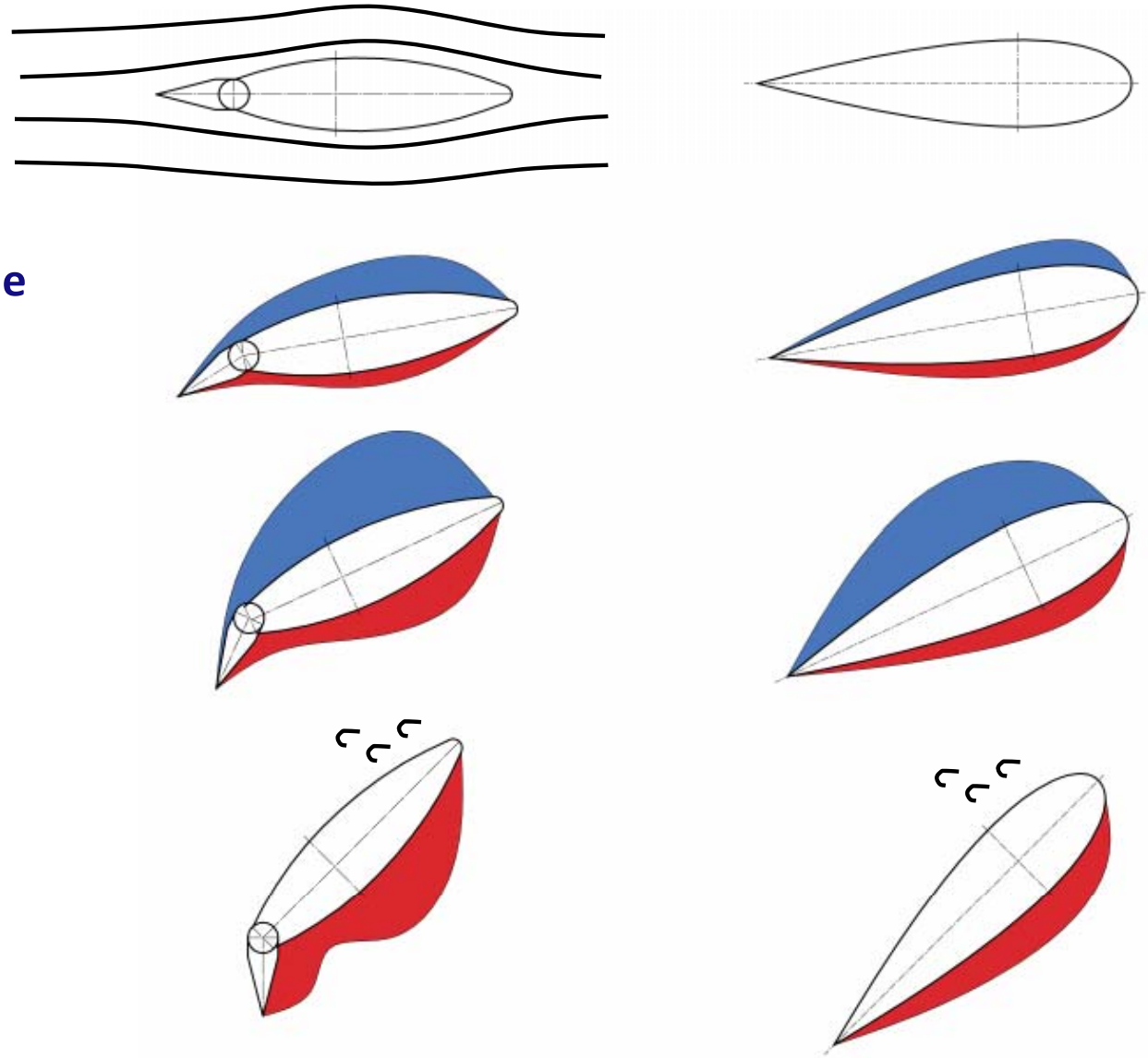
(High Performance) preferred for slow/zero speed maneuvering

Comparison of rudder profile

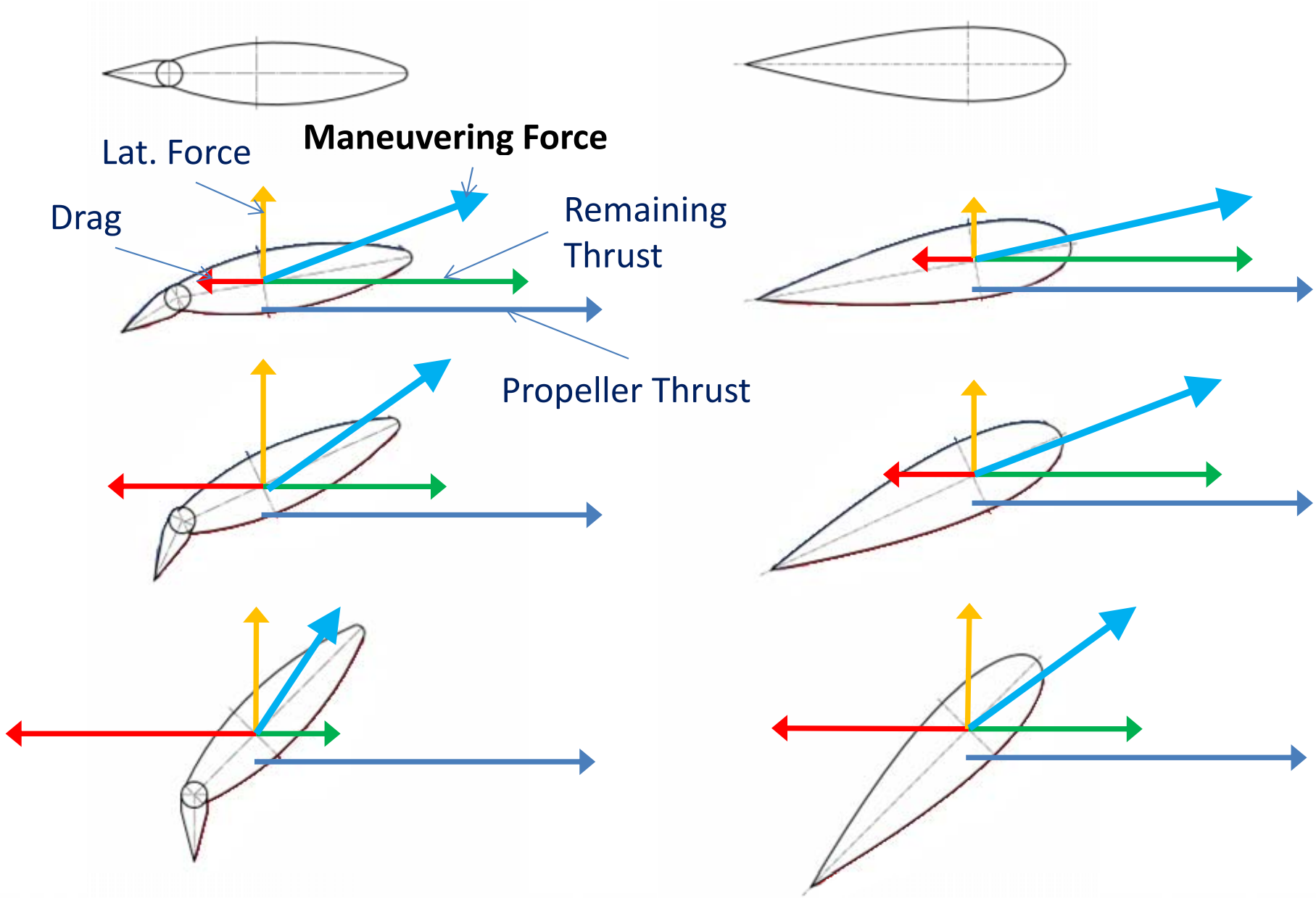
Rudder force
Hydrodynamic force resulting from pressure distribution around rudder blade

BLUE - suction side
RED - pressure side

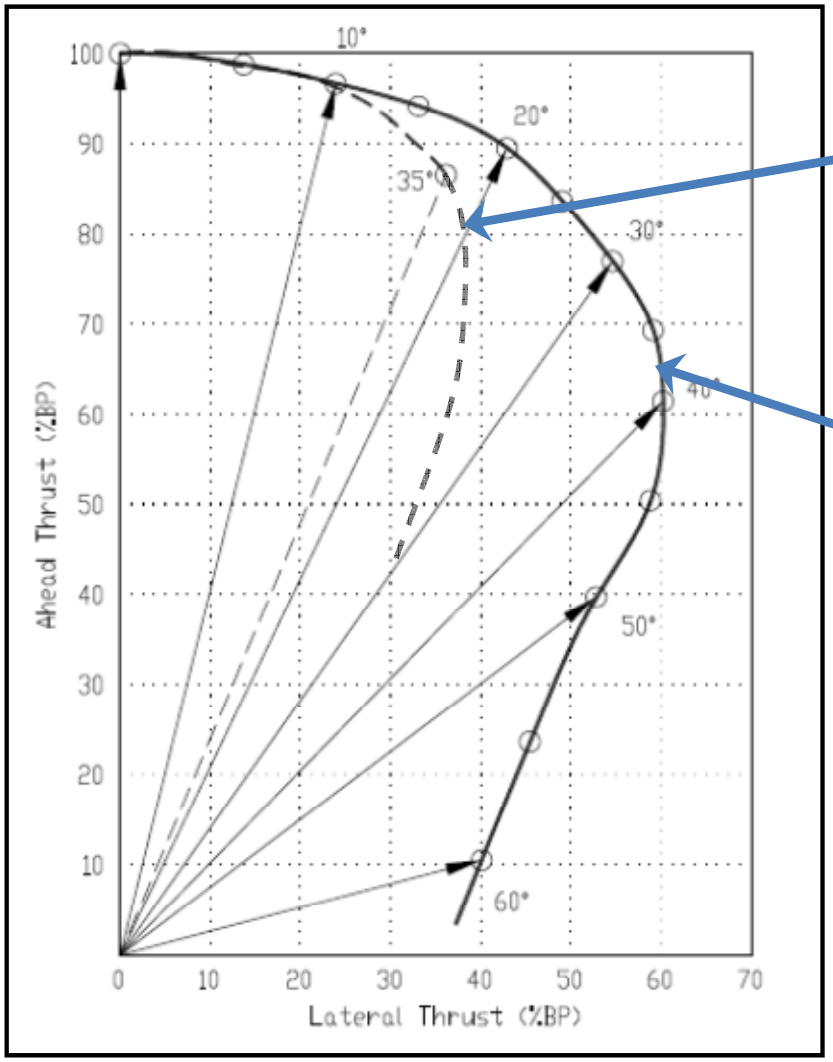
After stall (flow disruption on suction side) only pressure component remains.



Maneuvering Force – Flap (HP) vs conventional profile



Vector graph of a High Performance vs Conventional Rudder

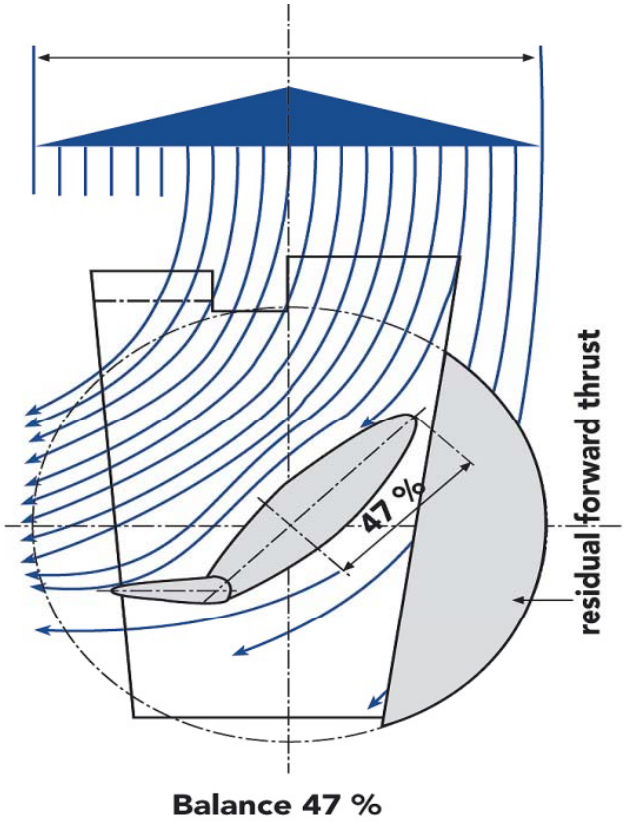


Max lateral force of the conventional rudder profile

- High remaining ahead force,
- Low thrust deduction,
- Low lateral Force,

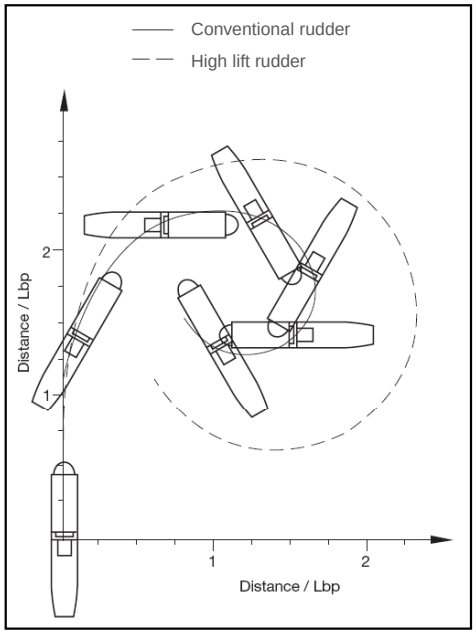
- High lateral force,
- Low thrust deduction,
- Low lateral Force,

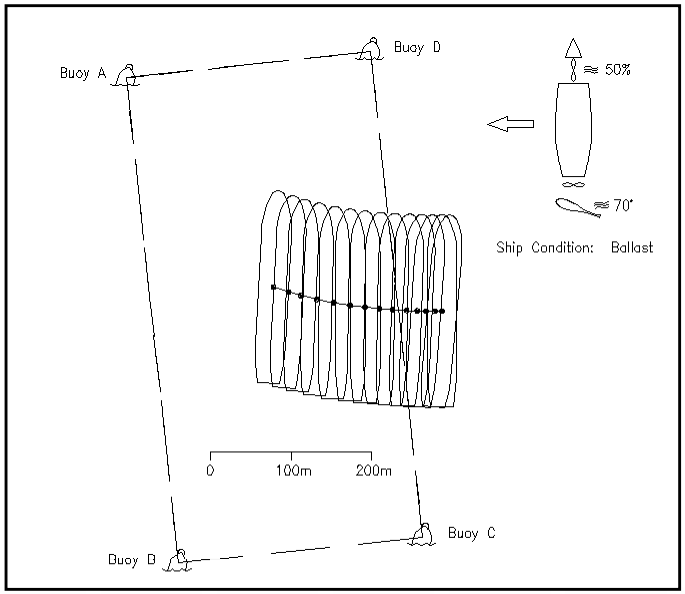
Manoeverability for slow speed



- **High propeller coverage**
- **Optimum use of propeller thrust**
- **Time and cost efficient**
- **Independent ship operation - less tug boat support required**

Slow speed/zero speed maneuvering





- Smallest turning circles / Turning on the spot at slow speed and zero speed at larger rudder angles

- Crabbing at zero speed

Becker Intelligent Monitoring System (BIMS)

New possibilities for Rudder operation:

- Measurement of real manoeuvring force acting on the aft ship
- Ideal rudder operation through exact determination lift maximum
- Drag measurement allows calculation of ahead thrust deduction (important for single screw)
- Monitoring of manoeuvring condition changes and adaption survey

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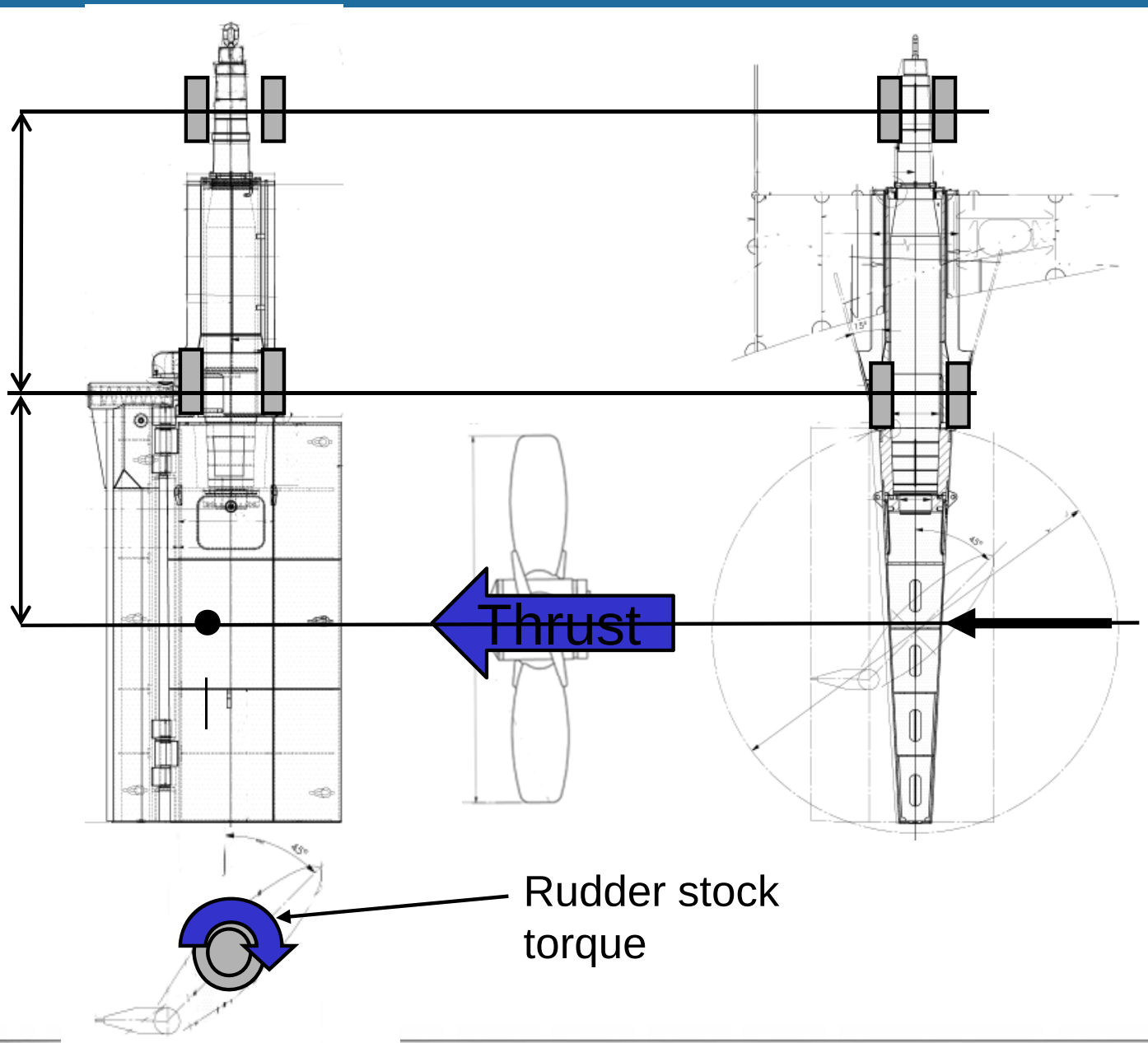
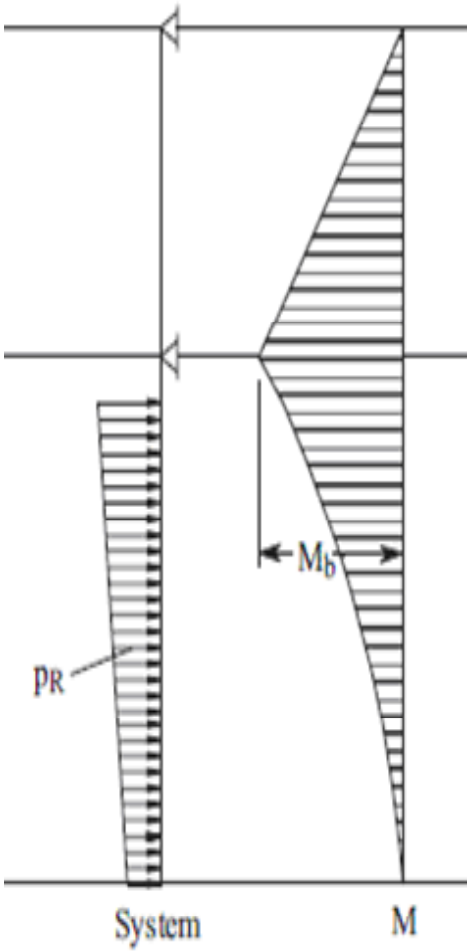
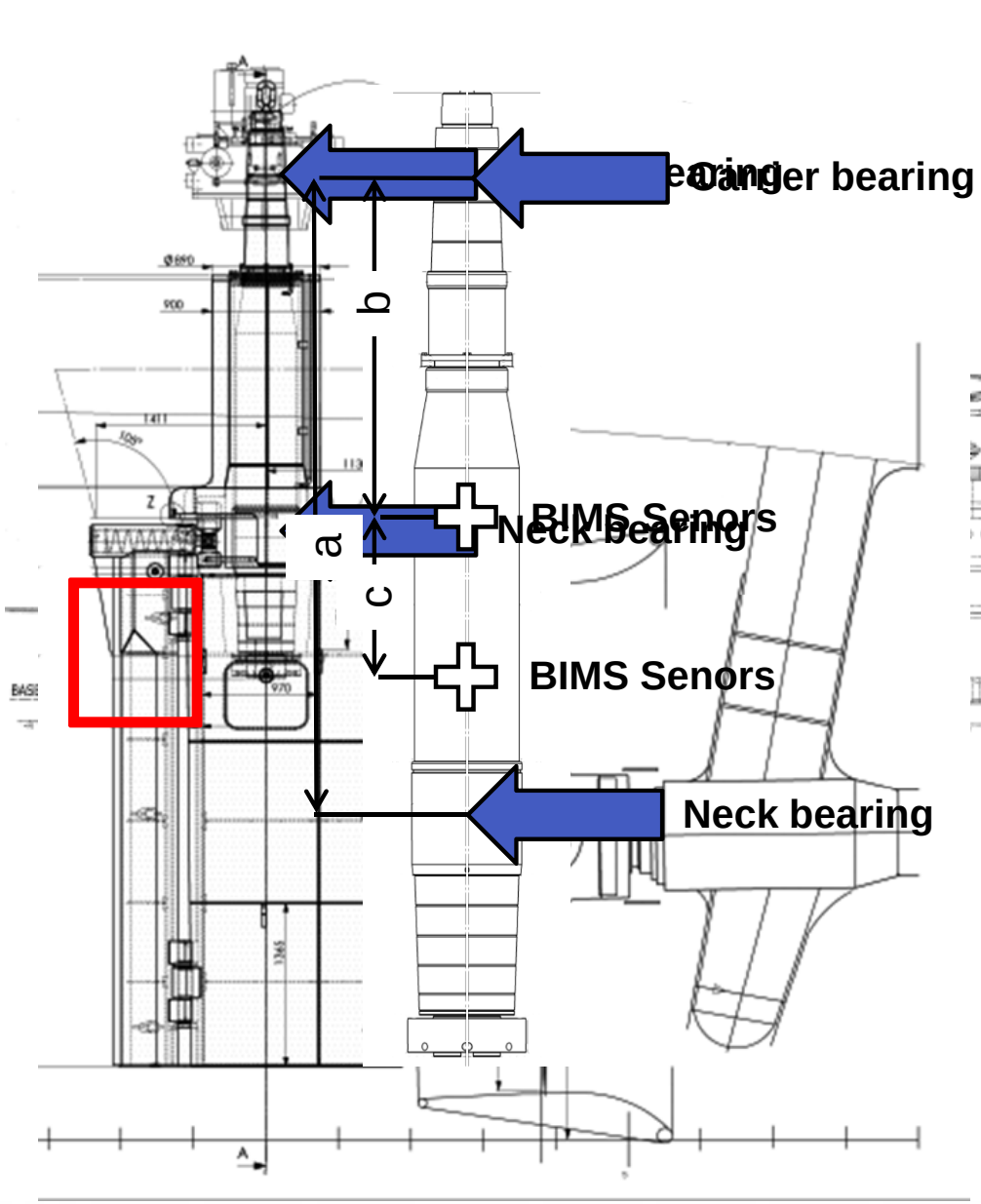
becker marine systems manoeuvring

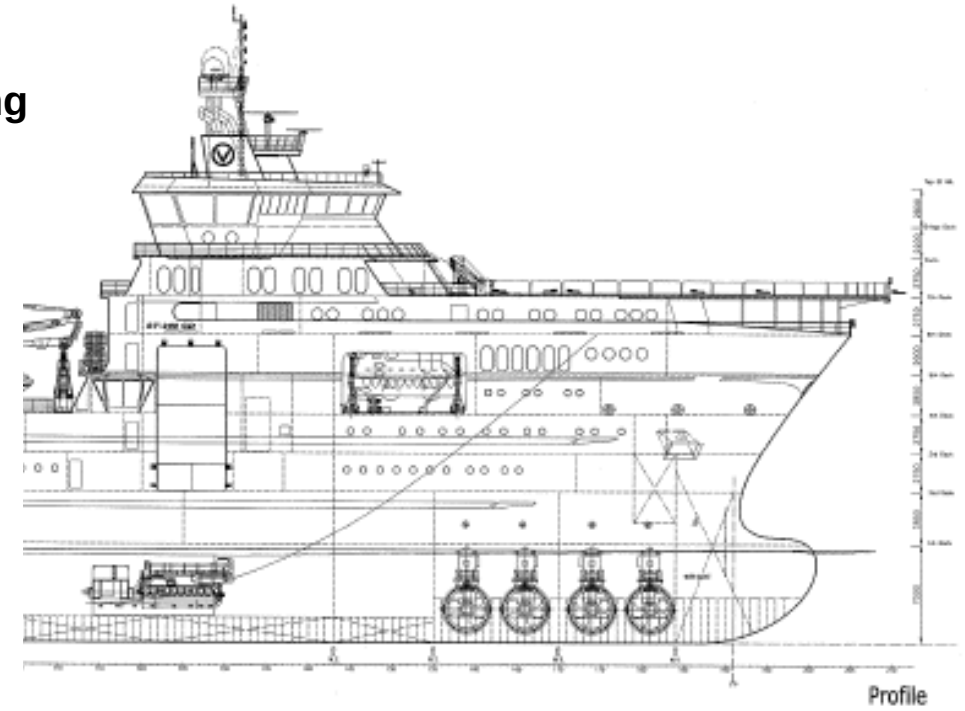
BIMS - From Theory and …





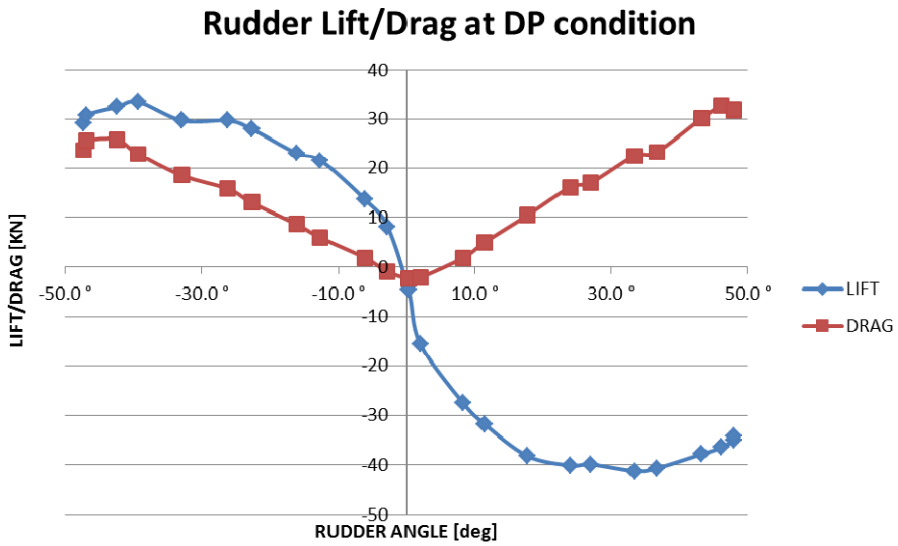
…. Principals to…





.... Practice

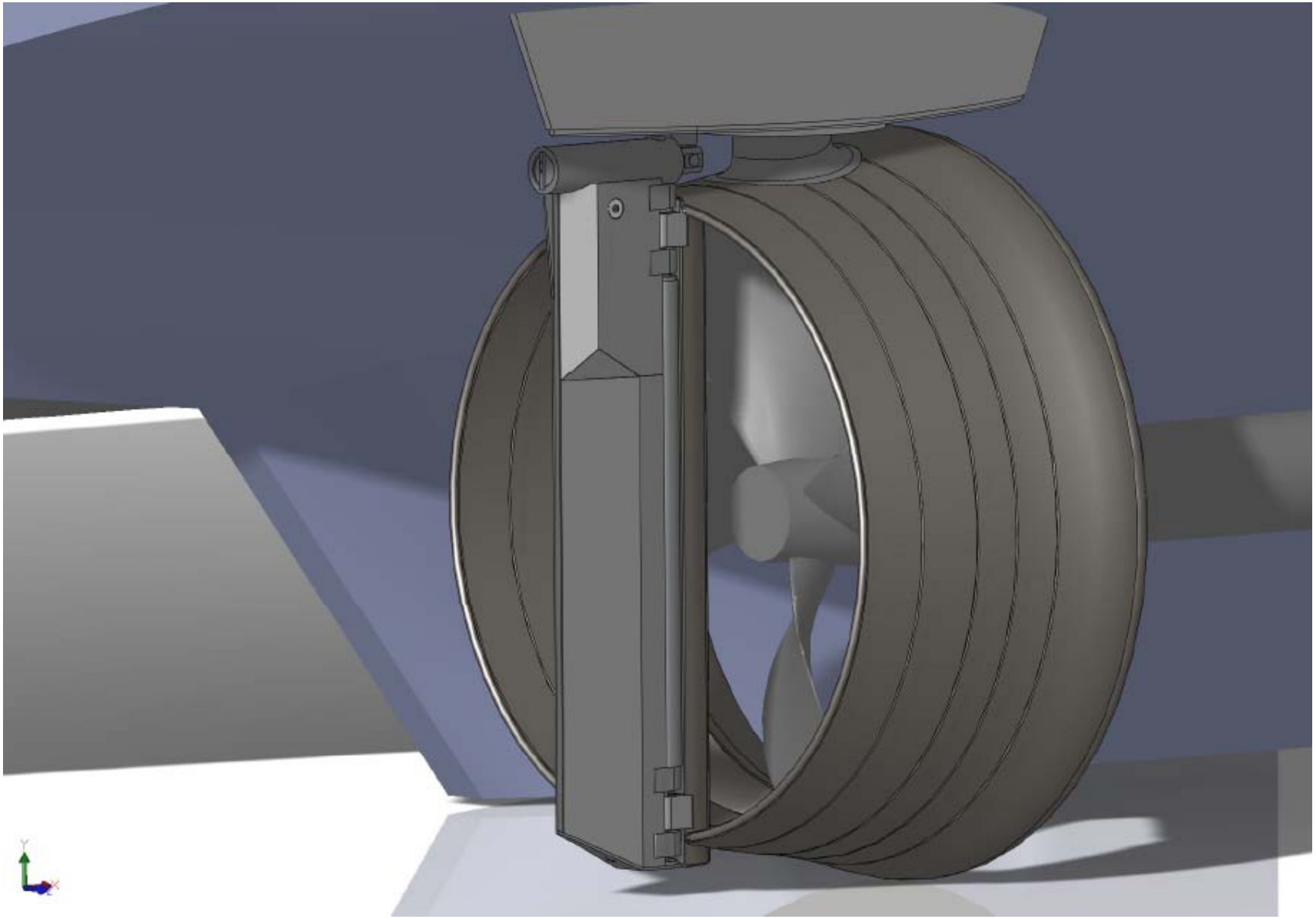
BIMS PANEL SB
Force Long FSX
-1 kN
Force Lat FSY
-0 kN
Torque MZ
-2 kNm
Rudder Angle
0.3 °


Rudder Lift/Drag at DP condition
LIFT/DRAG [KN]
40
30
20
10
0
-10
-20
-30
-40
-50
-50.0 °
-30.0 °
-10.0 °
10.0 °
30.0 °
50.0 °
RUDDER ANGLE [deg]
LIFT
DRAG

BIMS - Improved Propeller-Rudder Opration

- More reliable and more predictable Propeller-Rudder Operation,
- Recorded rudder data available for the DP/steering control system,
- Less rudder acting, no rudder flipping
- More potential for high performance rudders
- Reduced response time during maneuvering
- Much less steering gear motion
- Energy savings through improved efficiency

Becker Nozzle



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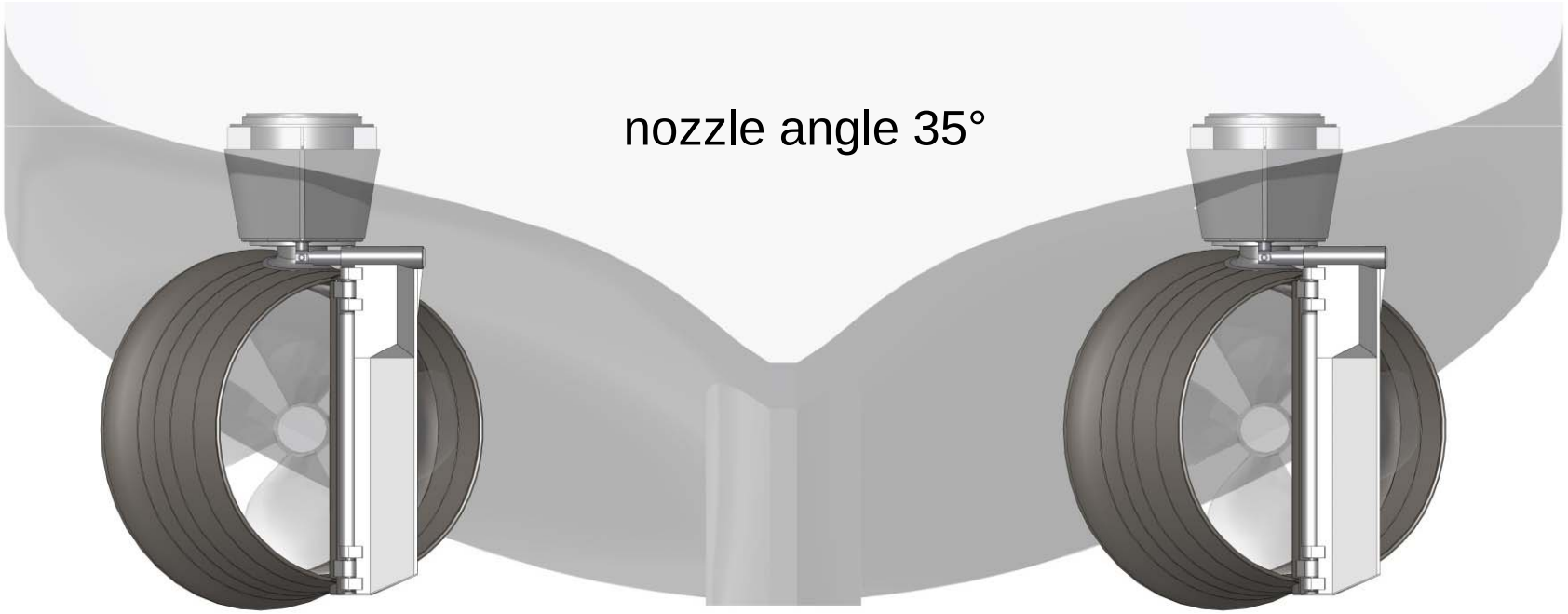
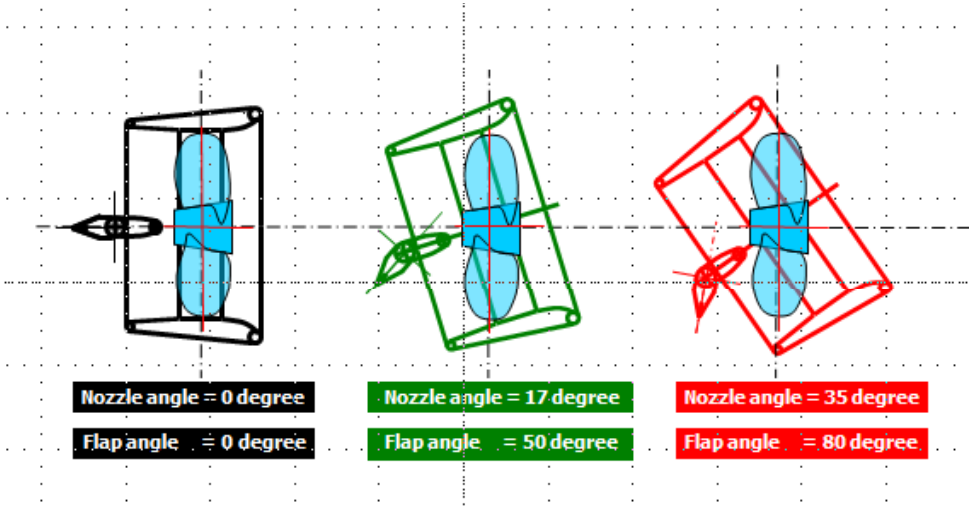
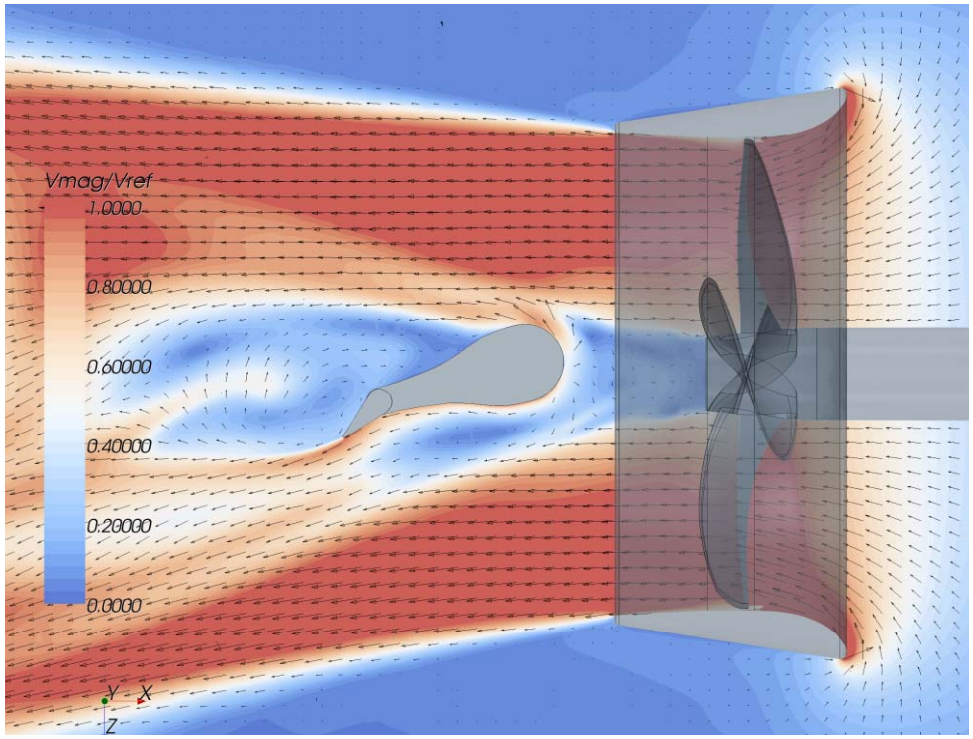
Becker Nozzle – Steering nozzle



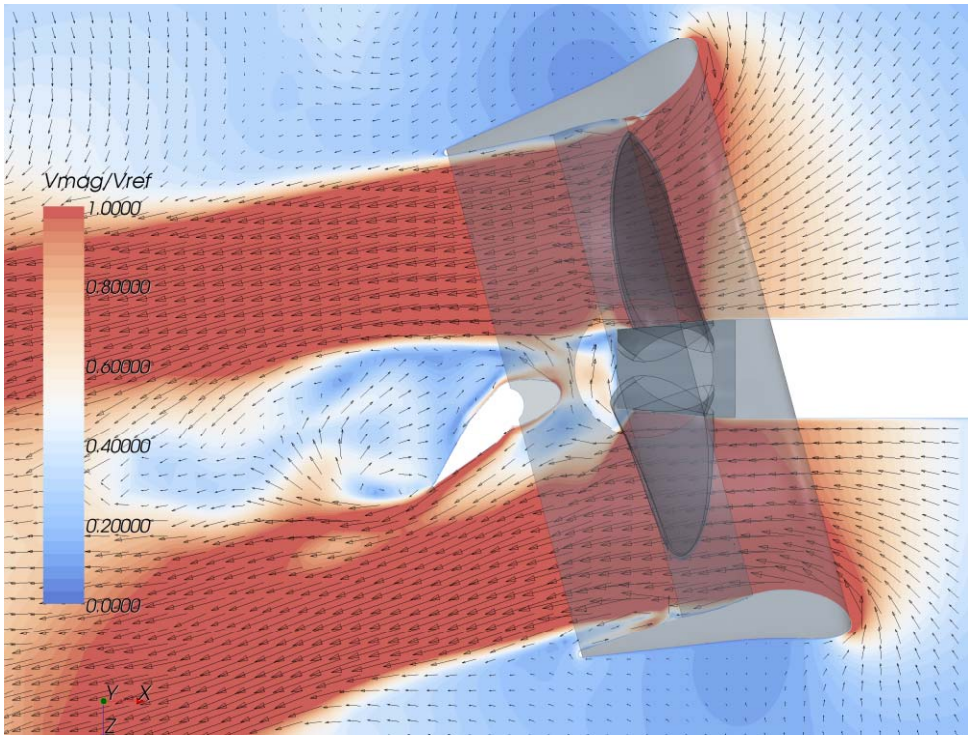


Flow distribustion at BP cond. 15 deg rudder angle/nozzle angle

Fixed nozzle/propeller and flap rudder

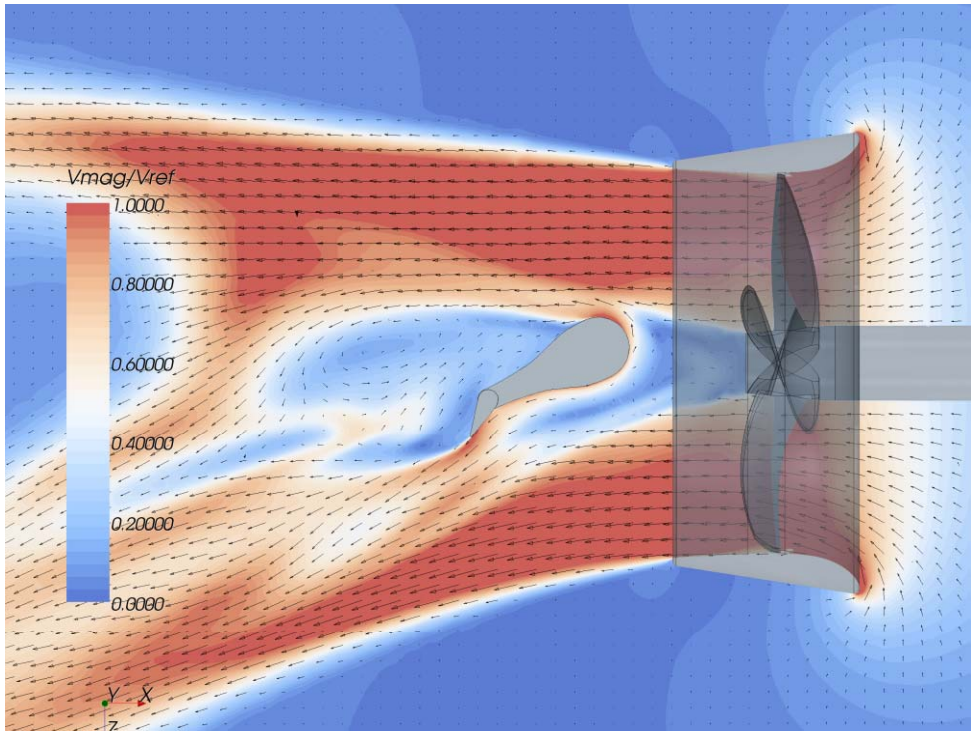


Becker Nozzle

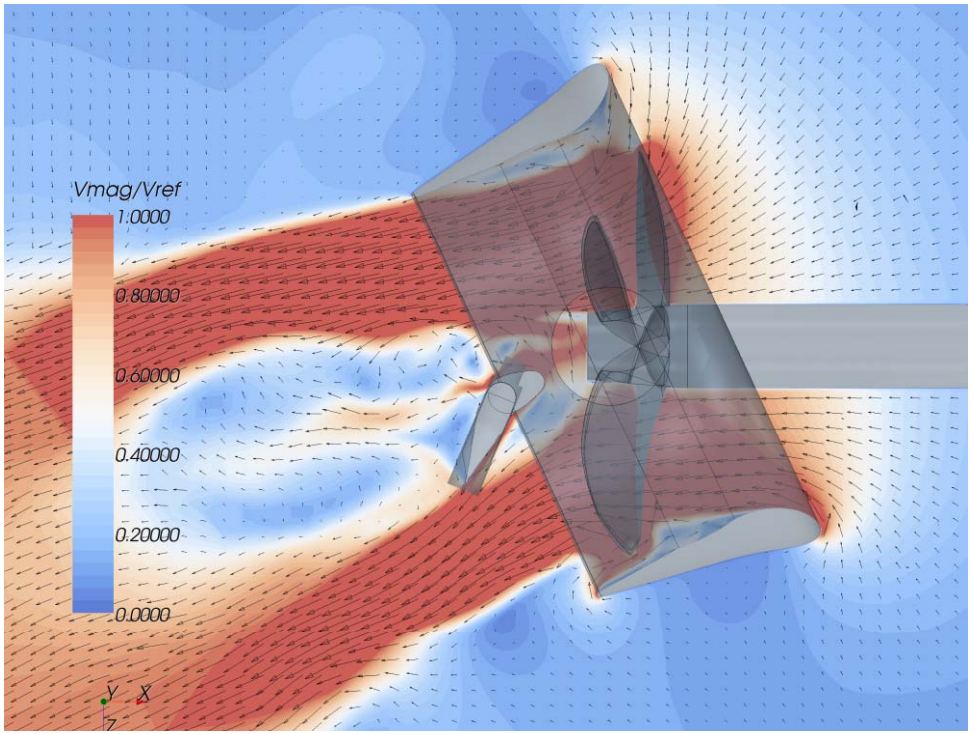


Flow distribustion at BP cond. 25 deg rudder angle/nozzle angle

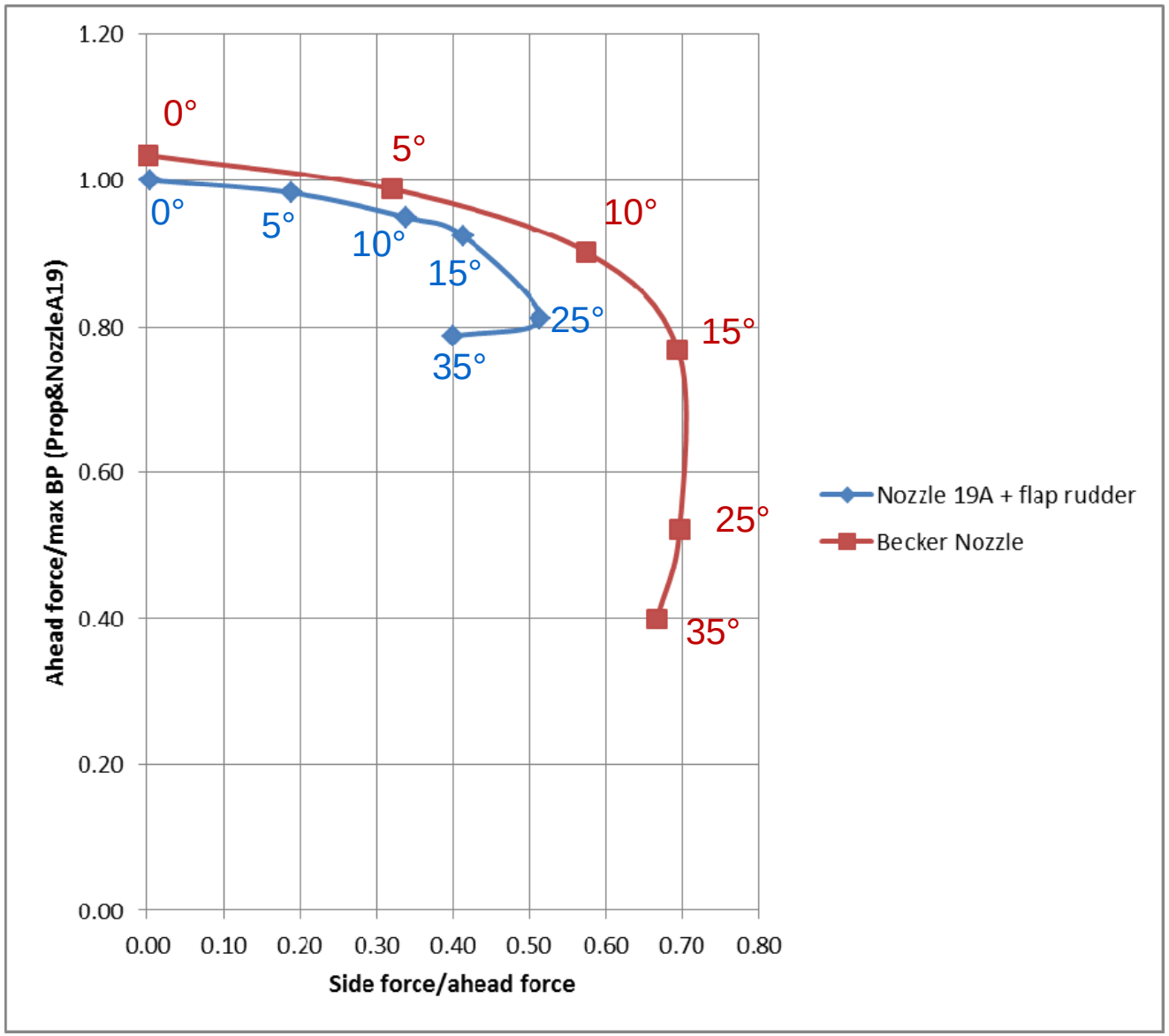
Fixed nozzle/propeller and flap rudder



Becker Nozzle



Performance of Becker Nozzle vs fixed nozzle and flap rudder



Ahead force and side force ratio at different rudder angles.

New Becker Nozzle - Facts

- High maneuverability for conventional twin shaft line driven ships,
- Faster response of maneuvering force,
- Higher maneuvering forces than high lift rudders,
- Simple interaction of propeller, nozzle and flap,
- Compact unit, no higher weight,
- Less engine power required,