

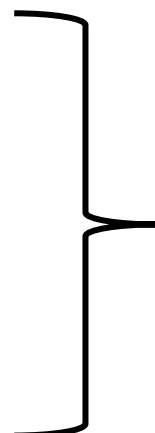
# petestep®



Combat boat 90

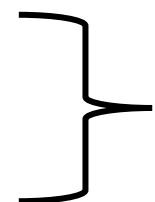
# USPs when using Petestep

- Lower G-forces
- Drier ride
- Increased feeling of safety and control
- Improved hull strength



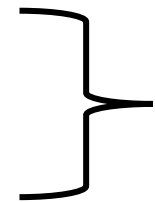
**Improved comfort & safety**

- Higher top speed
- Significant reductions of fuel consumption



**More efficient**

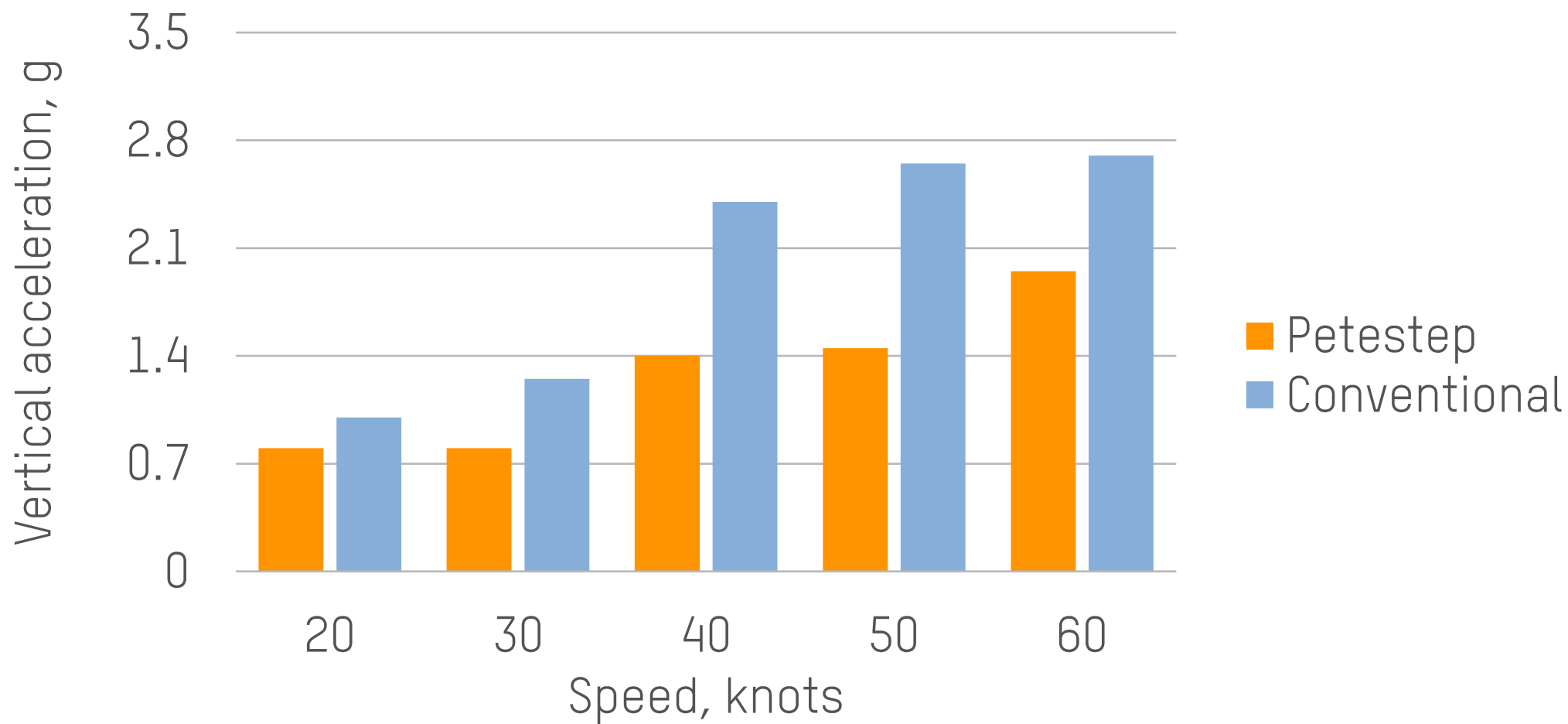
- Less spray – less visible and radar signature
- Quieter hull noise up to 10 db



**Lower signature**

- Latest technology in hull technology and hull development method

## Softer ride



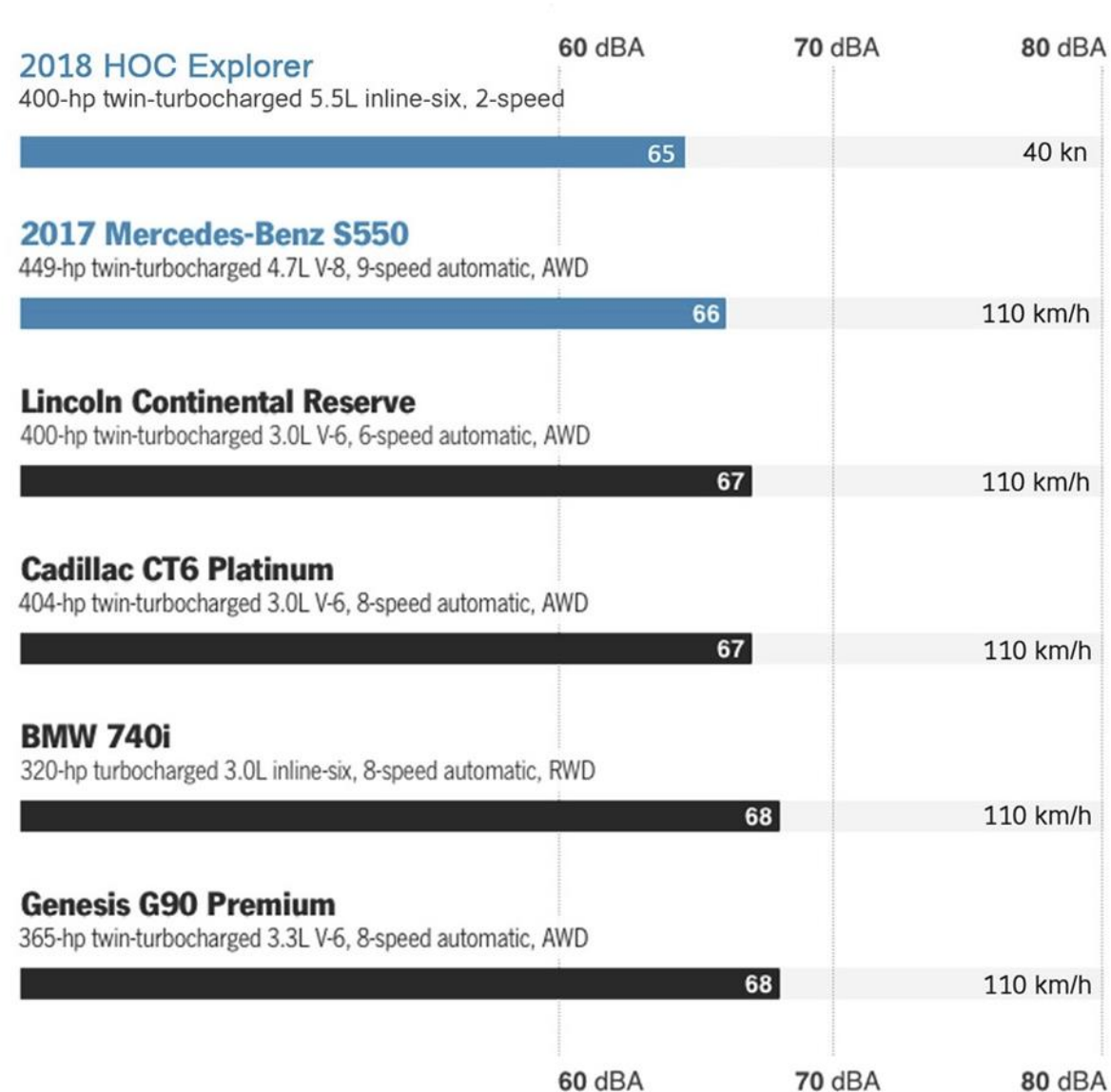
Sea trial test running side by side with identical boats one with Petestep hull and one with conventional hull

## Softer and drier ride



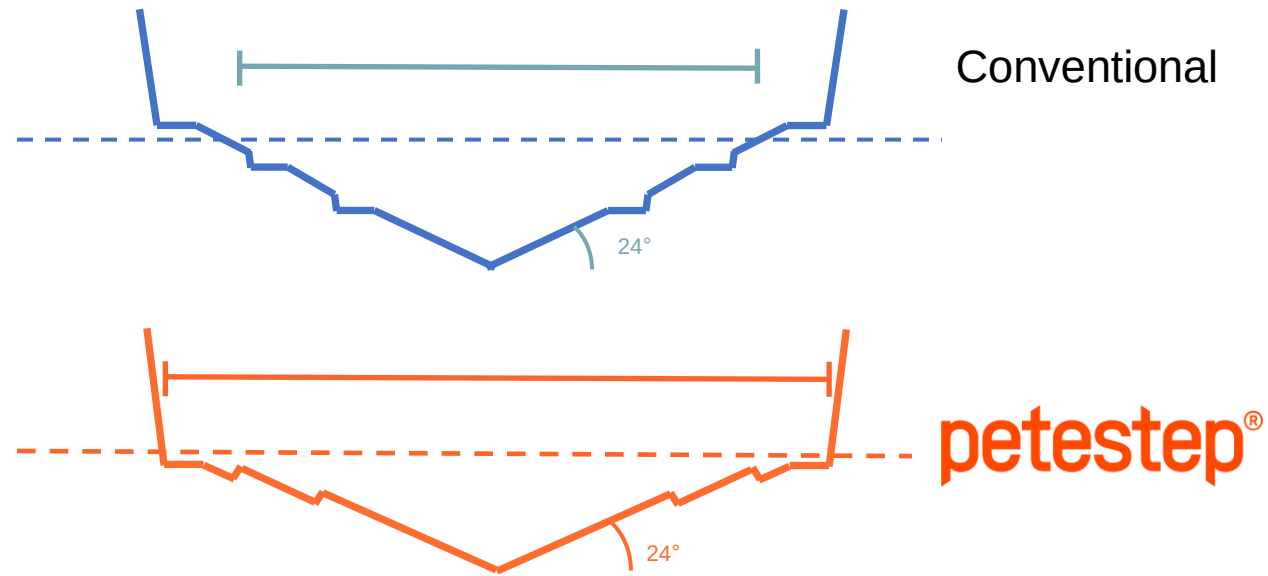
- Water pressure distribute on larger surface, reducing peak impacts
- Redirecting the water flow away earlier and downwards

# Quiter ride



Sea trial test running in ~0.5-1 m significant wave height measuring dBA level in the cabin by helms seat

# More stable



- Increased stability
- Decreased draft

## CB 90 – CFD resistance simulation in 50 knots

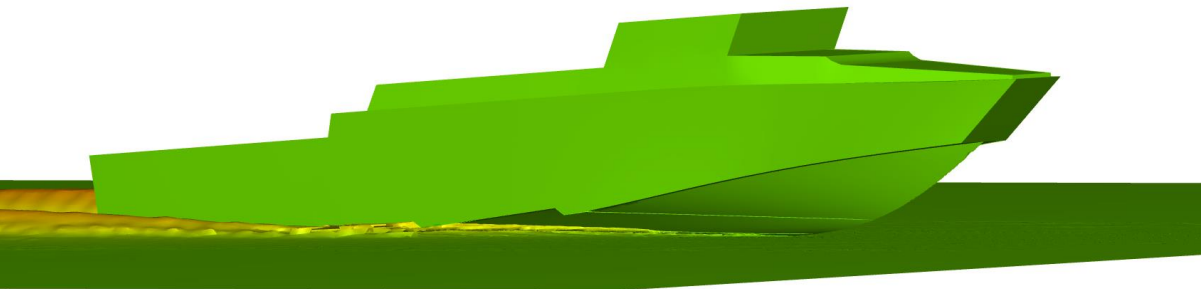
Loadcase:

Weight: 27 000 kg

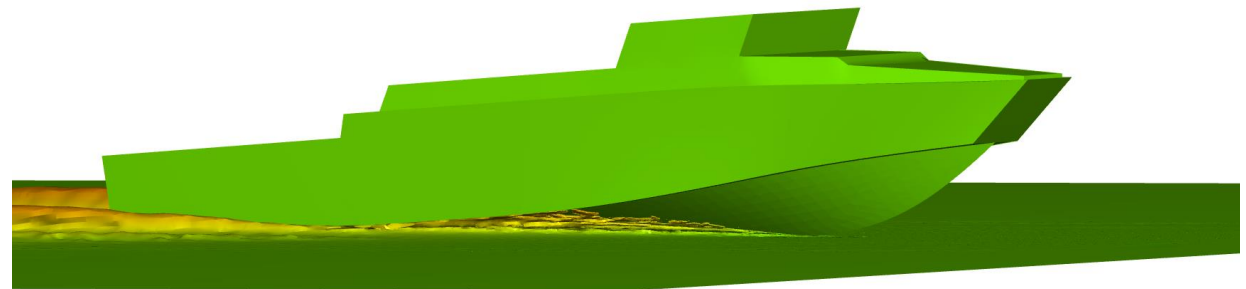
LCG: 5.45 m

VCG: 1.1 m

Engine: 2 x Scania Di 16L 846 kW/ 1150 hp with Jetdrive



Petestep hull with 2 deflectors



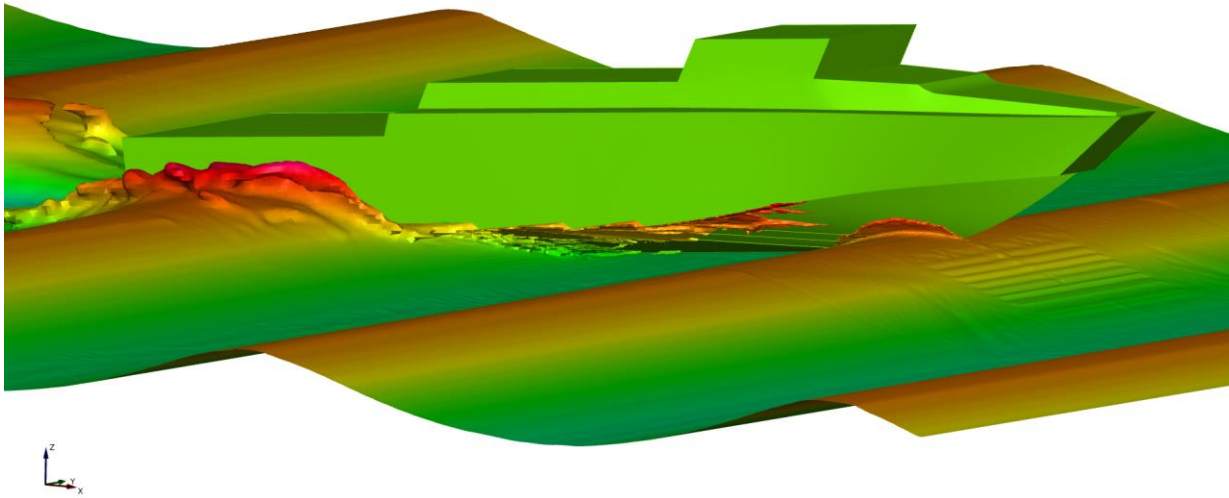
Original hull

7% lower resistance

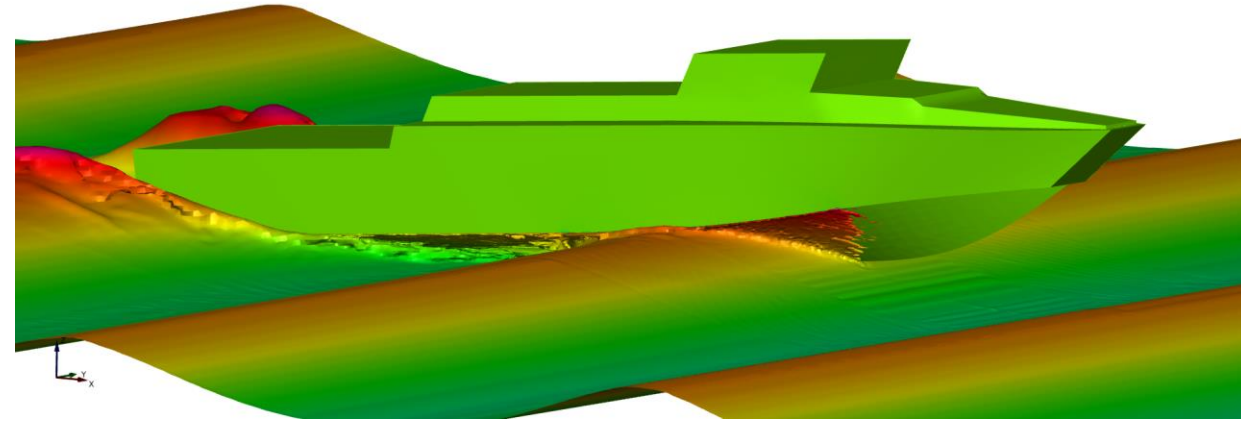
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# Wave simulation demonstrating reductions of vertical accelerations with a Petestep hull with 3 deflectors

Loadcase:  
Weight: 27 000 kg  
LCG: 5.45 m  
VCG: 1.1 m



Petestep with 3 deflectors

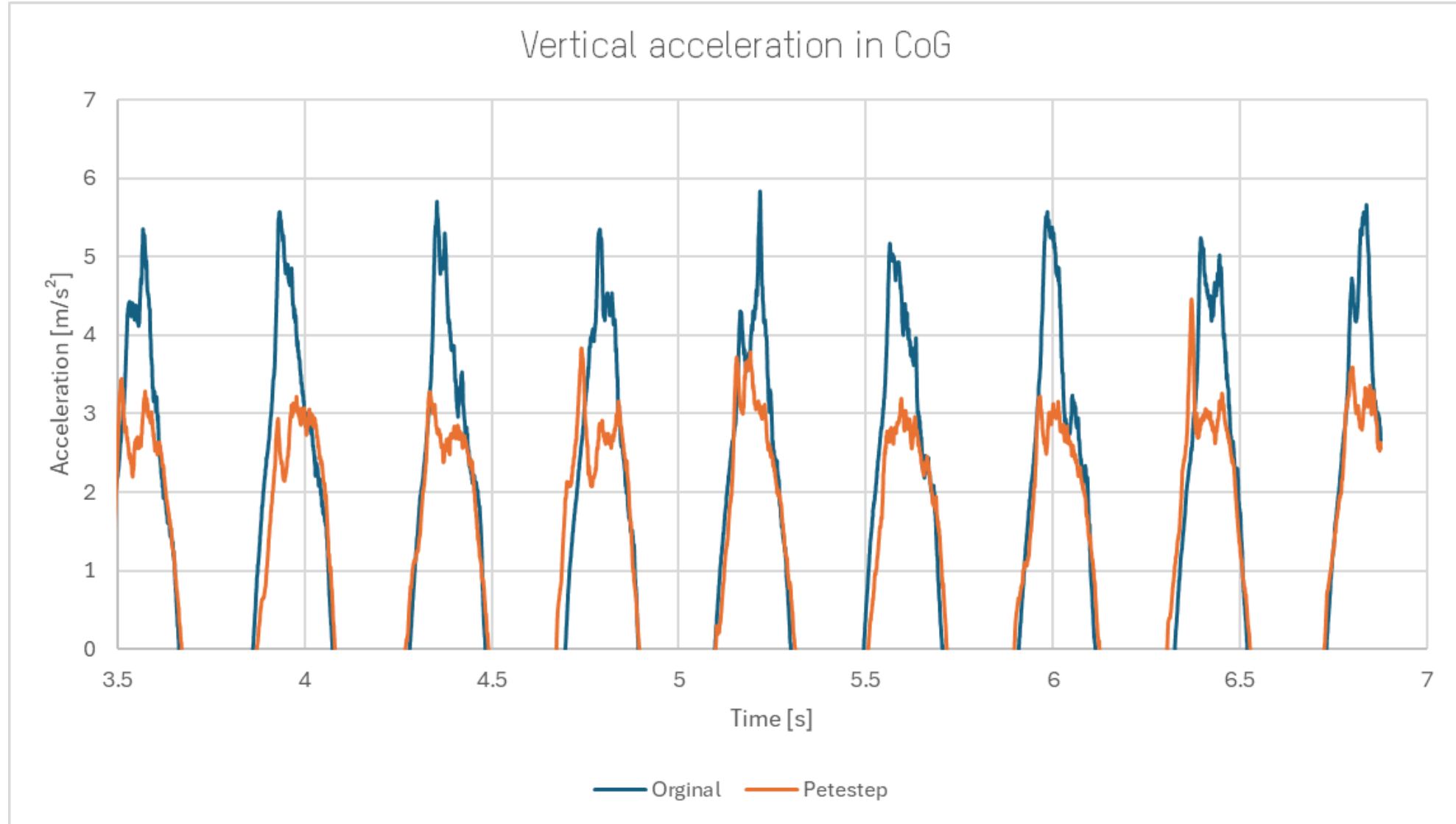


Original hull

Wave simulation have been performed with simulation setup:  
Regular waves – Stokes 5-order  
Wave height – 1 m  
Wavelength – 10 m  
Head sea in 40 knots

Reductions  
 $A_{1/10} = 35\%$   
 $A_{max} = 25\%$

**petestep<sup>®</sup>**



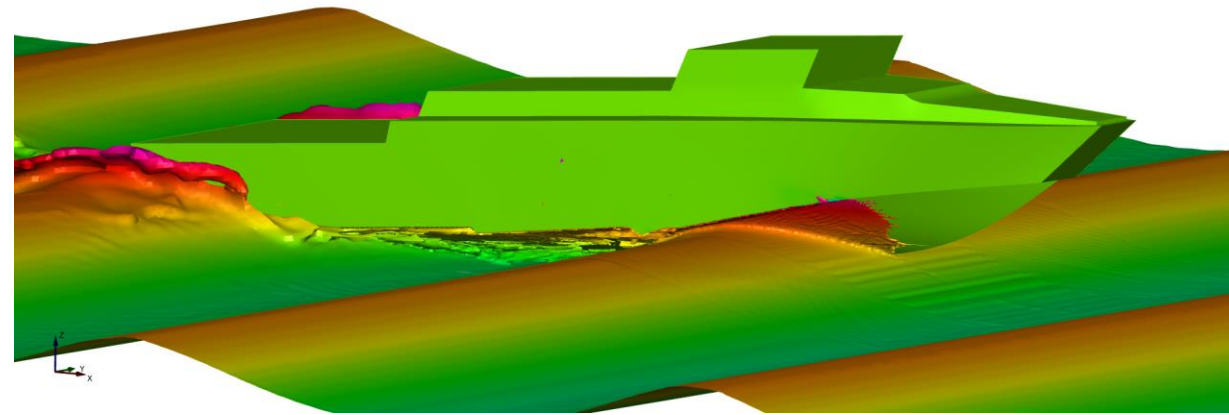
Wave simulation have been performed with simulation setup:  
Regular waves – Stokes 5-order  
Wave height – 1 m  
Wavelength – 10 m  
Head sea in 40 knots

Reductions  
 $A_{1/10} = 35\%$   
 $A_{\max} = 25\%$

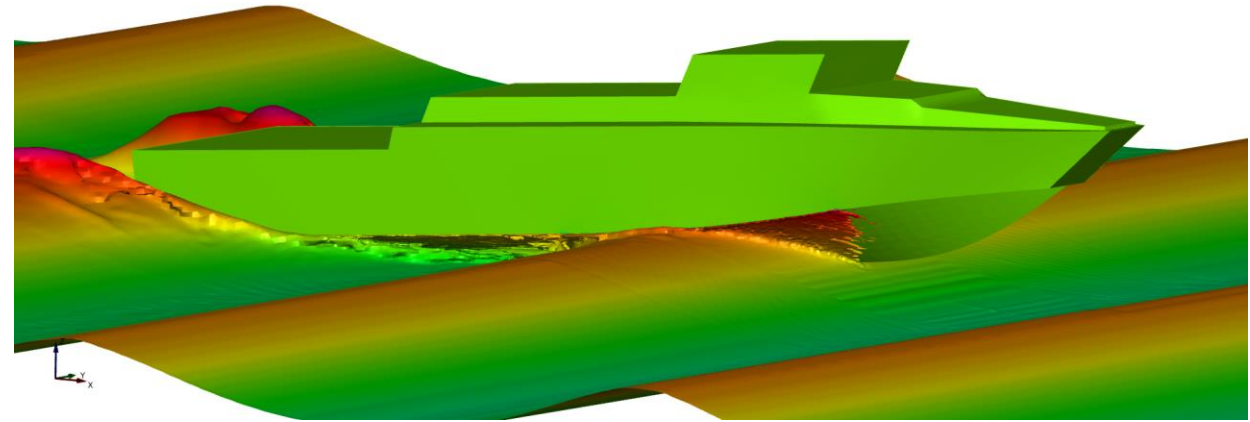
**petestep<sup>®</sup>**

# Wave simulation demonstrating reductions of vertical accelerations with a Petestep hull with 2 deflectors

Loadcase:  
Weight: 27 000 kg  
LCG: 5.45 m  
VCG: 1.1 m



Petestep hull with 2 deflectors

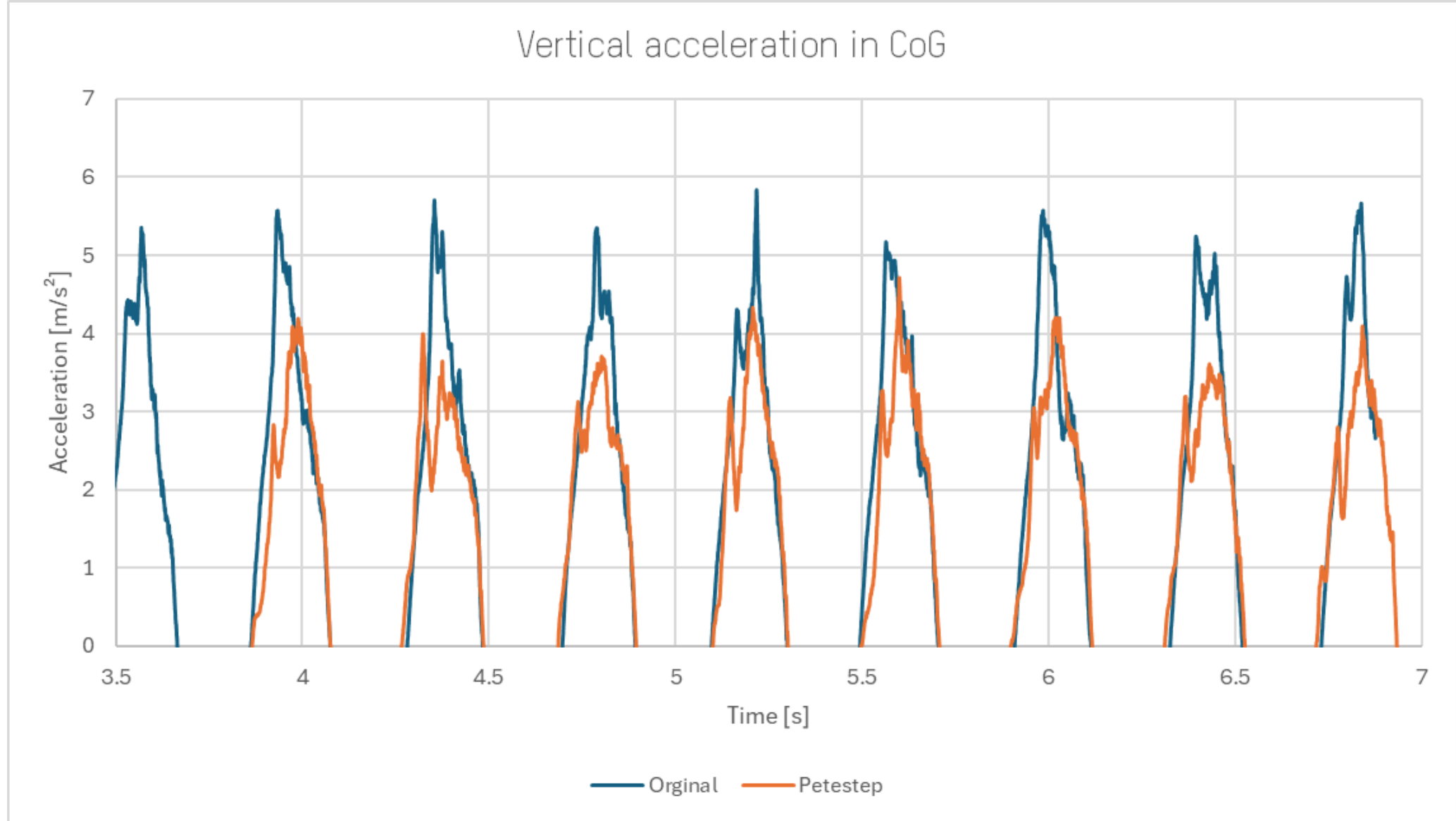


Original hull

Wave simulation have been performed with simulation setup:  
Regular waves – Stokes 5-order  
Wave height – 1 m  
Wavelength – 10 m  
Head sea in 40 knots

Similar reductions recorded in all setups  
 $A_{1/10} = 22\%$   
 $A_{max} = 20\%$

**petestep<sup>®</sup>**



Wave simulation have been performed with simulation setup:  
Regular waves – Stokes 5-order  
Wave height – 1 m  
Wavelength – 10 m  
Head sea in 40 knots

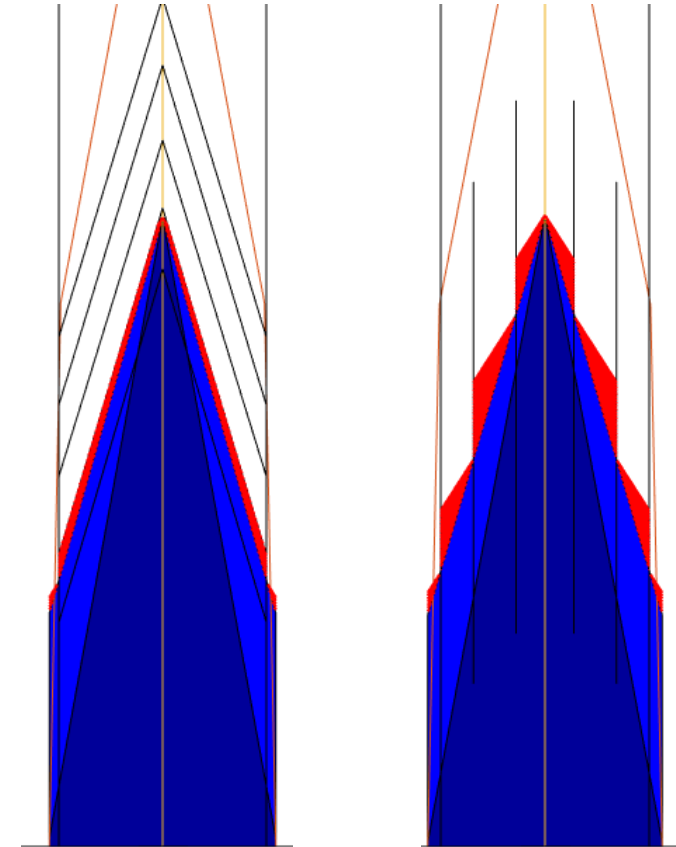
Similar reductions recorded in all setups  
 $A1/10 = 22\%$   
 $A_{max} = 20\%$

**petestep<sup>®</sup>**

# Performance indications and calculation setup

## Petestep developed software based on Savitzky parametric method

- Included in predictions
  - Deadrise distribution
  - Effects of spray rails and effects of Petestep deflectors
  - Hull resistance
  - Approximate resistance of drives
  - Approximate resistance of aerodynamic
  - Engine power and consumption curve (based on previous project with electric engines)
  - Propeller efficiency curve (based on previous projects)
  - Propeller slip
- Assumptions in predictions
  - Flat water
  - 20-degree air and water temperature
  - Clean hull bottom without antifouling
  - At sea level
  - Total max efficiency of drivetrain 57%



# Combat boat 90– Performance Indications using parametric method

Load case:

2700 kg

LCG at 5.45 m

Engine: 2 x Scania Di 16L 846 kW/ 1150 hp with Jetdrive

| Speed (kts) | Resistance (kN) | Trim angle (°) | Engine Power (hp) | Consumption (l/nm)* | RPM  | Slip | Wetted area (m²) | Pe (kW) |
|-------------|-----------------|----------------|-------------------|---------------------|------|------|------------------|---------|
| 20          | 39.33           | 7.49           | 1224              | 12.13               | 2036 | 49%  | 41.52            | 405     |
| 25          | 39.56           | 7.17           | 1308              | 10.44               | 1943 | 33%  | 38.09            | 509     |
| 30          | 38.30           | 6.30           | 1434              | 9.63                | 2023 | 23%  | 36.55            | 591     |
| 35          | 37.84           | 5.41           | 1629              | 9.41                | 2188 | 17%  | 36.02            | 681     |
| 40          | 38.73           | 4.64           | 1891              | 9.54                | 2398 | 14%  | 36.01            | 797     |
| 45          | 41.00           | 4.02           | 2241              | 10.05               | 2631 | 12%  | 36.33            | 949     |
| 46          | 41.61           | 3.91           | 2323              | 10.24               | 2680 | 11%  | 36.42            | 985     |

Top speed ~46 Knots

# Combat boat 90 - Petestep hull

## Performance Indications using parametric method

Load case:

2700 kg

LCG at 5.45 m

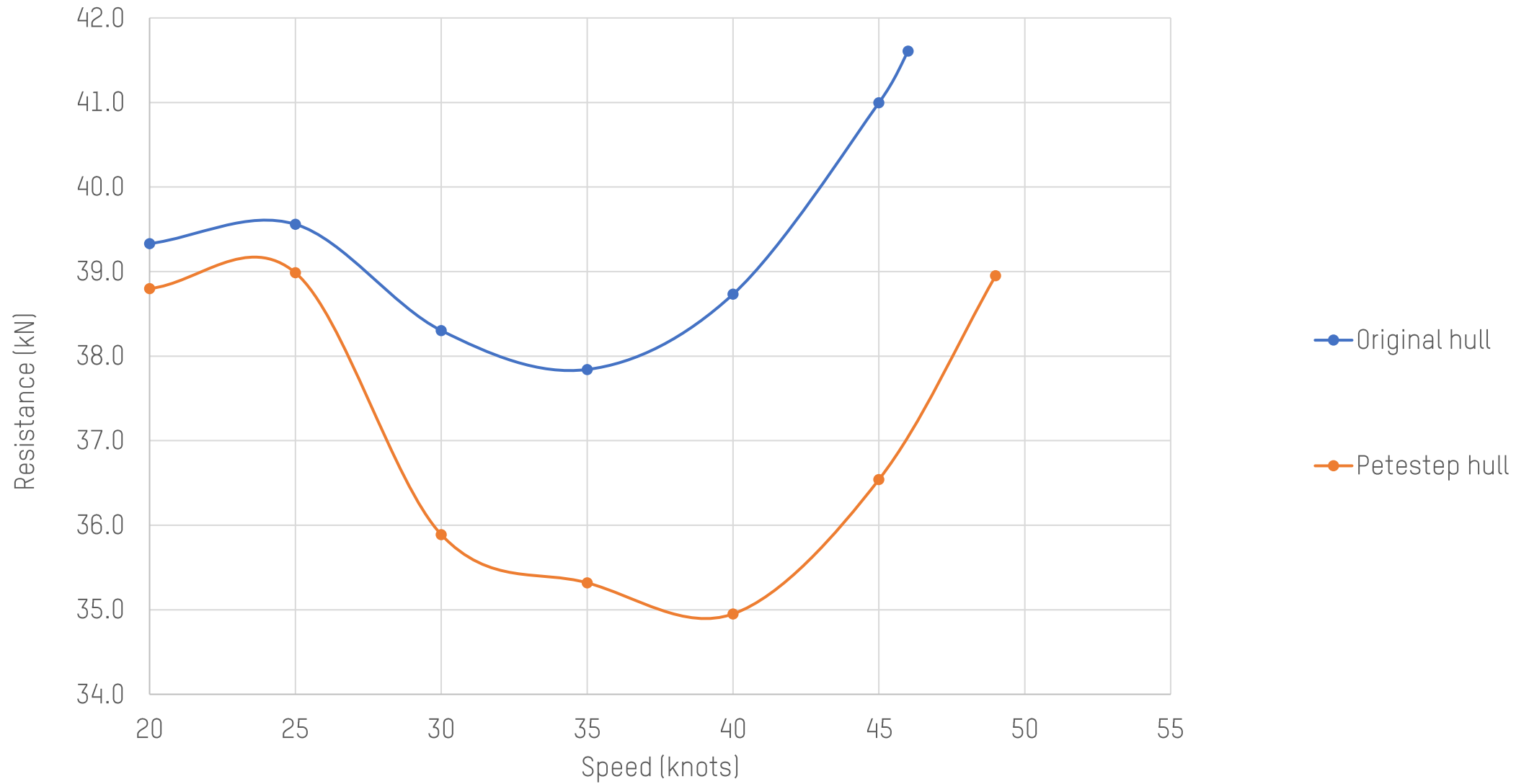
Engine: 2 x Scania Di 16L 846 kW/ 1150 hp with Jetdrive

| Speed (kts) | Resistance (kN) | Trim angle (°) | Engine Power (hp) | Consumption (l/nm)* | RPM  | Slip | Wetted area (m²) | Pe (kW) | Resistance reduction |
|-------------|-----------------|----------------|-------------------|---------------------|------|------|------------------|---------|----------------------|
| 20          | 38.80           | 7.74           | 1196              | 11.85               | 2012 | 48%  | 38.05            | 399     | 1.4%                 |
| 25          | 38.99           | 7.25           | 1286              | 10.24               | 1929 | 33%  | 34.68            | 501     | 1.5%                 |
| 30          | 35.89           | 6.30           | 1338              | 8.92                | 1987 | 22%  | 32.71            | 554     | 6.3%                 |
| 35          | 35.32           | 5.39           | 1516              | 8.75                | 2159 | 16%  | 32.20            | 636     | 6.7%                 |
| 40          | 34.95           | 4.59           | 1701              | 8.60                | 2361 | 12%  | 31.56            | 719     | 9.8%                 |
| 45          | 36.54           | 3.96           | 1994              | 8.92                | 2595 | 10%  | 31.80            | 846     | 10.9%                |
| 49          | 38.95           | 3.56           | 2321              | 9.60                | 2794 | 9%   | 31.86            | 982     |                      |

Improved top speed by ~3 Knots

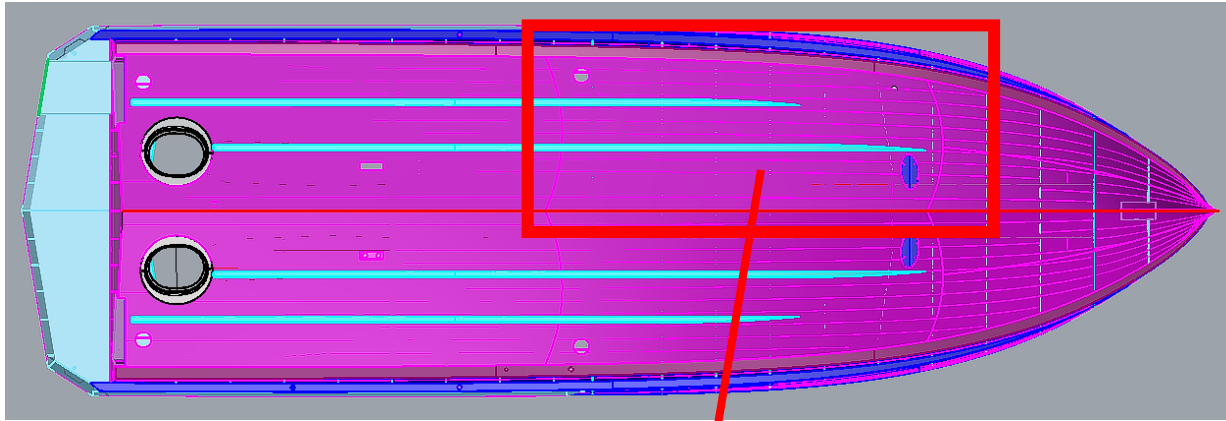


Resistance curves using parametric method

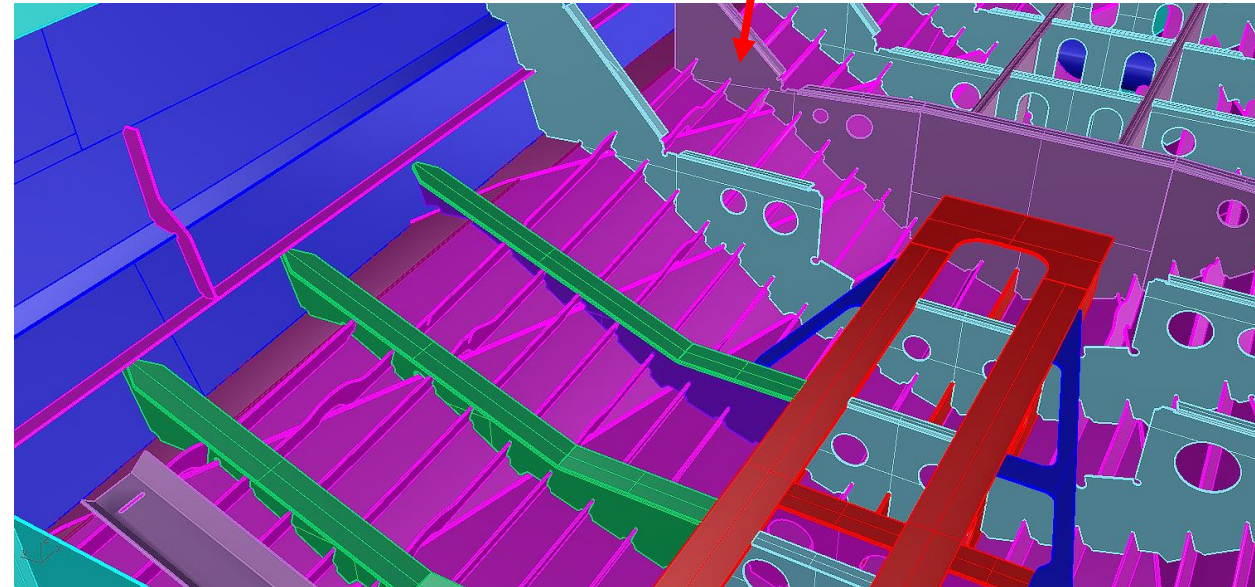
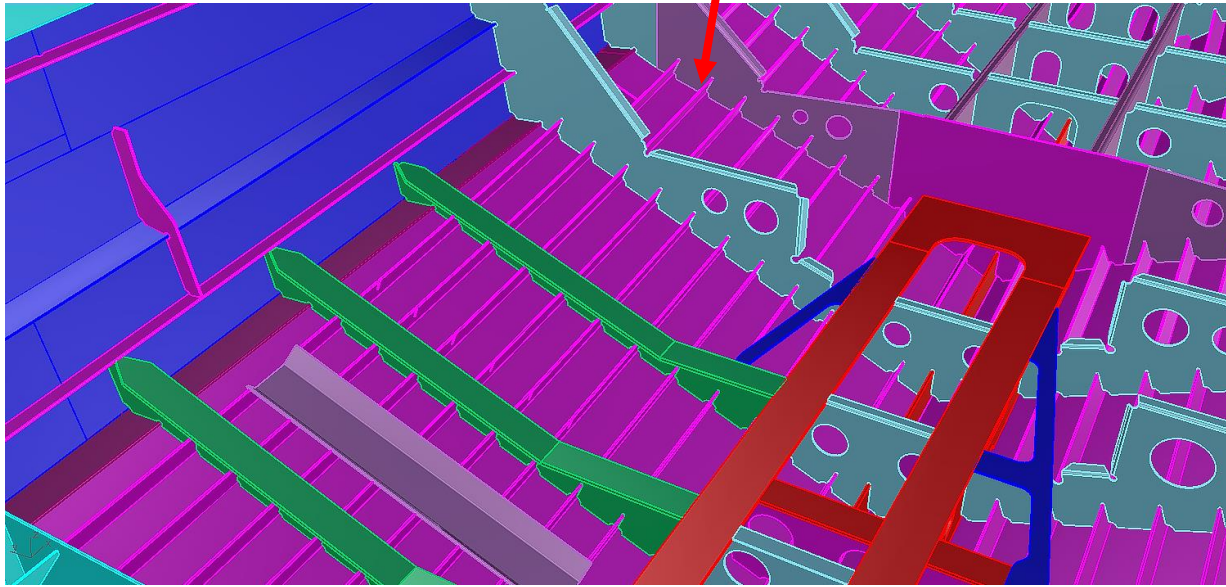
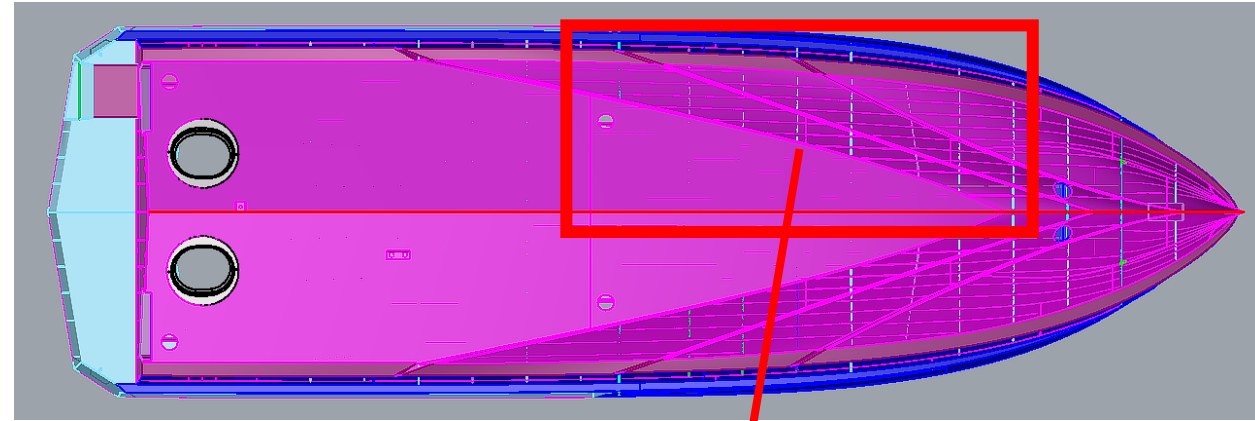


# Example aluminum boat updated to a Petestep hull

Old hull

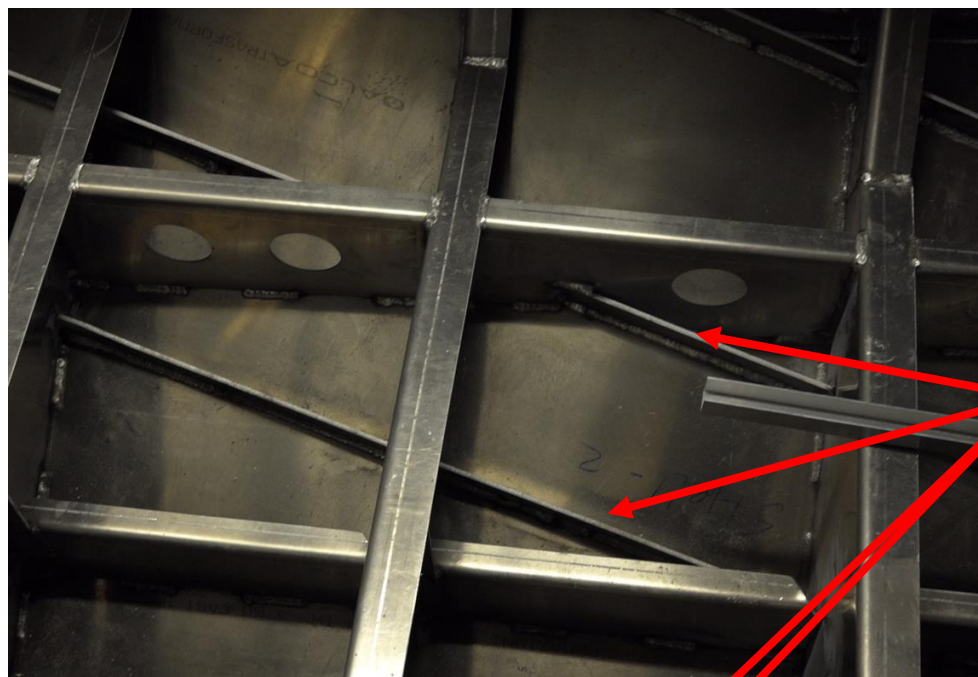


Petestep hull



- Internal structure are adapted for the defectors
- Petestep defectors becomes a part of the stringer structure

# Example aluminum Petestep hulls



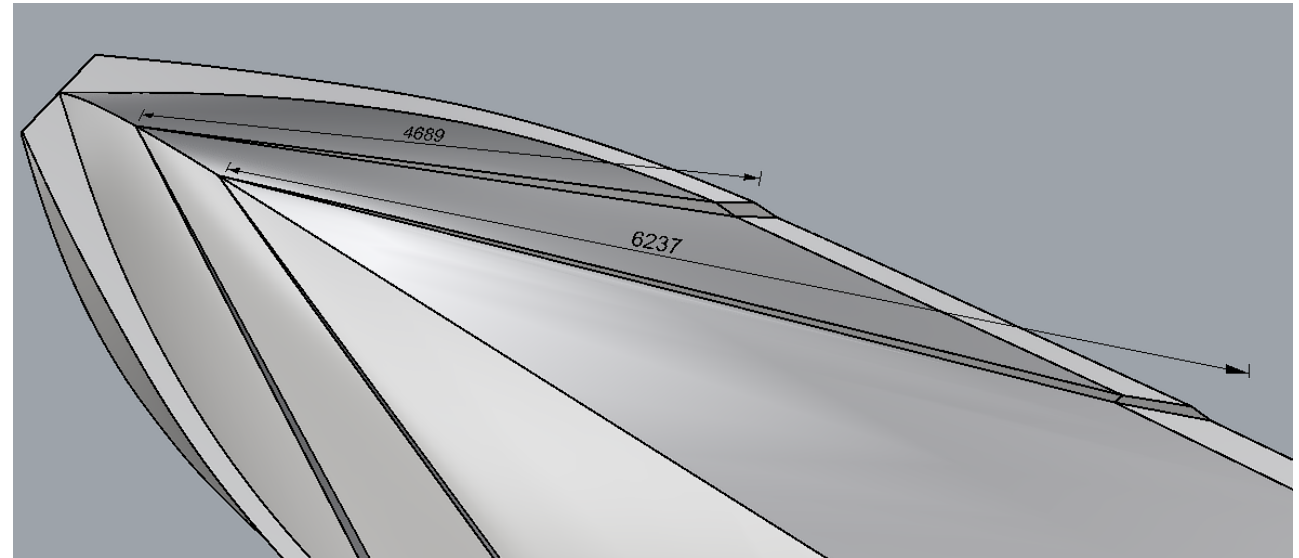
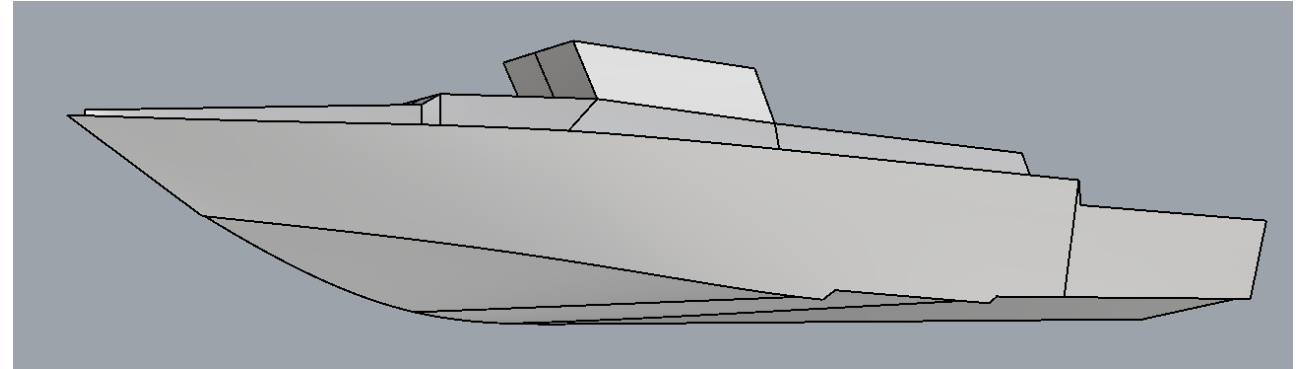
Deflectors



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# Additional time estimate to weld CB90 with a Petestep hull

- Internal structure – no additional time only slight change of cutting file
- Hull shell
  - Assumed weld time 5 m/h
  - With 2 deflectors ~ 18 h extra weld time per boat
    - 2 weld inside, 2 weld outside, port and starboard
      - Aft deflector ~ 6.3 m x 4 x 2
      - Forward deflector ~ 4.7 m x 4 x 2
  - With 3 deflectors ~ 26 h extra weld time per boat
    - 2 weld inside, 2 weld outside, port and starboard
      - Aft deflector ~ 6.3 m x 4 x 2
      - Middle deflector ~ 5.5 m x 4 x 2
      - Forward deflector ~ 4.7 m x 4 x 2



# Reference to design and develop an Aluminum boat with a Petestep hull



Work as structural engineers and Naval architects. Studio delta see benefits to the structural integrity using Petestep hull technology since the deflectors can be accounted as a stiffener.

## Collaborative projects

- Van der Valk Edge 65 ft
- Vanquish Yachts
  - VQ 115
  - VQ 80 SF
  - VQ 52 Custom
  - VQ 45 Custom

Contact Menno van Dijk Director of Studio Delta for more information.

[mvd@studiodelta.nl](mailto:mvd@studiodelta.nl)

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# Reference for production of an Aluminum boat with a Petestep hull



KD Workboats in Netherlands were the builders of the aluminum structure of the Venegy 37, Vanquish VQ 115 ft and the VQ 80 ft Sport Fish.

The Venegy 37, VQ 115 and VQ 80SF were built with the keel down without any jigs.

KD workboats haven't had any issues building Aluminum boats with Petestep.

Contact Egbert van Veen for more information.

[info@kdworkboats.nl](mailto:info@kdworkboats.nl)

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# Petestep hull costs and benefits

- Design fee – 200 tkr
  - Delivery of optimized hull shape for the FMV specifications
  - Includes full CFD development with performance predictions and handling characteristics
  - Petestep attending during first sea trial
- License fee per boat 45 tkr
- Lower G-forces
  - Improves accuracy of advance long-distance artillery
  - Lowers fatigue on weapon systems and crew
- Drier ride/less spray
  - Lower radar and less visible signature
- Improved hull strength with deflector as part of stringer structure
  - Ability to lower weight of internal structure or a stiffer hull
- ~3 knots higher top speed with same engines
  - Ability to lower engine output power to extend engine life-time with same top speed as current hull
- Significant reductions of fuel consumption
  - Ability to decrease fuel tank size and save weight or an increased range
- Latest technology in hull technology and hull development method
  - Enhance Swedish military defense operability

# Summary

- Potential to a substantially softer ride
- Potential to substantial fuel savings
- Less hull noise creating a quieter ride
- More dynamic and static stability
- Better ability to tailor boat attitude
- Huge accuracy in new designs
- Not interfering with the boat design
- Better maneuvering in low speed

www.petestep.com  
Tegelängsvägen 20  
14553 Norsborg, Sweden

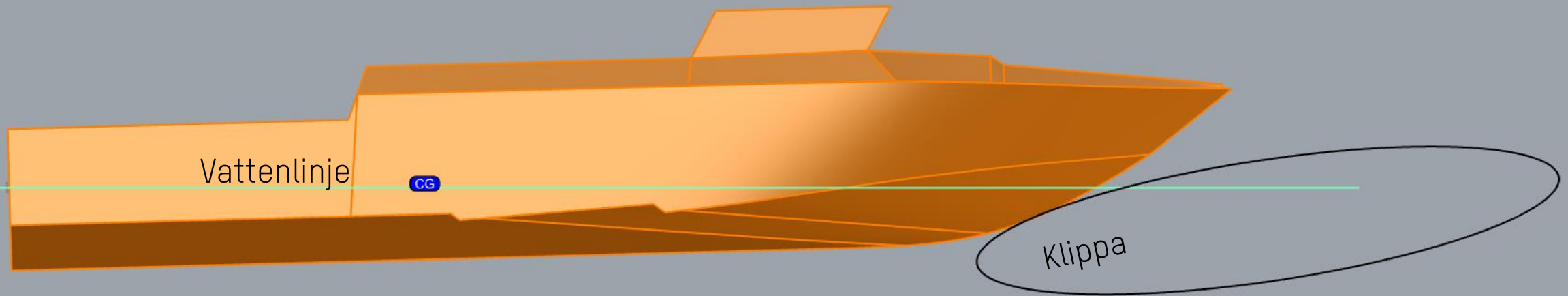
Fredrik Wikerman  
[fredrik@petestep.com](mailto:fredrik@petestep.com)  
+46736004906

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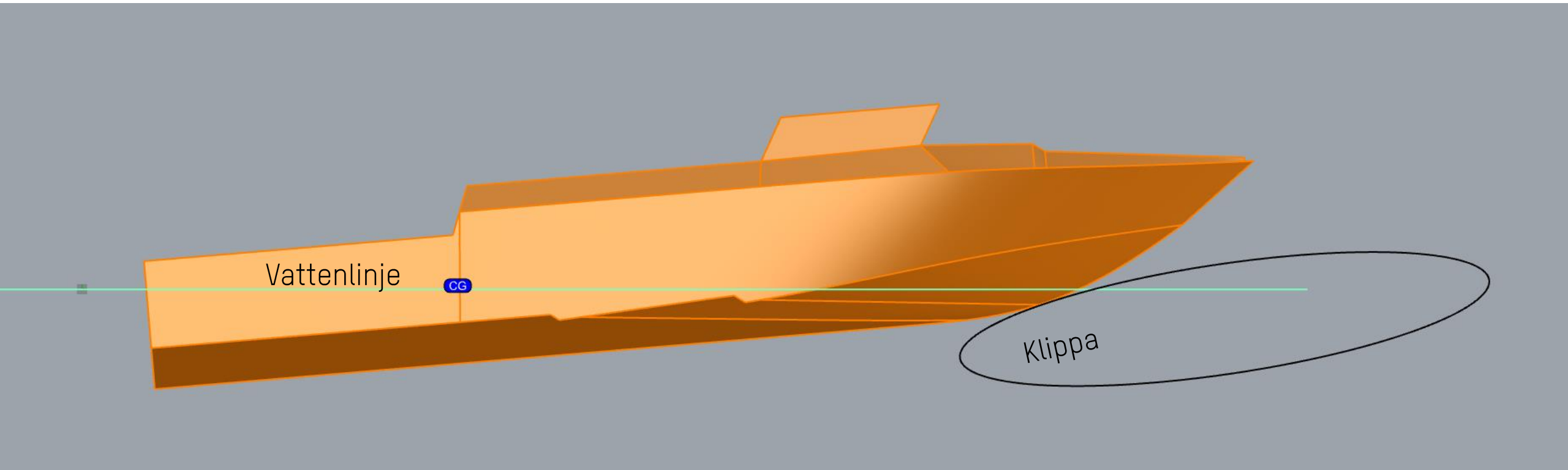
# FMV

Sätta stäv på klippa

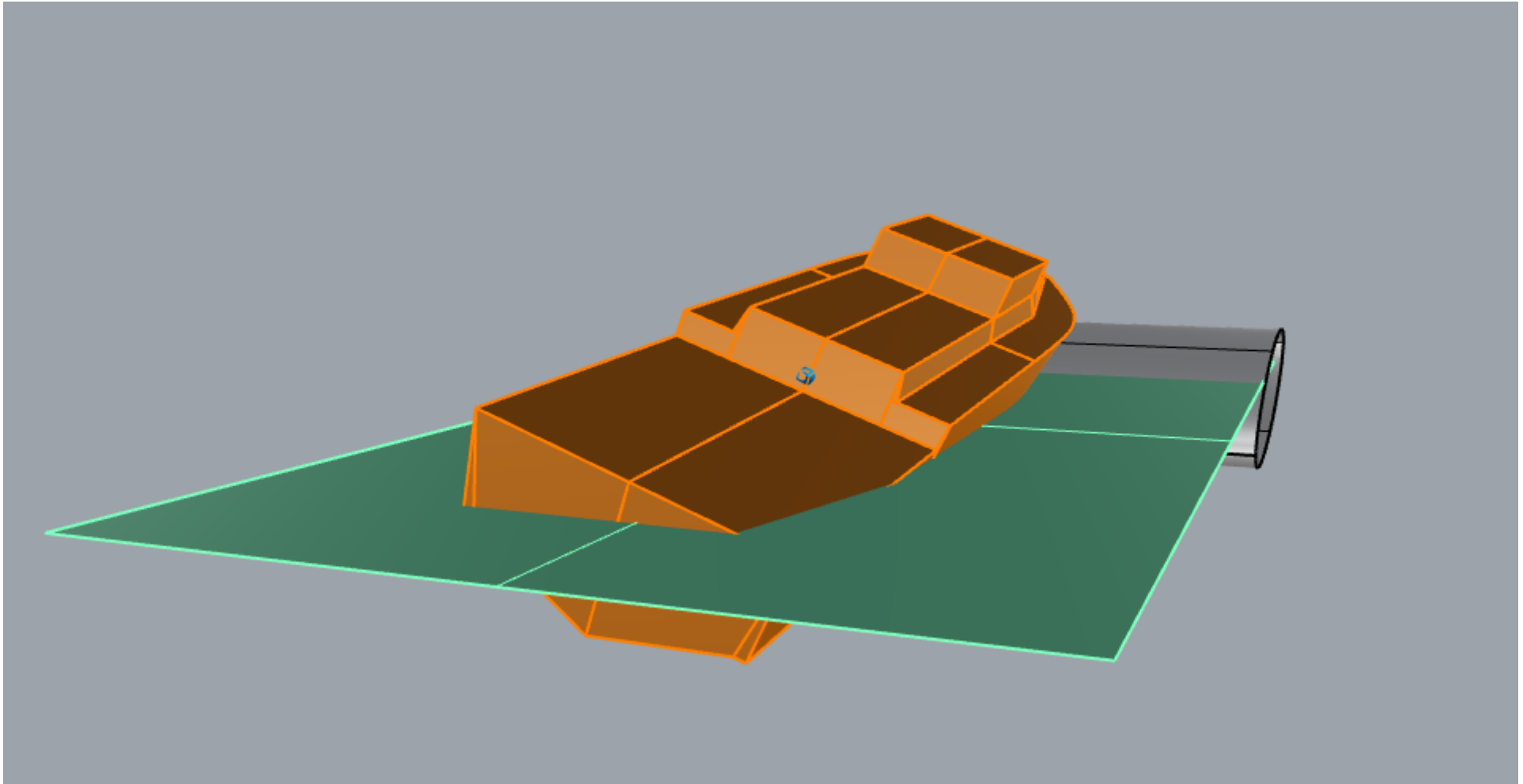
# CB90 flytläge mot klippa

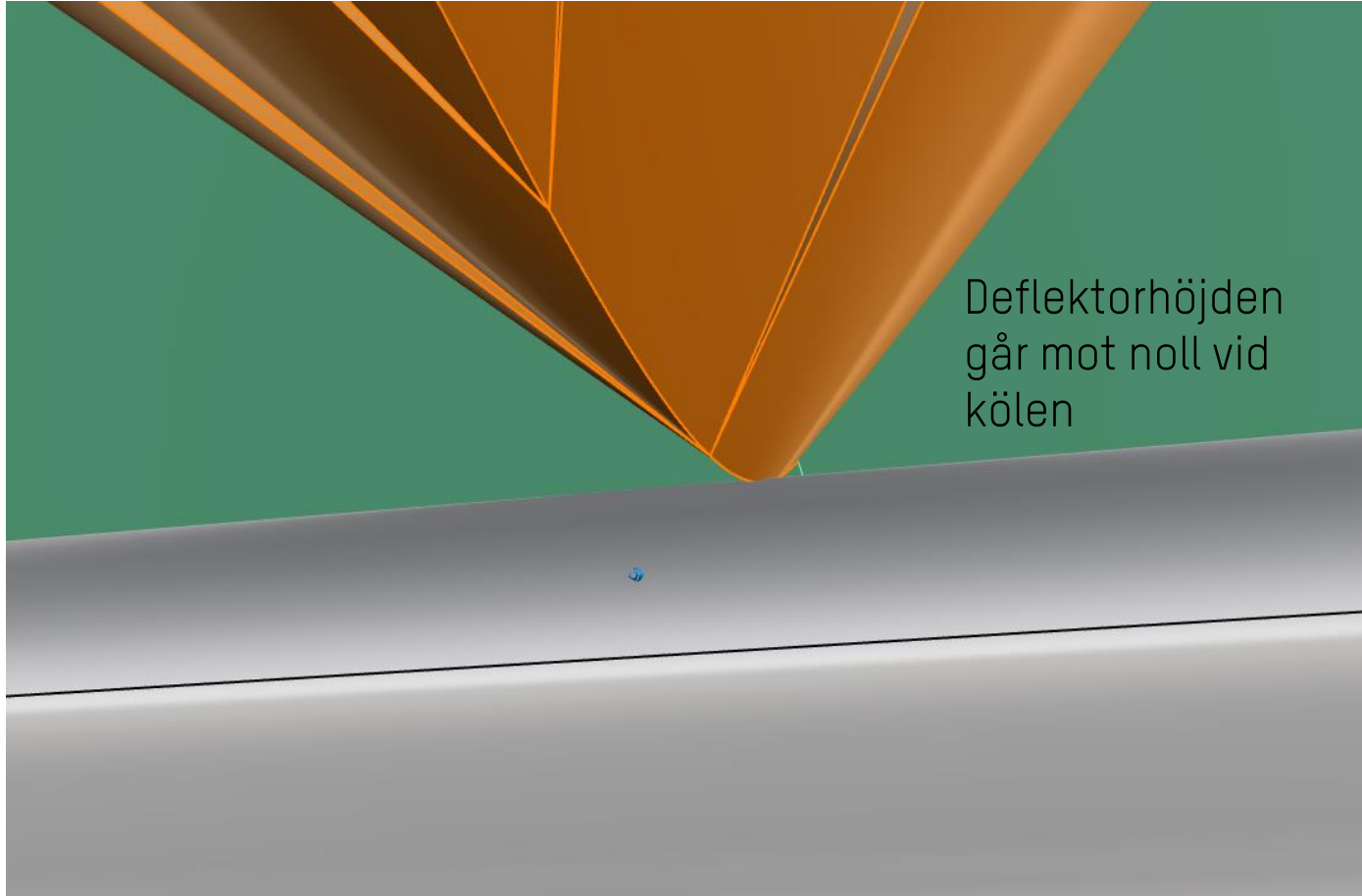


# CB90 stävar upp mot klippa



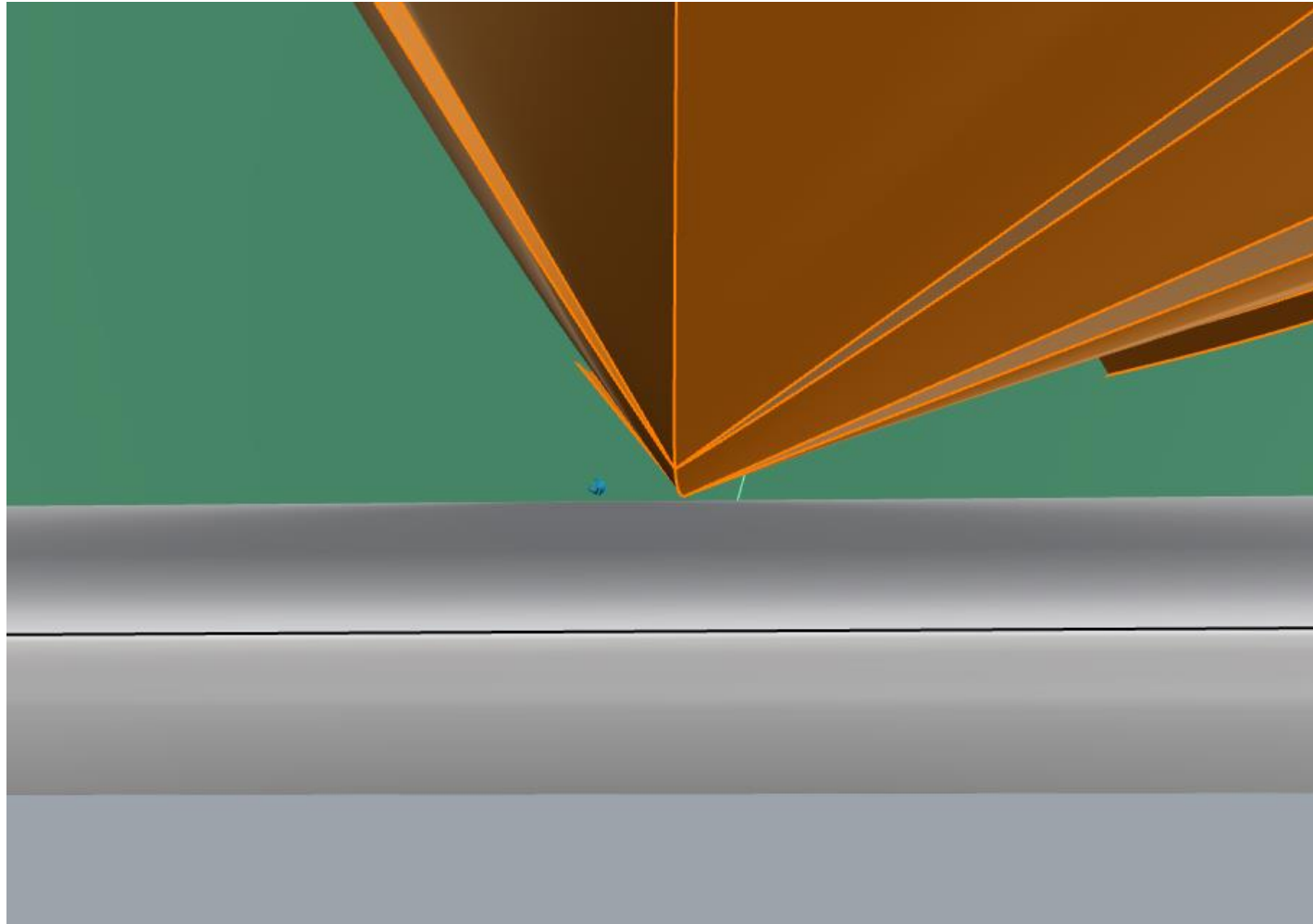
Sidsjö där båten rullar 20 grader





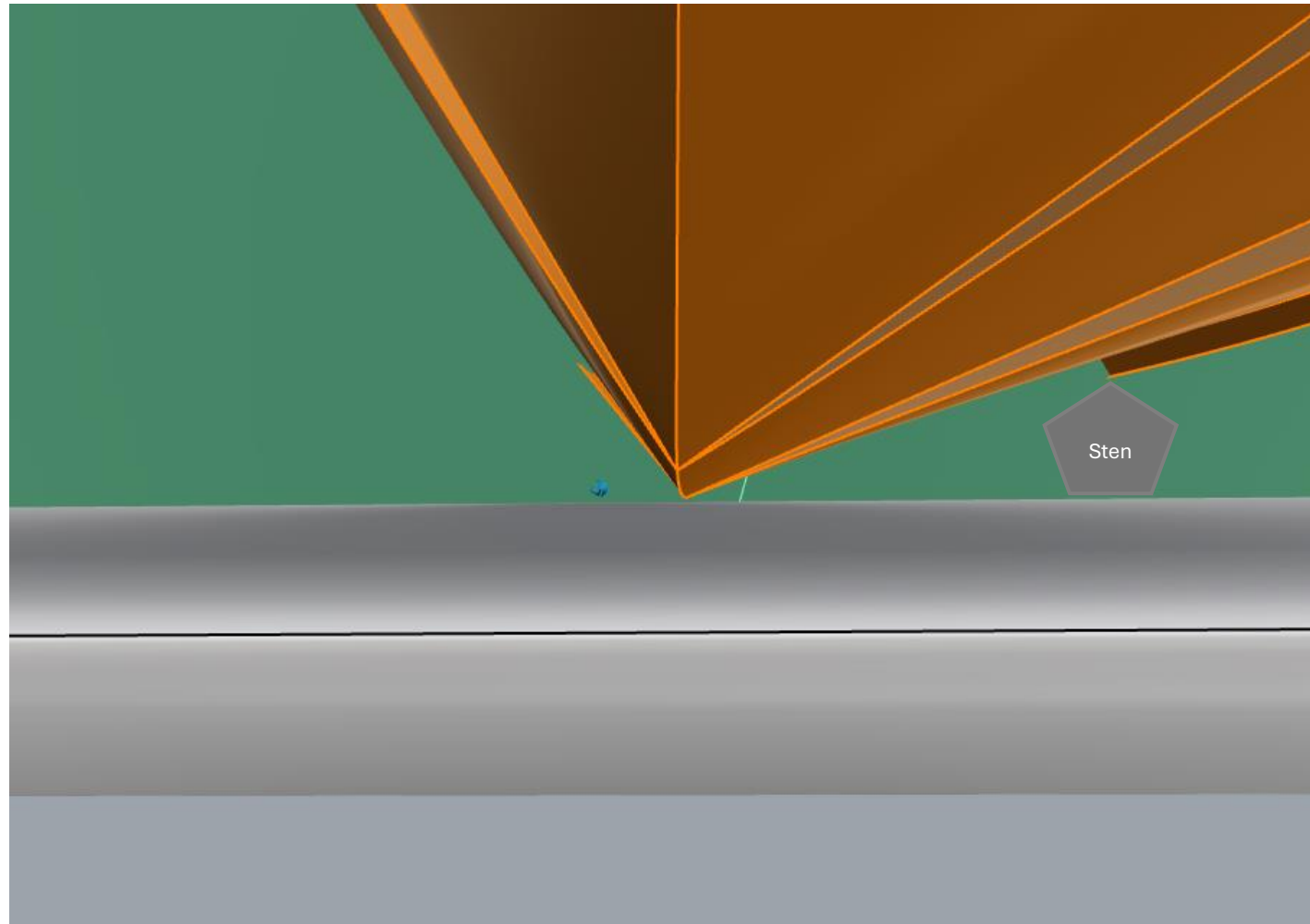
Deflektorhöjden  
går mot noll vid  
kölen

# 20 graders rullning



Även vid 20 grader  
lutning så är  
deflektorn långt  
ifrån klippan

# Deflektor på sten



Även om en deflektor skulle träffa en sten eller en vass klippa, så är strukturen starkare där lokalt, än ett motsvarande skrov utan en deflektor så deflektorn bidrar till styvhet och styrka