

# Ships design potential through autonomy in shipping



## Independent design and engineering company

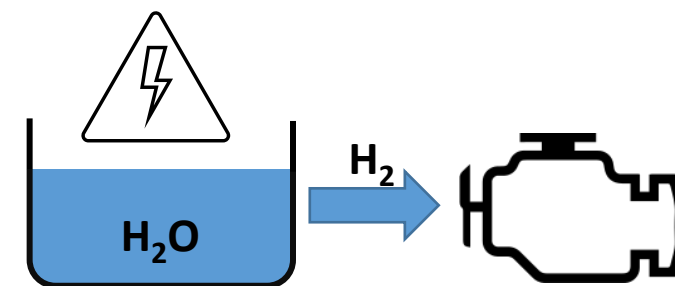
- Serving ship owners and shipyards worldwide
- 7 offices
- > 180 in-house engineers employed





## Autonomy as a tool

# AUTONOMY IN SHIPPING



## Autonomous Guard Vessel (AGV)



Item	
Year of fabrication	1973
Loa x B	32 x 7 m
Engine power	750 kW
Max. speed	13 kn
Crew	5 pers.

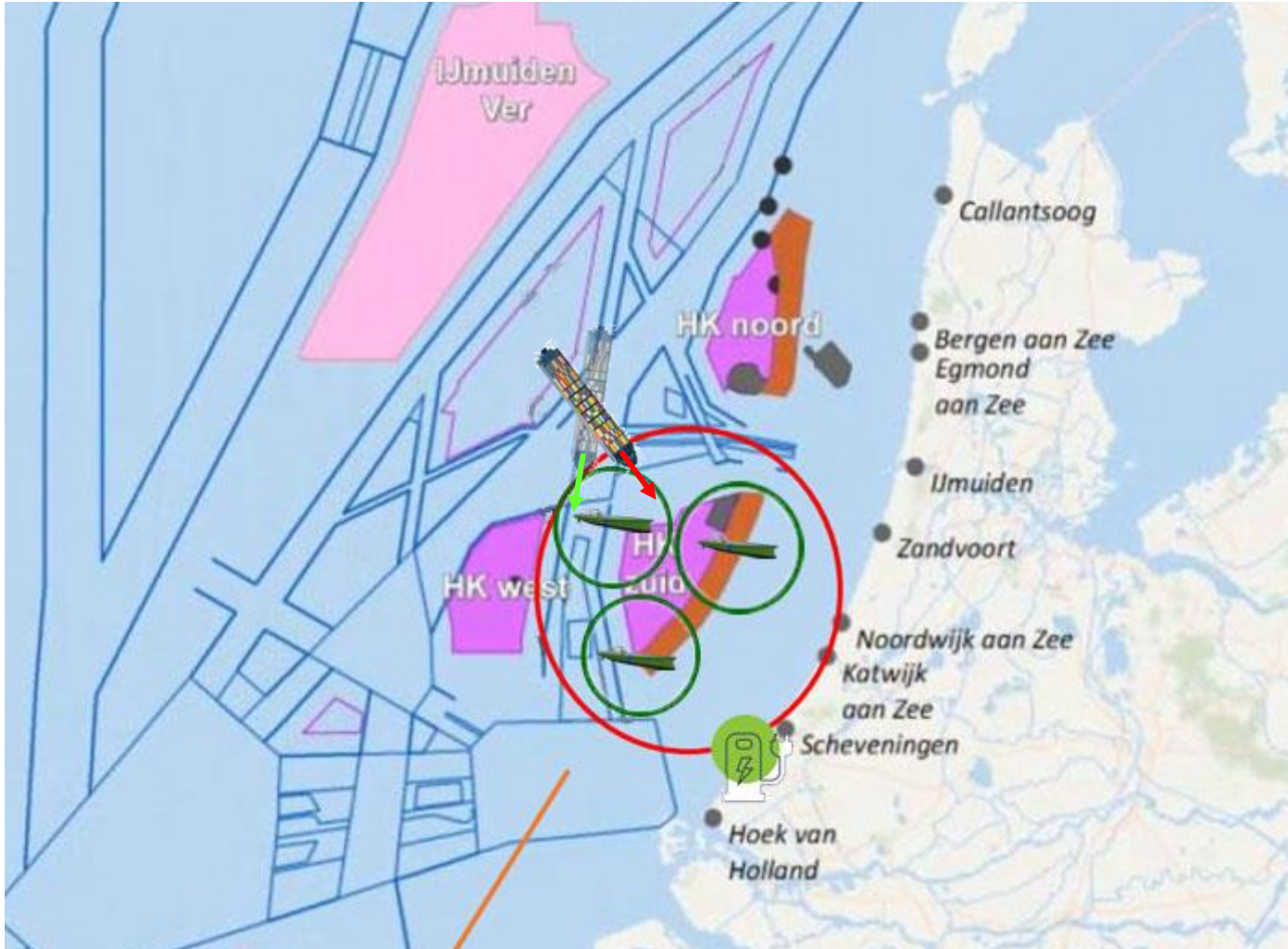


Lisa Community





## Operational profile



Hollandse Kust Zuid  
+  
Typical Containerfeeder  
+  
Charging in port  
+  
Standby

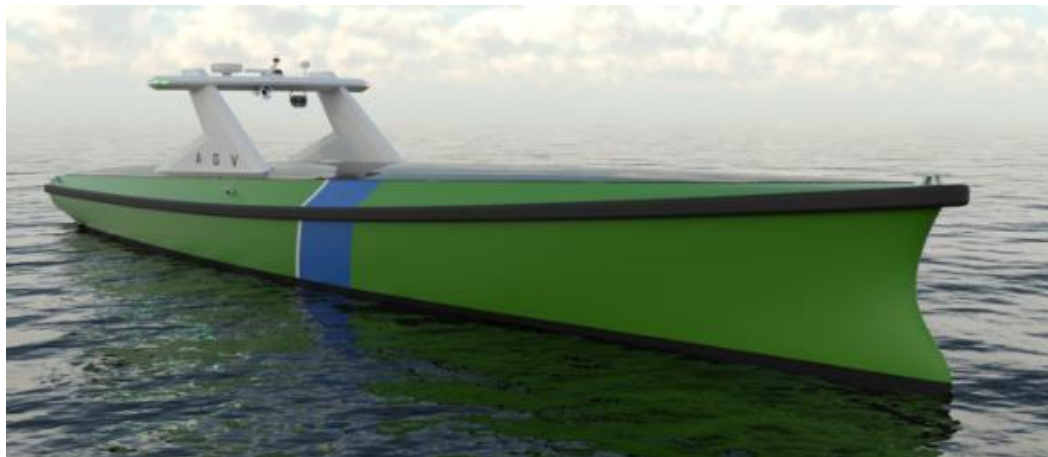


**4 AGV's**

**Intervention speed: 15 knots**

**Batteries:  $\pm 450$  kWh**

## Autonomous Guard Vessel (AGV)



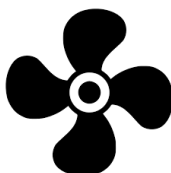
Item	
Loa x B	11.7 x 2.1 m
Engine power	130 kW
Max. Speed	15 kn

## AGV vs Common practice

 *Autonomous Vessel design*



$\Delta = 99\%$  ↘



$P = 80\%$  ↘



↗↗↗



100%



Total cost  $\approx$





..... *Then, a completely different design* .....

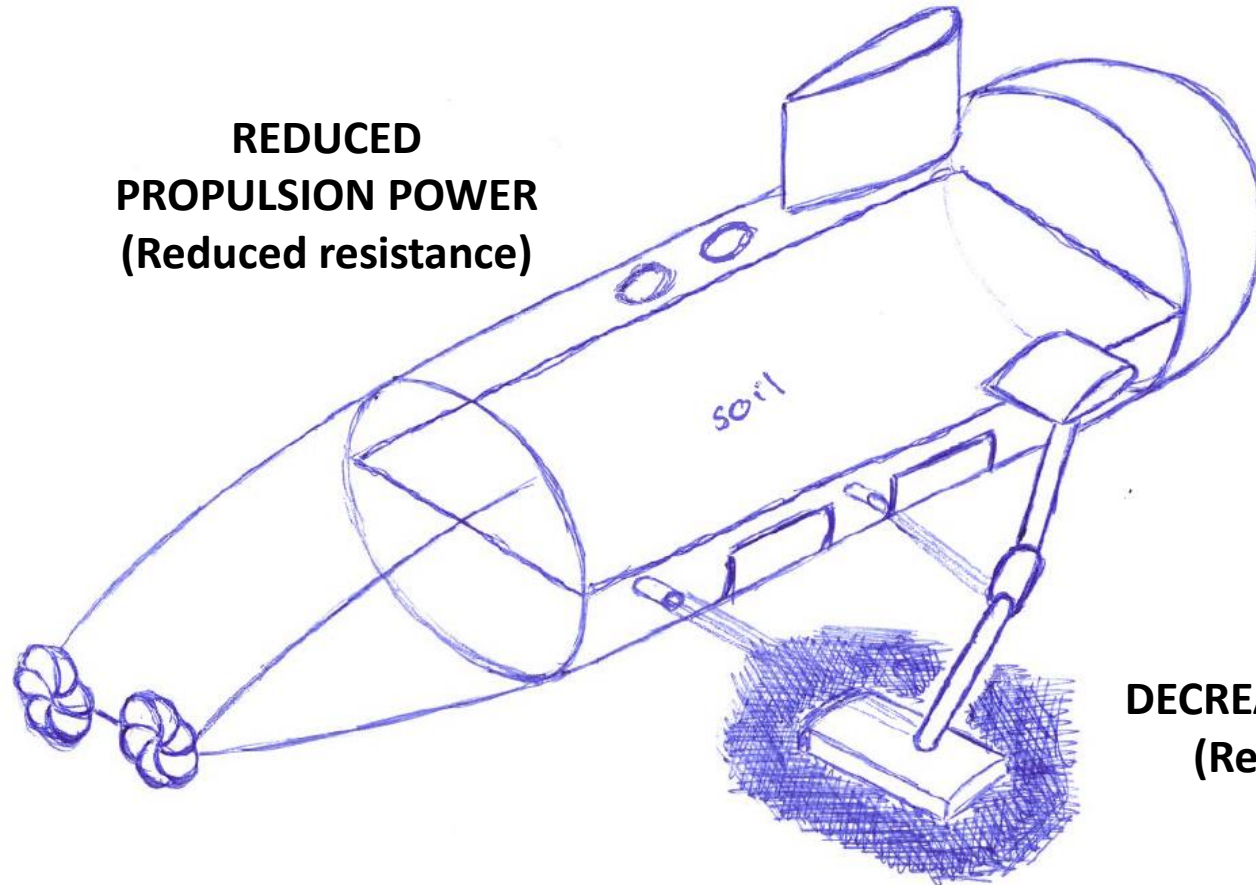


## Disruptive innovation: Autonomous submarine dredger



**IMPROVED  
OPERABILITY  
(Submerged)**

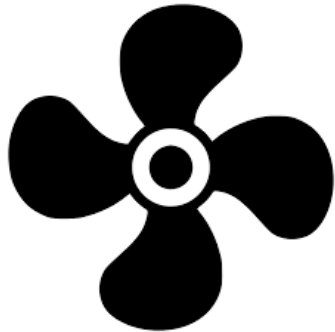
**REDUCED  
PROPULSION POWER  
(Reduced resistance)**



**REDUCED  
OPERATIONAL COSTS  
(No crew)**

**DECREASED DREDGING POWER  
(Reduced suction depth)**

## Power requirements



$$R_{\text{total}} = R_F (1 + k_1) + R_{\text{app}} + R_w + R_{\text{TR}}$$

$R_F (1 + k_1)$  = Frictional resistance



$R_{\text{app}}$  = Appendage resistance



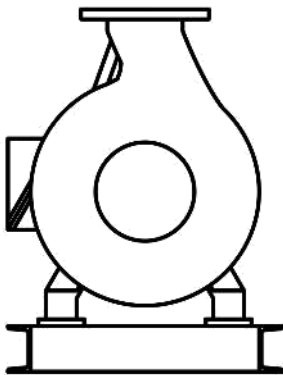
$R_w$  = Wave making / -breaking resistance



$R_{\text{TR}}$  = Transom immersion resistance



**2x 1100 kW (Conventional) → 2x 500 kW (AUMD)**



$$\Delta p_{\text{loss,tot}} = \Delta p_{\text{su,loss}} + \Delta p_{\text{dis,loss}} + p_{\text{abs,dis}} - p_{\text{abs,draghead}}$$

$\Delta p_{\text{su,loss}}$  = Frictional loss + suction head, suction side



$\Delta p_{\text{dis,loss}}$  = Frictional loss + pressure head, discharge side



$p_{\text{abs,dis}}$  = Absolute pressure, discharge side

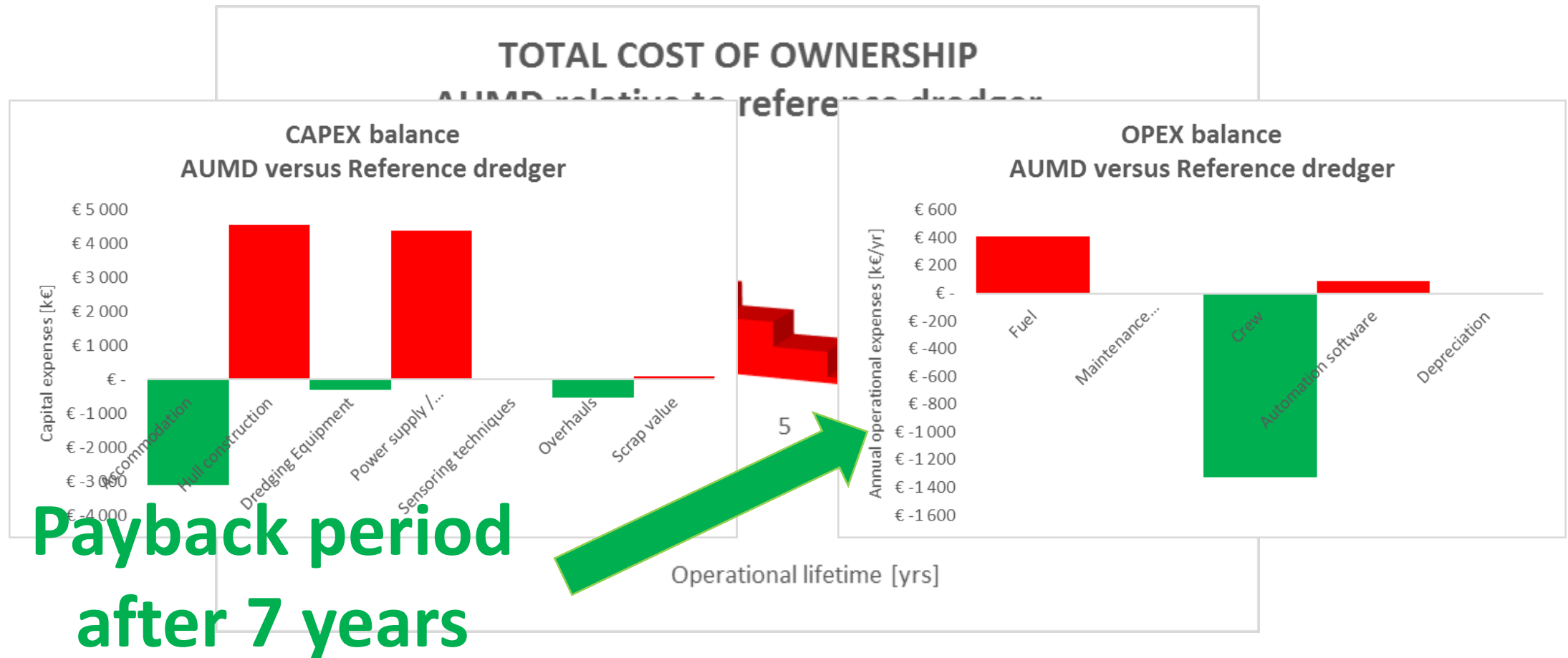


$p_{\text{abs,draghead}}$  = Absolute pressure, suction side



**2x 675 kW (Conventional) → 2x 150 kW (AUMD)**

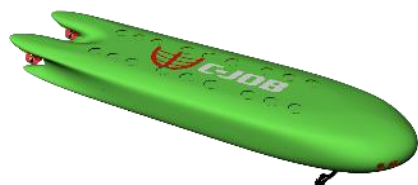
## Total cost of ownership



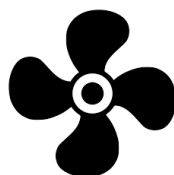


## AUMD vs Common practice

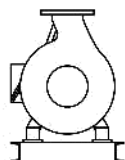
 *Autonomous Vessel design*



$\Delta = 13\%$  ↘



55% ↘



80% ↘



100%



CAPEX ↗

OPEX ↓



# Innovaties in de KustlijnZorg (IKZ)

## Innovations in the Coastline Care

- Rijkswaterstaat selected AUMD version 2.0
- Innovation partnership
- Ambition ship ready by 2024
- Go / NoGo strategy



Rijkswaterstaat  
Ministerie van Infrastructuur en Waterstaat





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