



Obliczenia CFD dla załączonej koncepcji linii kadłuba Następcy Daru Młodzieży

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1 General

1.1 Introduction

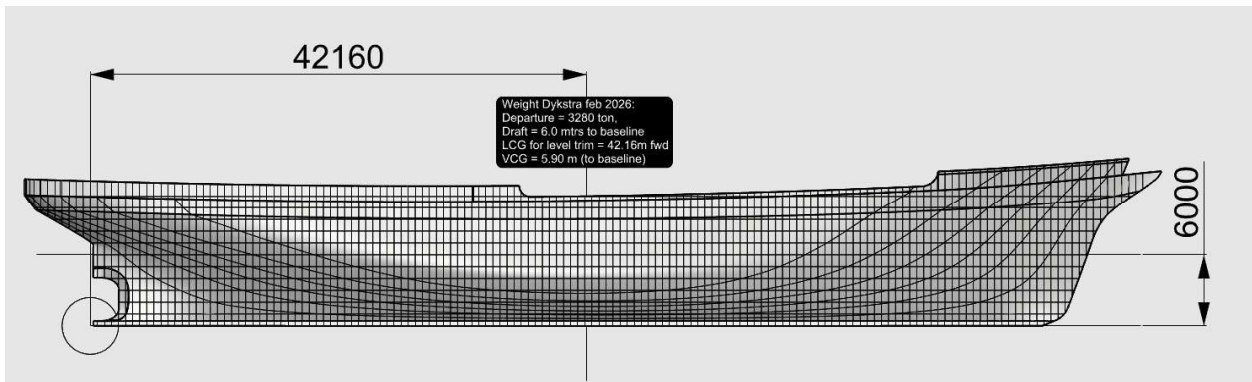
This document describes the Upright Resistance and Power calculation for the DAR Replacement design.

The calculations use the latest Linesplan to date: Lines #7 (20260303), and the deepest loaded draft at 6.0 meters to underside keel and even trim.

The Resistance is calculated using the in house CFD software by Cadence, Fidelity 2025.2-1 for meshing and FineMarine 2025.1-1 for solving.

Model was free to sink and trim.

No heel or leeway has been investigated



1.2 Main particulars

Main dimensions

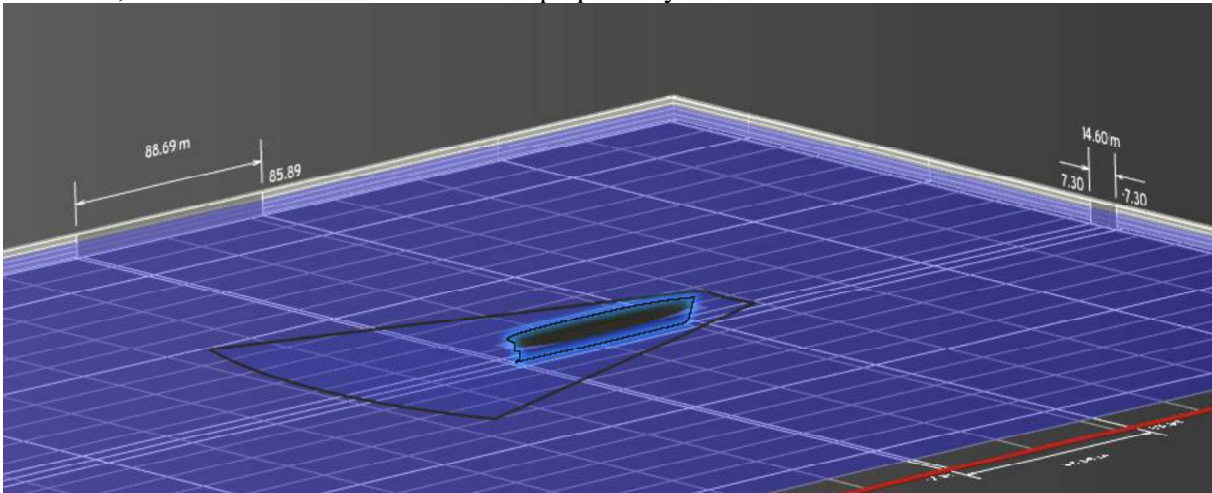
Total Length	111.70	m
Total hull length	96.58	m
Waterline length	84.44	m
Lenght between perpendiculars	84.44	m
Loadline length	84.87	m
Beam	14.60	m
Beam waterline	14.57	m
Depth	8.30	m
Draft (max)	6.00	m
Sail area	3313	sqm
Air draft	58.40	m
Max displacement	3275	ton

1.3 Environment

The calculation was done in Seawater of 19degrees:

Gravity	9.807	m/s ²
Kin. viscosity	1.19E-06	m ² /s
Rho water	1025.00	kg/m ³
Rho Air	1.29	kg/m ³

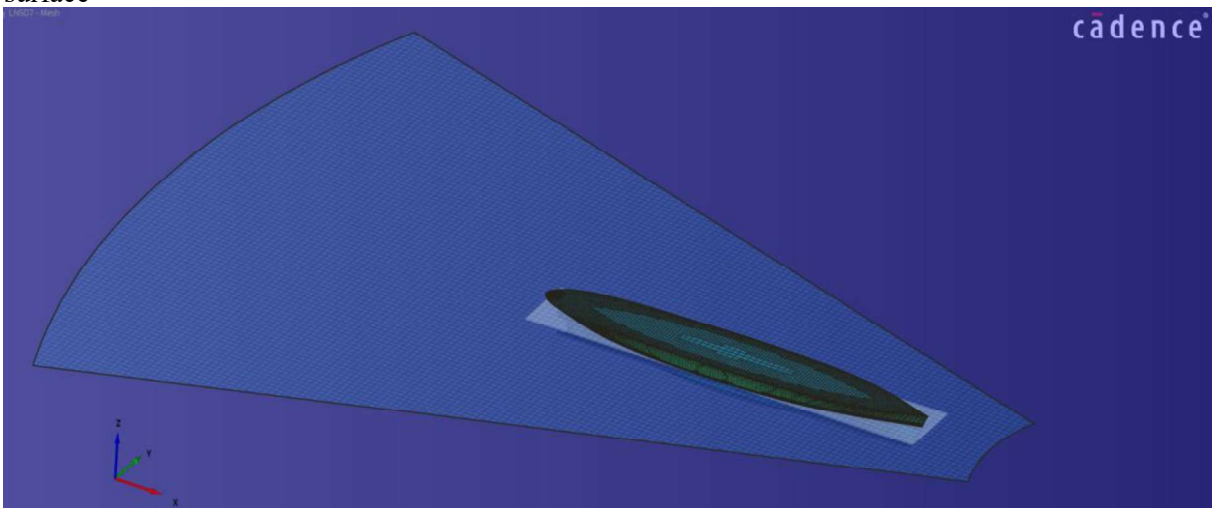
From this, a usable 3D model of the hull was prepared by DNA:



1.1 Mesh

Based on this geometry, a computational mesh was created.

Fidelity was used to create a mesh with **4.5 M** cells. Applying additional refinement on the hull and free surface



1.2 Settings

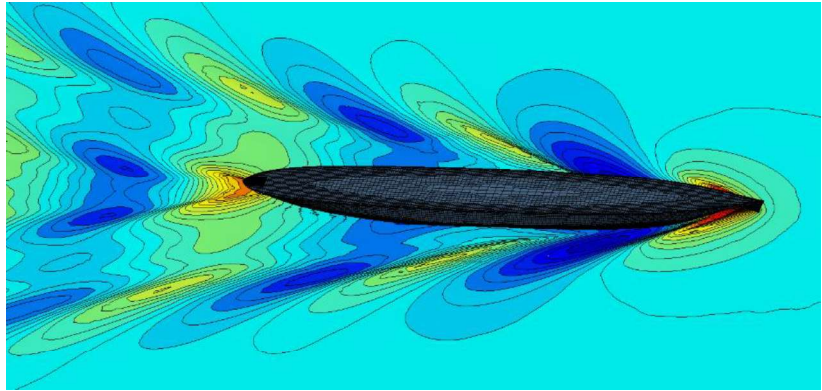
The boundary layer around the vessel was captured using Viscous layer inflation and an equivalent skin roughness of **100 micro meter** was applied to represent light fouling.

2 Upright resistance

2.1 General

In the CFD, the model was free to sin and trim for equilibrium in vertical forces and pitching moment.

The Total cfd drag (Fx) from the CFD software is reported below.



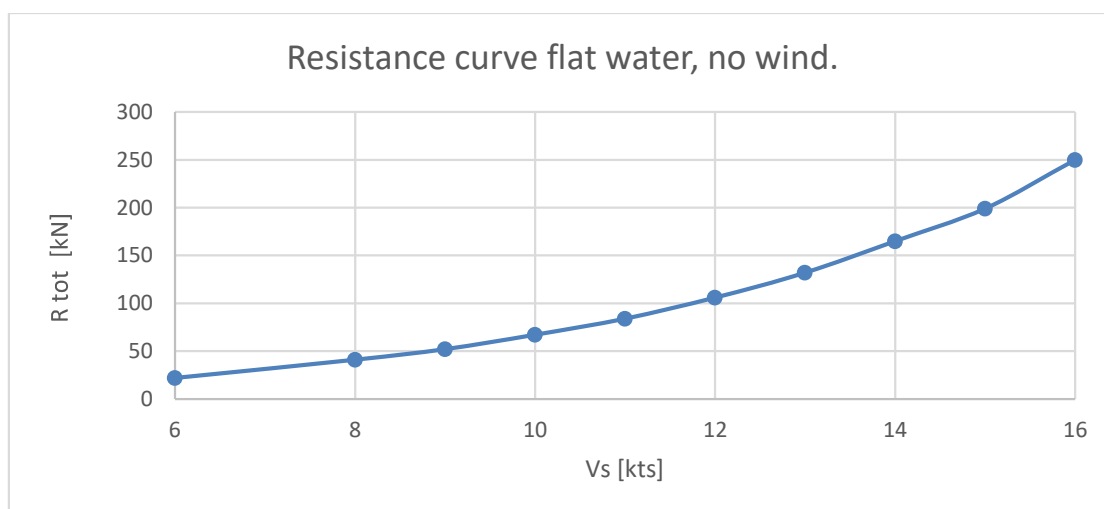
In addition to the drag of the modeled geometry, additional drag (R_{add}) is to be expected for rudder, hull openings, anodes, bow thruster etc. This was estimated at 0.45 sqm of drag area.

The aerodynamic drag of the superstructures, spars and rigging was estimated at a drag area of 580 sqm at apparent wind speed equal to boatspeed.

No sea margin is added to these numbers.

2.2 Results

Vs	Fn	CFD Drag	R add	R wind (TWS=0)	R tot	trim	Sink
[kts]	[-]	kN	kN	kN	kN	[deg]	[m]
6	0.1	17	2	3	22	0.03	0.02
8	0.14	31	4	6	41	0.04	0.05
9	0.16	40	5	8	52	0.04	0.06
10	0.17	51	6	9	67	0.05	0.08
11	0.19	65	7	11	84	0.05	0.1
12	0.21	84	9	14	106	0.06	0.12
13	0.23	106	10	16	132	0.06	0.15
14	0.24	135	12	19	165	0.06	0.18
15	0.26	164	14	21	199	0.06	0.22
16	0.28	210	16	24	250	0.03	0.26



3 Power and Speed

3.1 General

Data

Engine		
Diesel engine		
Rated power	1300	kW
Rated power	1743	HP
Engine type	Diesel	
Max break power	1300	kW
Max break power	1743	HP
Max RPM	1800	RPM
Gearbox ratio 1:	7.50	-

Propeller		
Number of props	1	
Number of blades	4	
Material of propeller	CuNiAl	
Propeller type	CPP	
Design Pitch	0.933	m/m
Shaft immersion	3.7	m to dwl
Ae/A0	0.600	-
T of seawater	30	°C <32°>
Cavitation free speed	13.0	kn <0.0>
D prop	2.50	m
Wake fraction	0.1	
Thrust deduction factor	0.08	

3.2 Efficiencies & Margins

Efficiencies		
Propulsion efficiency	65%	<53%>
Mech. efficiency	95%	<95%>

Data presented here are for trial conditions, flat water, clean hull, no wind.

3.3 Results

