
cDynamics
EXPERTS IN ENGINEERING SIMULATION
MARINE || COMPOSITES || RENEWABLES || SUBSEA

CDYNAMICS COMPANY INTRO

- Founded in 2015 as a supplier of analysis services to marine engineering firms, expansion to general engineering
- Principal experience in the design and analysis of new generation ships including surface effect and hydroplaning catamarans
- Expertise in composites and fluid dynamics
- Applicable skills in CFD and FEA to any engineering problem
- Recent addition of combustion and thermodynamic analysis to our portfolio

COMPANY STAFF

- We have experts in composite materials and fluid dynamics on our staff – all analysts have a PhD or MSc
- Our staff have previous experience in industry as analysts for heavy industrial firms or consultancies
- Wide variety of methods and software to solve virtually any problem

COMPANY STAFF

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Glenn Tørå
Structural Analysis & CFD (PhD)

Working area: Fluid dynamics, thermal analysis, offshore cable analysis and structural analysis of composites & metals.

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Magnus Jorstad
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Working area: Structural analysis and computer aided design.

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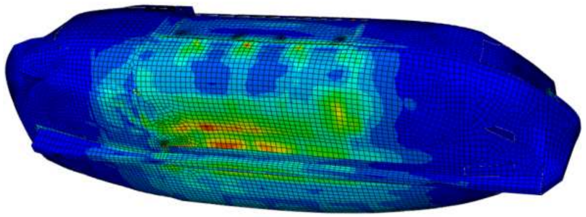
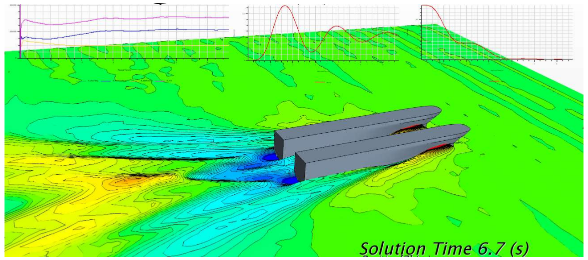
VESSEL DEVELOPMENT SERVICES

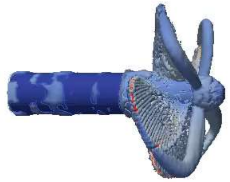
- Vessel structural layout
  - Specialty within composite vessels. Experienced with Catamarans, monohulls, Swaths, SES
  - Weight optimization procedures
  - Cost optimization procedures



- Hydrodynamical calculations
  - Hull geometry. Low drag, stability,
  - Slamming calculations
  - Propeller optimization
  - Prediction of speed/needed shaft ef



REFERENCES



Lavt eneregiforbruk: Skrogmotstand

Friksjonsmotstand ($F_R = C_F \frac{1}{2} \rho V^2 A_s$)

- Avhenger av skrogets våte areal (A_S)
- Blir større jo ruere overflaten til skroget er. F.eks. marin begroing

Bølgemotstand ($F_W = C_R \frac{1}{2} \rho V^2 A_s$)

- Er proporsjonal med kvadratet av farten (V) ved lav hastighet
- Høyere fart gir kraftigere økning av motstand.

Luftmotstand ($F_A = C_A \frac{1}{2} \rho_{air} V^2 A_{air}$)

- Proporsjonal med fartøyets fart ved stillevann

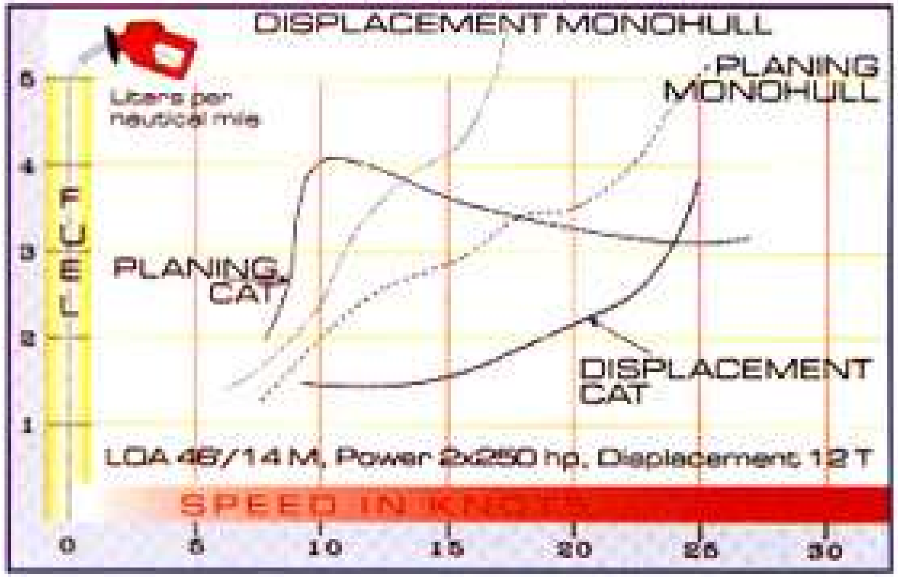
Motstands kraft	% av den totale kraften	
	Høy fart	Lav fart
$F_R = Friksjonsmotstand$	45 %	90%
$F_W = Bølgemotstand$	40%	5%
$F_A = Luftmotstand$	10%	2%
$F_E = Virvelmotstand$	5%	3%

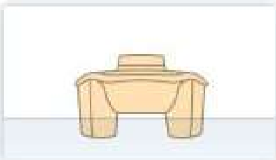
Den totale kraften er gitt ved summen av kreftene

$$F = F_R + F_W + F_A + F_E$$

<u>Jo mindre den totale kraften er, desto mindre energi trengs for å drive fartøyet fremover.</u>

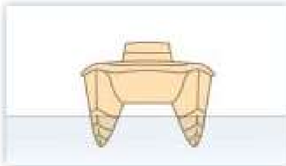
- Typiske motstandskurver
- skrogdesign.
- Et lav energi-skrog må optimaliseres for driftsområdet!





Planing

Semi-displacement

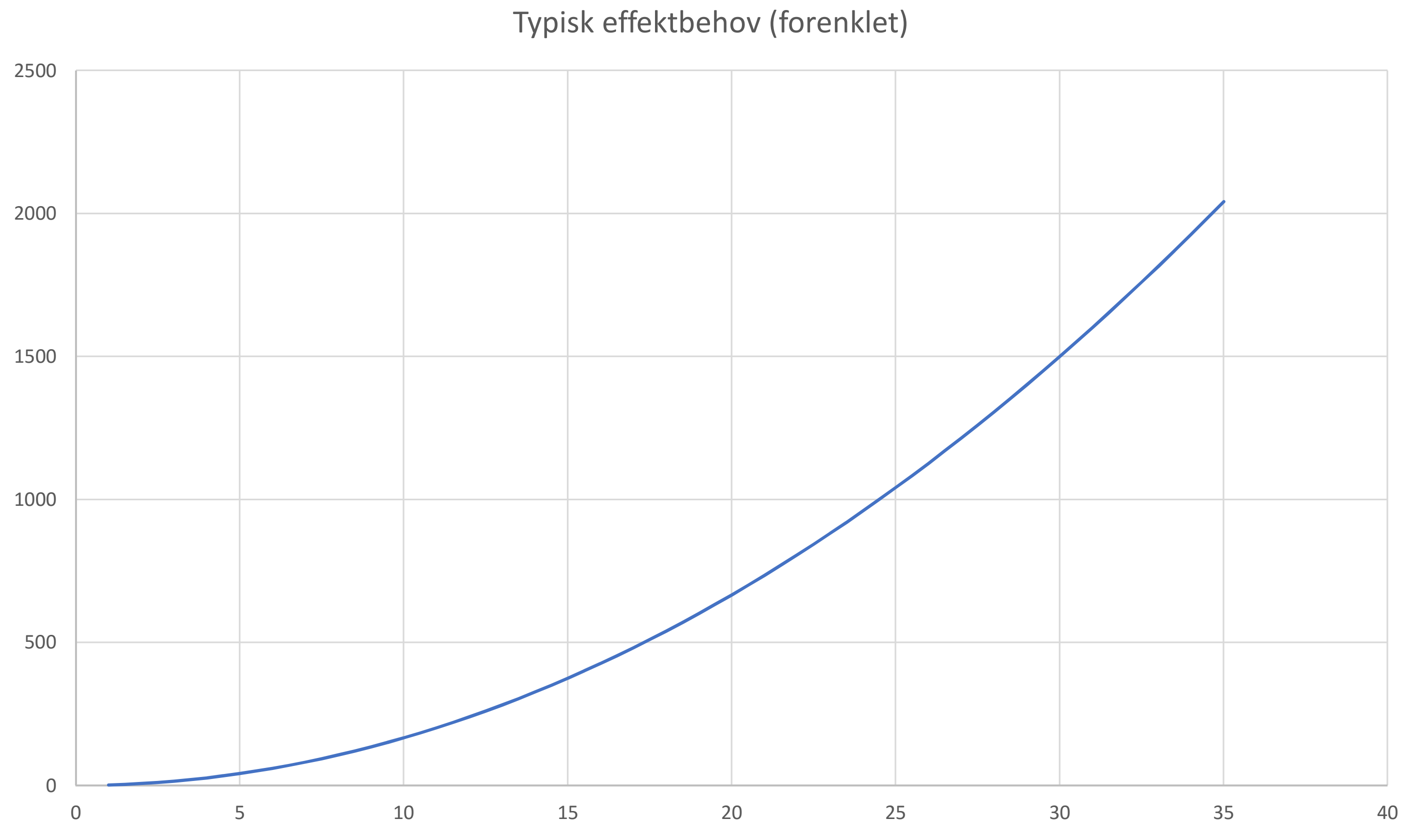


Full Displacement

Skrogmotstand

- Forenklet motstandsdiagram (basert på v^2)
- Utledet fra typisk effektforbruk 30 m katamaran ved 30 knop er 1500 kW

Fart [kn]	Effektbehov [kW]
15	375
20	667
25	1042
30	1500
35	2042



Vekt - Materialvalg

- Karbonfiber gir en vektbesparelse på ca 30% kontra aluminium
- Skrogvekt 30m aluminiumsbåt: 25-30 tonn
- Skrogvekt 30m karbonfiberbåt: 17-21 tonn
- Besparelsen på 8-9 ton gir redusert effektforbruk på ca 10%

Oppsummering – Tiltak for å redusere effekt

- Redusere hastighet
  - Gitt av rute
- Vektoptimalisert skrog
  - 10-20 % redusert effekt
- Optimalisert skrogdesign
  - 10-20 % redusert effekt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THANK YOU FOR YOUR TIME
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