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Shallow Water Changes Everything.

A guide to what changes — and what it costs you.

Why Open-Water Models Break Down in Shallow Water

Performance models calibrated for deep water assume undisturbed flow around the hull. In shallow or restricted water, that assumption fails.

The seabed and canal walls change pressure fields, flow velocities, and resistance in ways that standard corrections don't capture.

If your fleet transits rivers, channels, or ports regularly, your performance baseline may be systematically wrong.

Effect 1 — Squat: The Ship Sinks as It Moves

As speed increases in shallow water, flow under the hull accelerates and pressure drops. The result is sinkage and trim change — squat.

Under-keel clearance can reduce by more than 1.5 m on a loaded tanker at 12 knots. It scales with speed squared, block coefficient, and depth-to-draft ratio.

This is not a safety curiosity. It directly affects power demand and grounding risk.

Effect 2 — Bank Effect: The Canal Pushes Back

A vessel passing close to a canal bank or shallow shoulder experiences asymmetric pressure. The bow is repelled. The stern is attracted.

This hydrodynamic force — governed by blockage ratio, speed, and lateral clearance — adds resistance and constrains the manoeuvring envelope.

It is not a steering issue. It is physics that needs to be quantified, not estimated.

Effect 3 — Critical Speed: A Wall You Cannot Push Through

In shallow water, wave speed is bounded by sqrt(g x h). As a vessel approaches the critical depth Froude number (Fr = 1.0), resistance rises sharply and non-linearly.

Most commercial vessels should stay well below Fr = 0.7. Above that, each additional knot costs disproportionately more power.

The resistance curve becomes the most important constraint on speed selection.

Effect 4 — Wave Pattern Deformation in Confined Water

In open water, bow and stern wave systems spread freely. In canals and narrow channels, they reflect off the banks and interact with the hull.

This increases wave-making resistance and creates trim variations not predicted by calm-water models.

The blockage ratio — the ratio of hull cross-section to channel cross-section — governs how severe this effect becomes.

Effect 5 — Mud and Silt: The Seabed That Moves

Soft fluid mud does not behave like hard sand or rock. A vessel transiting over a fluid mud layer can generate internal waves at the mud-water interface, adding a resistance component that standard shallow-water corrections ignore.

Fluid mud also makes under-keel clearance harder to define: nautical depth, not charted depth, is the operationally relevant number.

How These Effects Show Up in Your Performance Data

Normal performance models can corrects for speed, trim, and fouling — but assumes deep-water conditions. If your vessel regularly transits shallow or restricted waters, shallow-water resistance appears as unexplained speed loss or elevated fuel consumption.

These effects are not just noise. They should be accounted.

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