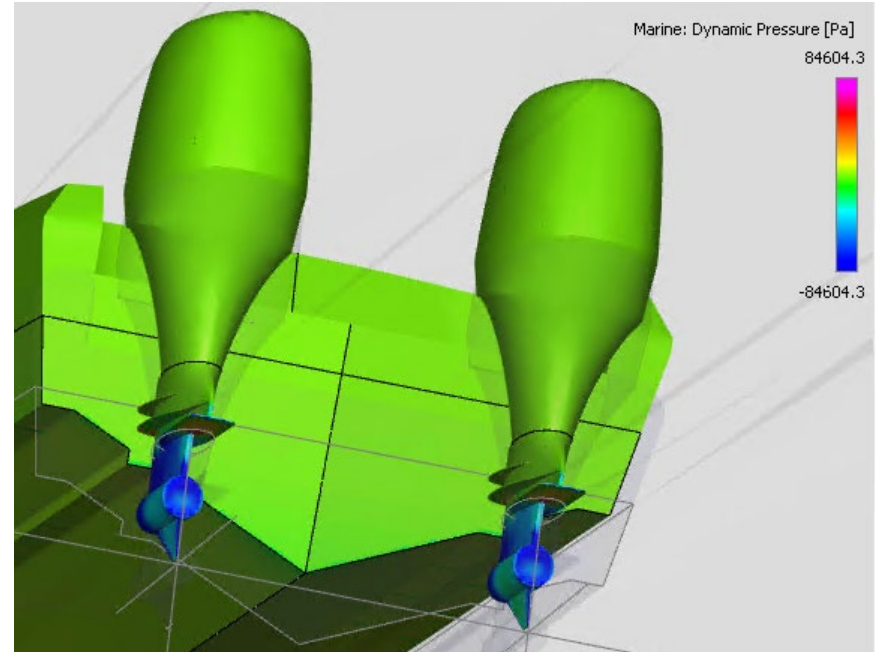


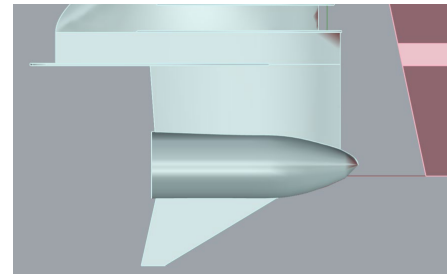
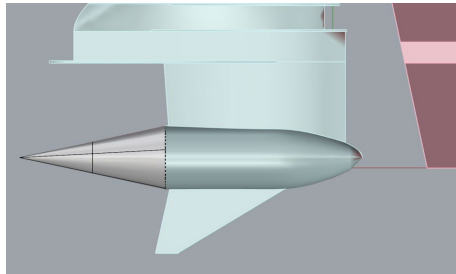
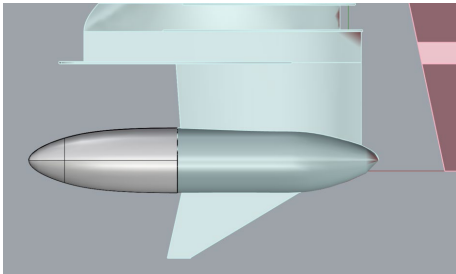
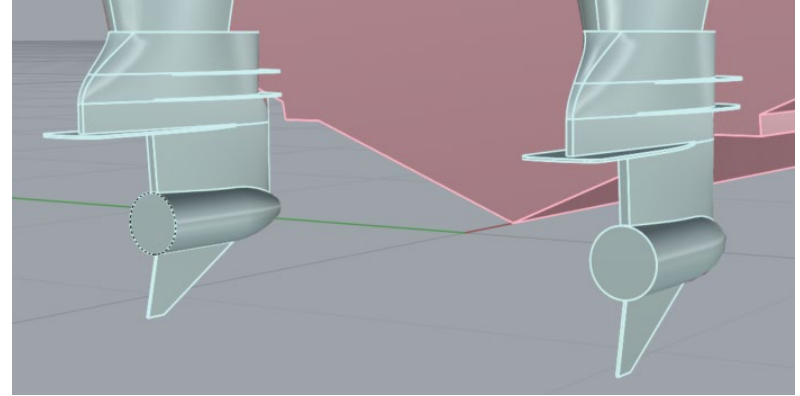
- With the Rhino/Orca3D interface, it's tempting to include a lot of geometric detail in the CFD simulations
- Consider accuracy/complexity/time trade-offs
- OBM lower units are worth considering to capture drag and pitching moment
- Resistance simulations: your usual rules for going from resistance to power will not apply if you include the outboards in CFD
- Self-propelled simulations: the flow disturbance into the propeller does not affect the actuator disk

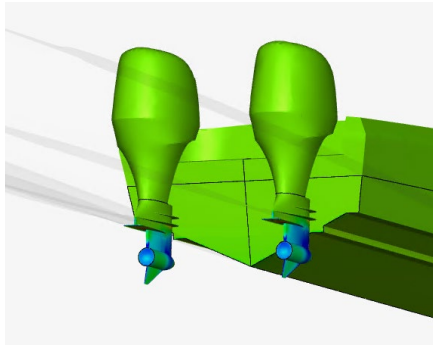
- CAD models from manufacturers tend to be too detailed and need to have openings closed
- The aft face of the gearbox will create an unrealistic low-pressure zone, and therefore unrealistic drag and pitching moment



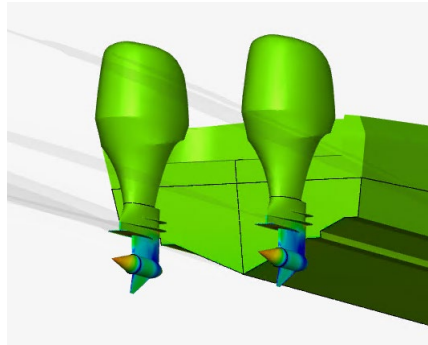
Options to Consider to Improve Results

- Include air/water exhaust through the aft face
- or
- Include a fairing on the transmission hub
 - The fairing should include a cylinder with the same diameter as the propeller hub, extending to the aft face of the propeller hub
 - From there, the fairing should extend aft about 1.5x to 2.0x the diameter of the propeller hub.

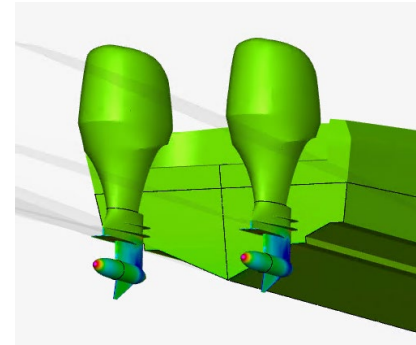




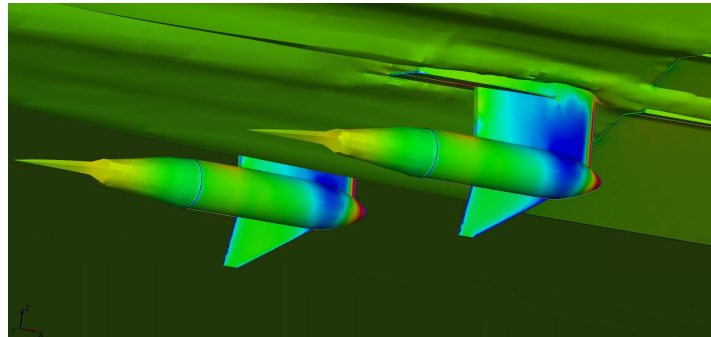
No Fairing



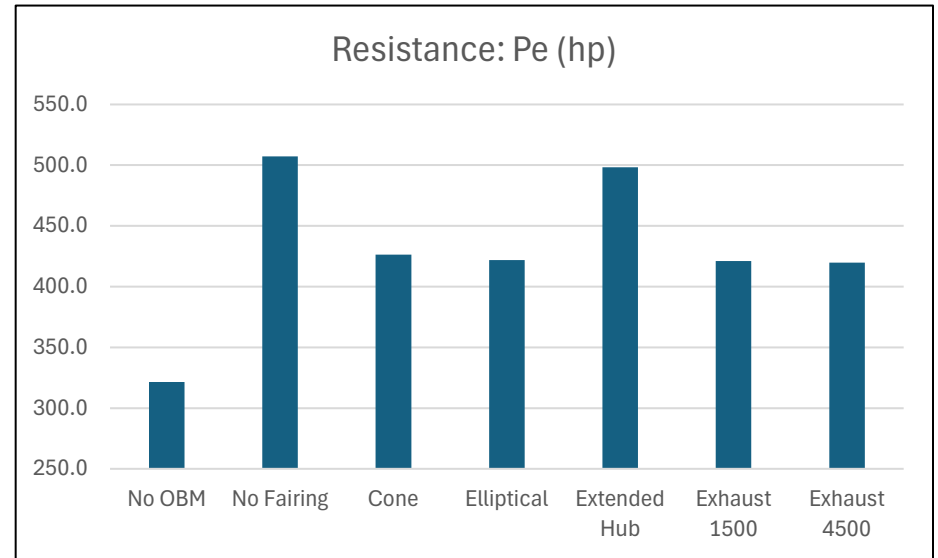
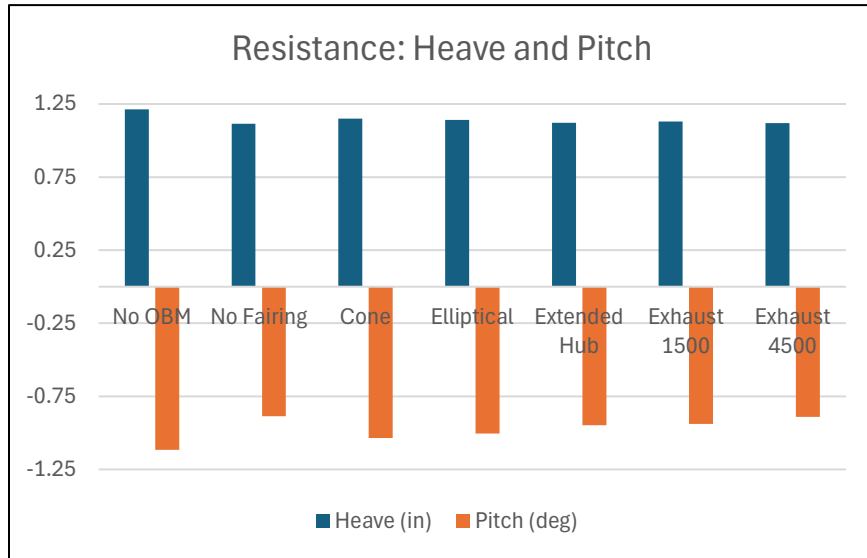
Cone Fairing

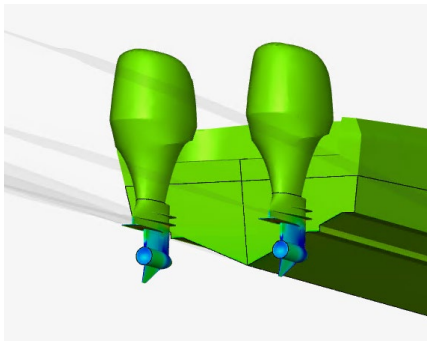


Elliptical Fairing

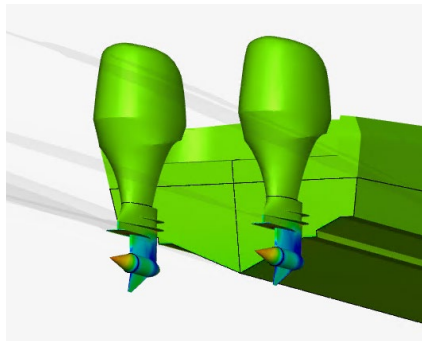


Exhaust (extended hub)

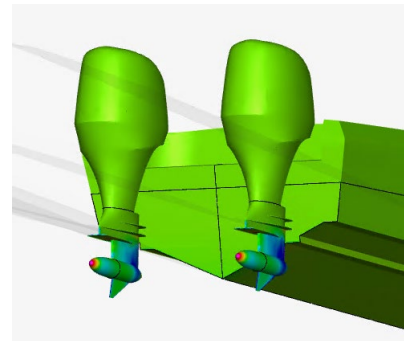




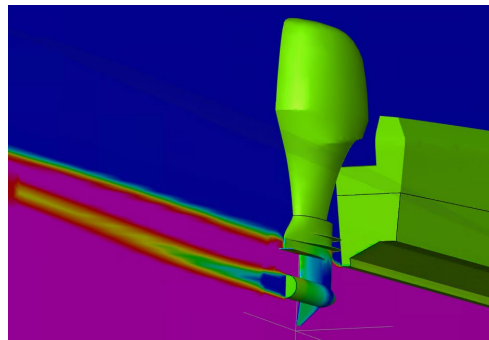
No Fairing



Cone Fairing

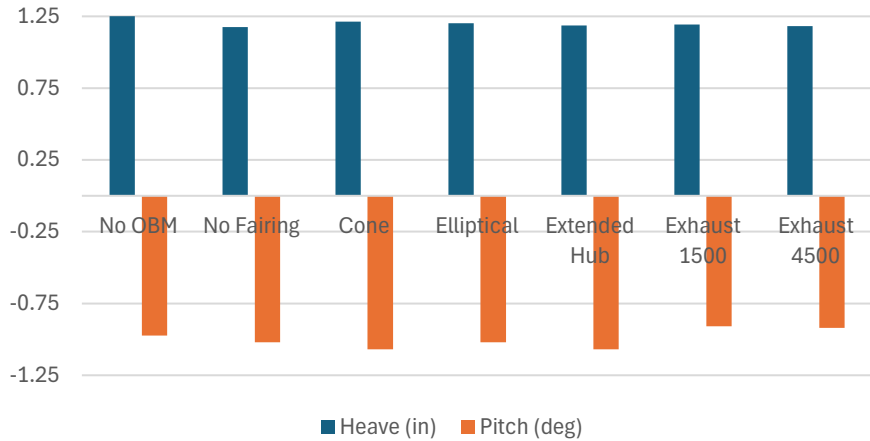


Elliptical Fairing

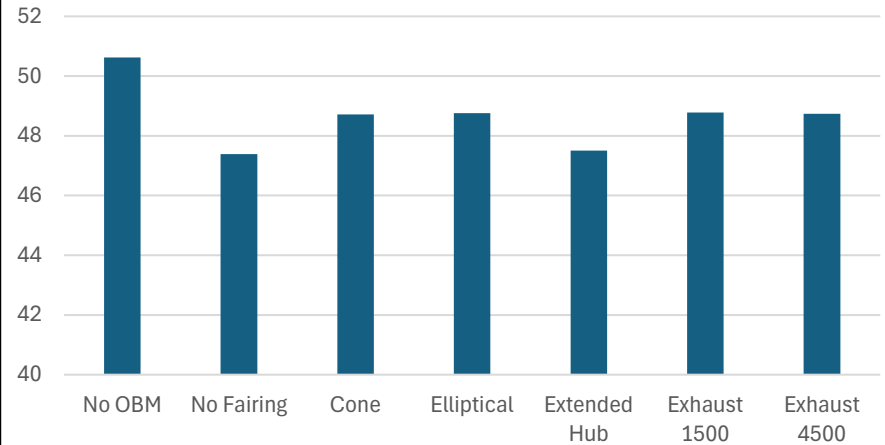


Exhaust with Extended Hub

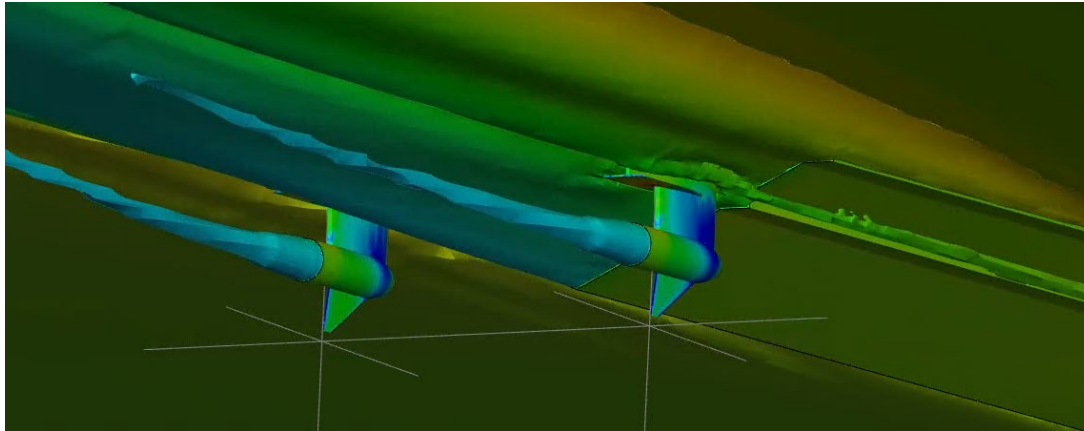
Self-Propelled: Heave and Pitch



Self-Propelled: Speed (kts)

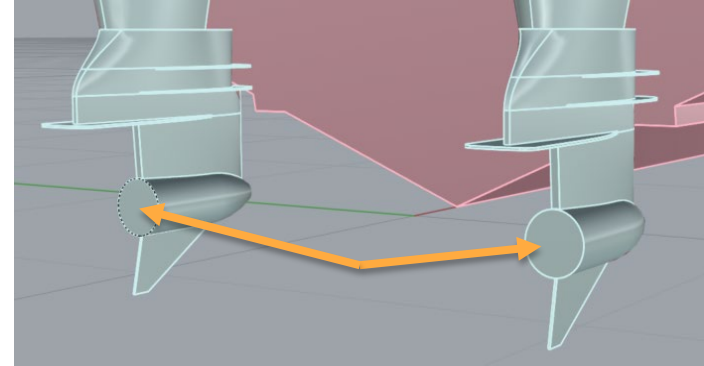


- Decide whether or not to include the lower units
 - Potentially small effect on Pitch and Heave, but significant difference in resistance estimate
 - If using a self-propelled simulation to predict shaft horsepower vs. speed the outboard(s) should be included with some treatment on the aft face of the transmission
- Modeling the exhaust flow might be the most accurate representation, but a simple fairing will give very similar results



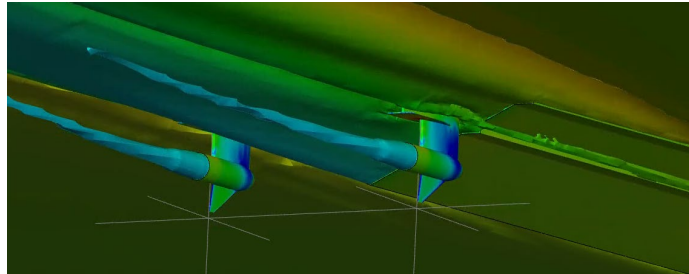
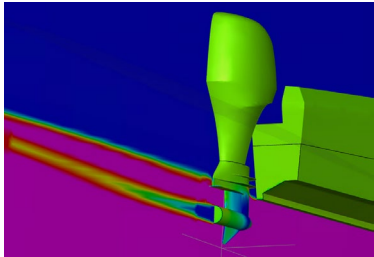
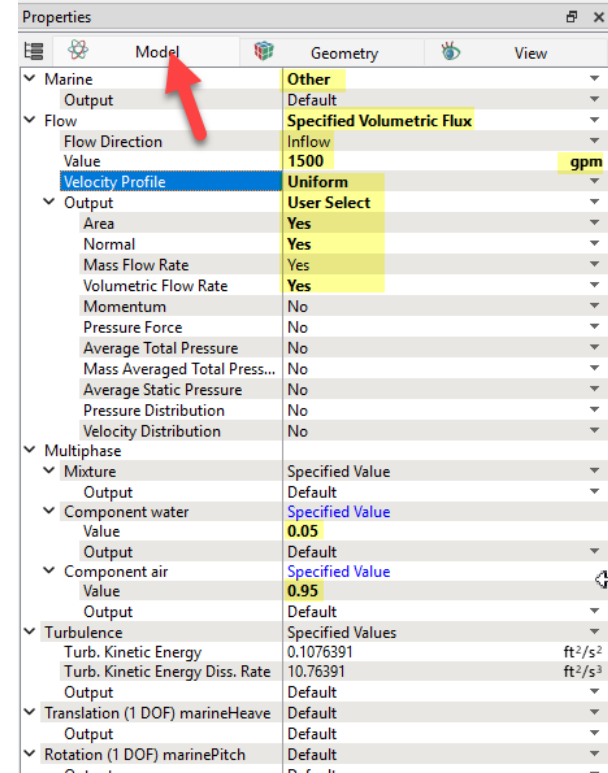
Including Exhaust through the hub

- Adding an air/water mixture to simulate exhaust through the propeller hub involves changing the boundary condition of the aft face of the gearbox.
- When assigning face types in Orca3D, create a face type specifically for this and assign it to those faces.
- If you are doing a self-propelled run, you should first extend the gearcase with a cylinder so that the back face of the cylinder is at the aft face of the actuator disk. Then the exhaust will be released from this face.



Including Exhaust through the hub

- In SimericsMP, select the boundary in the Geometric Entities pane.
- In the Properties pane, select the Model tab.
- Change the settings as shown. In this example, the flow rate is set to 1500 and the exhaust is 5% water and 95% air. Results are not too sensitive to flow rate, as long as it's high enough to clear out the low pressure. You should research the flow for your engine, but as a starting point you can use 15 gpm per hp at WOT. Scale it linearly at lower rpm.
- Be sure to include the units (gpm in this example) by typing them after the number.

The Properties pane shows the following settings:

Category	Property	Value	Units
Marine	Output	Default	
	Other	Specified Volumetric Flux	
Flow	Flow Direction	Inflow	
	Value	1500	gpm
Velocity Profile	Profile	Uniform	
	Output	User Select	
Output	Area	Yes	
	Normal	Yes	
	Mass Flow Rate	Yes	
	Volumetric Flow Rate	Yes	
	Momentum	No	
	Pressure Force	No	
	Average Total Pressure	No	
	Mass Averaged Total Press...	No	
	Average Static Pressure	No	
	Pressure Distribution	No	
	Velocity Distribution	No	
Multiphase	Mixture	Specified Value	
	Output	Default	
Component water	Value	0.05	
	Output	Default	
Component air	Value	0.95	
	Output	Default	
Turbulence	Specified Values		
	Turb. Kinetic Energy	0.1076391	ft ² /s ²
	Turb. Kinetic Energy Diss. Rate	10.76391	ft ² /s ³
Translation (1 DOF) marineHeave	Output	Default	
	Output	Default	
Rotation (1 DOF) marinePitch	Output	Default	
	Output	Default	