Demonstrating the Effect of Vessel Weight Change with PropExpert

A HydroComp Technical Report
Report 126

One interesting application for PropExpert is to demonstrate the effect on performance of an increase in vessel weight. This might be used to evaluate potential increases in engine and propeller load, cavitation or fuel consumption. There are two simple techniques that can be used to show this effect.

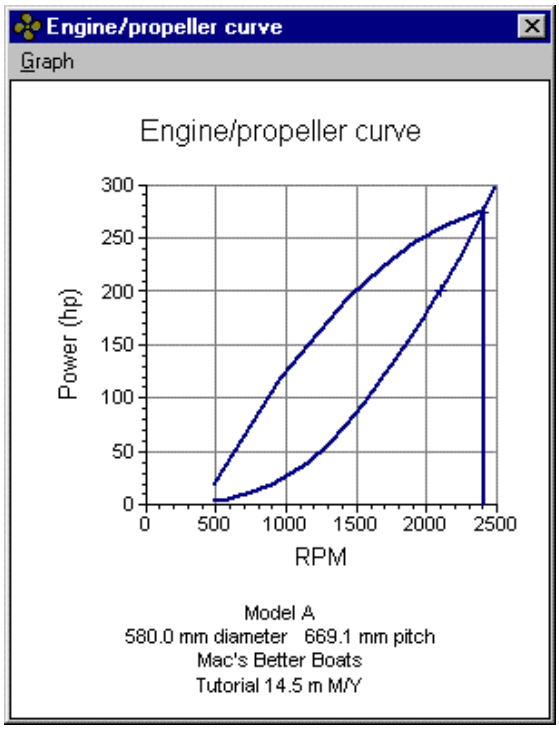
CORRELATION TO A SEA TRIAL

The most accurate way to demonstrate this is to build a new speed prediction for an increased weight from a sea trial of the boat at its expected operating condition. For example, let's say that a builder wants to modify his boat with heavier engines, additional equipment and more fuel, and that this amounts to a weight increase of 20%.

We would first define the vessel for its initial condition, say 14000 kg, with a speed prediction *based on a prior trial* at this condition. Once the sea trial condition has been analyzed in PropExpert - finding its drag, thrust, efficiencies, cavitation - this information can be saved to PropExpert's *Vessel* database.

Then, the weight of the vessel can be increased by 20% and the speed prediction is now *based on a similar vessel* - the original lighter weight trial. This technique "non-dimensionalizes" the basic speed-to- drag parameters so that a proper higher drag is predicted for the increased weight.

Continue with the sizing and system analysis, and you will see the new results, including the reduction in



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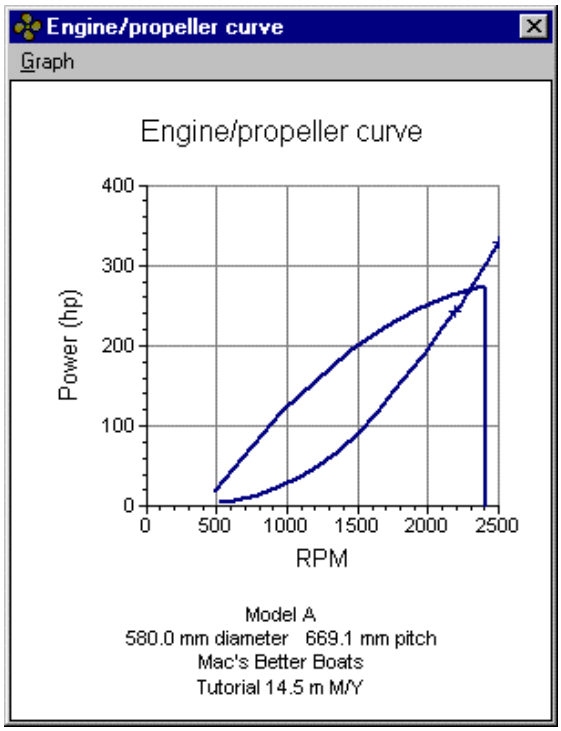

AFTER

achievable top speed and the increase in power and fuel consumption.

The accompanying graphs show a before-and-after example of a 20% weight increase on a planing hull. The top speed of 23 knots was reduced to about 20 knots and the prop curve shows a noticeable shift to the left - indicating potential engine overload.

AN APPROXIMATION

If you are lacking sea trial data or want a very quick look at the effects, you can simply modify the multiplier for the Average hull formula. This will shift the drag curve and you can produce the same kind of results, albeit without the real correlation to the actual vessel.

HydroComp, Inc.
13 Jenkins Court, Suite 200
Durham, NH 03824 USA
Tel (603)868-3344
Fax (603)868-3366
info@hydrocompinc.com
www.hydrocompinc.com