Tips for Predicting Speed with PropExpert

A HydroComp Technical Report
Report 130

OVERVIEW

A propeller selection is based on solving for a proper combination of diameter, pitch, blade area ratio and RPM at a particular "design point". Each design point is described by a design power, design RPM and design speed.

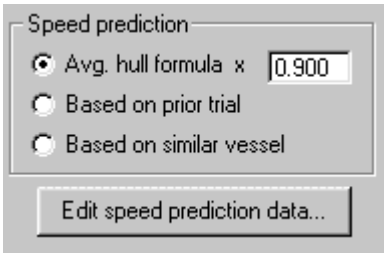
Design power is typically some percentage of the engine's rated power. This percentage of power, usually in the range of 85% to 100%, is sometimes called the %MCR - or the percentage of the engine's Maximum Continuous Rating. Design RPM is almost always the engine's rated RPM, although it may be less if the design is to be based on a cruising speed, for example. Both of these values are based on published engine specifications and are generally well-defined.

The design speed, on the other hand, is often based on a calculated prediction of top speed - or even a guess. One of the biggest challenges of propeller sizing is to determine the correct design speed - particularly with new installations where we know very little about the potential performance of the boat. In many cases, all we know about the boat is an overall length and maybe the weight. A prediction of speed based on such little data needs to be used with an appropriate amount of care. However, there are some strategies that you can use to reliably predict speed. The following are a few suggestions to help you consistently get an accurate speed prediction with PropExpert.

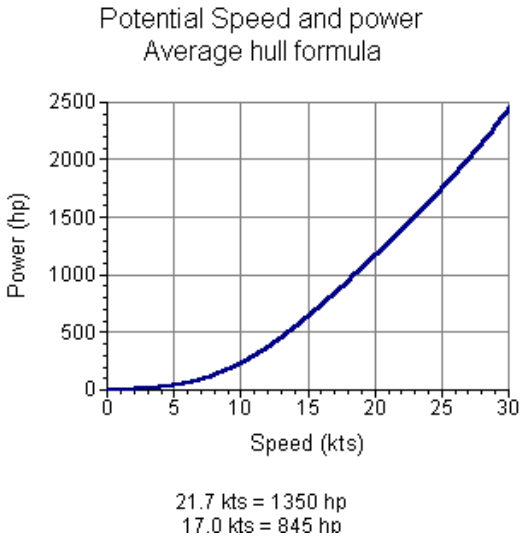
PREDICTING SPEED WITH THE "AVERAGE HULL FORMULA"

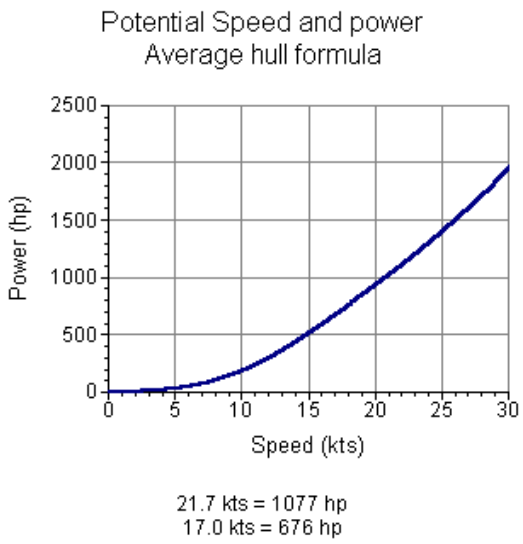
PropExpert has a method - the "Average hull formula" - that helps it predict the speed-power-thrust relationship. It is a simple approach used with simple data. Although we continuously check the method against real boats to find ways to improve the prediction, there will always be boats that are better or worse than any "average" prediction.

If you find that your boats (or your client's boats) are consistently better or worse than "average", there are a few things that you can do to improve the prediction. (In other words, if your boats run faster in service than PropExpert predicts, you can use historical information to help PropExpert predict speed more accurately.) Two ways to alter the prediction are a) to change the vessel weight (see the report on this topic) or b) to apply a multiplier to the "Average hull formula" (see the figure to the right).



The effect of altering the multiplier is to shift the speed-power-thrust curves. (Using a multiplier of 0.900, for example, reduces the power and thrust required at each speed to 90% of the "average hull" value.) Look at the figures below to graphically see the effect of using a multiplier or changing weight. The curve on the left is the "average hull" prediction, the revised curve is on the right. If we were installing 1000 hp, for example, the top speed prediction would change from about 18 knots to about 21 knots. Our design speed would thereby increase, as would the pitch selected by PropExpert.





So how do you determine what multiplier to use? One way is to keep track of actual performance, and go back and review your sizings. A better way, however, is to use sea trial data to develop these figures (see below).

PREDICTING SPEED WITH SEA TRIAL DATA

Sea trial data is generally not available for new boats before delivery, but it should be after delivery and for repowers. Predicting speed for repowers is easy and quite accurate with the "Based on prior trial" option. By entering information about the existing engine, gear and propeller - and the actual speed and RPM at trial - PropExpert can accurately determine the required propeller thrust and vessel drag at the trial speed. (It is critical, of course, that all data be accurate and that the "prior trial" analysis passes all of the data checks.)

The "Average hull" curve is then fit through this point of trial performance. Any new prediction of speed for the repower will then be based on this shifted performance curve. This has the same effect as manually entering a multiplier, but we have let PropExpert calculate a proper multiplier based on actual performance on the water.

You can also use the "prior trial" analysis to evaluate a boat after delivery to help you develop multipliers for future predictions. Make a chart and keep track of how your boats compare against the "average hull". You should find consistent trends before long.

A more thorough approach is to add sea trials that you have evaluated into PropExpert's "vessel database". You can then predict speed "Based on a similar vessel". To use this approach, choose a sea trial of a boat that is as close as possible the new boat. PropExpert will make all of the necessary corrections for length and weight, and will predict speed by looking at both the "average hull formula" and the actual performance of the boat in the database.

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