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### **Propellers**

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efore I get into the intricacies of props, let me tell you a (true) story about props and safety...

One day I was out in the Carquinez Straits doing a lesson with a client on a 36-foot twin-screw motor yacht (his first boat). One of the competencies I teach is Man Overboard Procedures. Exactly how I do this is a trade secret. HA! Anyway, the drill starts and I'm on the stopwatch. The goal is to retrieve the man overboard (MOB) ASAP. For smaller boats I give them 30 seconds. Bigger ones get 60 seconds. Now, I've been doing this long enough to expect just about anything in terms of whether folks driving (any) size vessel are capable of making the right decision or not during this situation. But I was not prepared for what happened next.

The guy stopped the boat as fast as he could (so far so good). I pointed to the MOB and got him oriented to where to steer the vessel. Then, he put that puppy in reverse (both screws) and ran right over the (simulated) MOB. As I looked at him in disbelief from below on the swim platform (wearing a life jacket of course), he asked, "How was that?" I replied: "We need to go over the concept again."

To get the most accurate information about propellers I turned (excuse the pun) to our resident local expert on props, Mr. Steve Thomas of Thomas Marine Propellers (T M P) in Rancho Cordova, for the following descriptions and answers to customers' questions.

## **Definitions**

Some definitions are in order. Prop size is determined by two factors: diameter and pitch. The first numbers on a prop size determine diameter. The second designate the pitch.

#### **Diameter:**

The blade tips and their outmost rotation describe the diameter of a marine propeller. Many propellers have more than one diameter because the blades are not all the same length, which is not good at all because it causes vibration.

#### **Pitch:**

Pitch is the theoretical distance a marine propeller would move forward in one full rotation through water if there were no slippage. To complicate things a bit there is more than one type of pitch that we deal with. There is "Section Pitch" and there is "Local Area Pitch," which will be described later in this article.

#### **Cavitation:**

Cavitation results from water vaporizing or boiling due to extreme lack of pressure on the back (suction side and the pressure side also referred to as the pressure face) of



the propeller blade. Many propellers partially cavitate during normal operation (this is referred to as slippage). Excessive cavitation can cause cavitation burn, metal erosion or pitting on the blade's surface. The best indication that a prop is cavitating is a sharp increase in rpm from the motor. It sounds (and feels) like you just lost the entire prop (lots of noise, little propulsion).

#### **Causes of cavitation include:**

- Dings or sharp corners in the leading edge of the prop.
- A leading edge that is higher than the area behind it.
- Incorrect engine height (outboards).
- Poor polishing or finishing. T M P uses a 3M Scotch-Brite<sup>®</sup> disc for most finishing as the slightly rough surface gives the right amount of surface tension, and this helps performance.
- Too much cup.
- Poor blade design.

#### Cup:

Cup is a localized increase in pitch at the trailing edge of a marine propeller. The Cup will provide varying degrees of lift depending on the amount of cup applied to the propeller. Cup is measured with a



An old prop being modified using the Prop Scan system.

cup gauge in the thousandths of an inch and a number four-cup normally refers to .040 or forty thousandths of an inch cup on the trailing edge. The lift provided by the cup gets your stern up and bow down on a planingtype hull.

#### **Face Camber:**

Simply the "curve" of the blade. Camber will be different in each section of the blade depending on the hull type the propeller is going to be installed on. More camber is normally used on higher performance planing hulls; less camber is used more on workboat or displacement-type hulls. Camber is the theoretical line that divides the pressure face and the suction face of a propeller.

#### **Section Pitch:**

Propellers are divided up into sections from the center out to the tips. Think of the "cross section" drawings that illustrate any number of manufactured products. Each section usually has a different pitch.

#### **Local Area Pitch:**

Each section is then divided into three local areas. Local area pitch one within section seven on blade one is then compared to the same local area on blades two, three and four. This is assuming, of course, that you have a four-bladed prop. Are you confused yet?

# **Questions:**

#### 1. What is Prop Scan<sup>®</sup>?

Prop Scan is a measurement device. Modern machine shops would refer to the Prop Scan system as a



The finished product after extensive modification.

#### CMM or coordinate measuring machine.

2. Why should I have my props checked with Prop Scan?

Prop Scan can accurately illustrate the condition of your propeller to determine if it is operating efficiently. The Prop Scan system generates a report that within a couple minutes of instruction can be read by any boat owner. This report allows the boat owner to make an informed and intelligent decision about whether he or she wants to proceed with a Prop Scan tune up.

3. How much does it cost to have my props analyzed by Prop Scan?

Most Prop Scan-equipped shops will measure and evaluate your props for no charge. All Prop Scan equipped shops are individually owned and policies may vary from shop to shop. T M P will measure your props at no cost when they are brought into the shop.



Steve Thomas, owner of Thomas Marine Propeller, after installation of newly tuned props using Prop Scan system.



# 4. How much is pickup and delivery to boatyard?

T M P does not charge for pick up and delivery to their regular boat yard customers on their regular routes when they do work that generates income. If a set of props is picked up, measured, and delivered back to the boat yard with no work done, T M P charges a fee for the pick up and delivery only.

5. What can I expect in terms of improved performance from Prop Scan?

T M P has seen up to a 22 percent drop in fuel usage with a three and half knot increase in cruising speed. The average runs between five and fifteen percent better fuel usage with one to three knots higher cruising speeds normally at less rpm than previous cruising speeds required.

## **Kevo's Tip:**

Propellers can cause serious or fatal injuries. They are out of sight and sometimes out of mind. Turn off motors when swimmers are in the water around your boat.

A correctly tuned propeller can enhance the performance and efficiency of your vessel. The next time you have your vessel hauled for maintenance, consider having your props scanned by Prop Scan. Steve Thomas can be reached at 916/852-8548 or www.thomasmarinepropeller.com.

Be safe & happy boating!

As always, feedback is appreciated. I can be reached at 925/890-8428 or kevo@yachtsmanmagazine.com. ≥