

Challenge Accepted.



PIRANHA IS PROPELLED TO PERFORM WITH LONG FIBER COMPOSITES

 **AVIENT™** > CASE STUDY: COMPLĚT™ MT LONG FIBER REINFORCED THERMOPLASTICS





LONG FIBER COMPOSITES ADD TOUGHNESS AND DESIGN FLEXIBILITY

THE CHALLENGE

Piranha Propellers of Jackson, California, is the leader in composite marine propellers, serving all major brands of outboard and inboard motors for the recreational boating market. Propellers made from polymer composites have a number of benefits over steel and aluminum alternatives, including improved impact resistance and vibration damping properties.

When a metal propeller blade strikes a submerged obstacle with severe impact forces, it can permanently bend or break. This often causes additional damage to the motor's lower unit, costing up to several thousand dollars to repair. Piranha's unique composite propeller design consists of a center hub with three or four slots for inserting interchangeable blades of varying size and pitch. The first propeller designs used a 60% long glass fiber reinforced nylon 6 composite, and testing on higher horsepower motors was successful. "When I dropped back to lower horsepower two-stroke motors, we started seeing failures," said Brad Stahl, founder of Piranha. "It came down to higher harmonics and vibration in the two-stroke motors."

THE SOLUTION

Avient proactively worked with Piranha to develop the next generation propeller. Complēt™ MT long glass fiber reinforced nylon 6 composite was selected because of the extra durability provided, making this solution ideal for demanding applications like Piranha's propellers. The addition of a toughening agent to the long fiber composite provided improved vibration damping, according to Stahl.

And, because they are formed by injection molding, long fiber reinforced thermoplastics can be easily customized to specific design requirements. "You really have to understand the flexural modulus properties of long fiber composites when designing a propeller,"

said Stahl. "Our designs have to be slightly distorted when molded so that in use, when the blade is experiencing propulsion forces, it has the proper shape to maximize thrust."

THE IMPACT

The main objective of this development work was to provide an alternative to one-piece solid aluminum and stainless-steel props while enabling similar performance. With a Piranha composite propeller, the blades flex and absorb energy from minor impacts. Avient's Complēt MT composite materials enable up to 20% more impact resistance than standard long fiber reinforced materials. At higher impacts, the blades, which have lower shear strength than metal, sacrifice themselves by breaking and releasing energy before transferring damaging forces to the motor's lower unit. Changing a damaged or broken blade is more cost-effective than replacing an entire propeller—or even worse, a lower unit—due to underwater impact.

Interchangeability also allows tuning of propulsion thrust to meet a boat's intended use, for either speed or transporting loads. The innovative blade design of Piranha's Hydrothrust propeller provides 400% more reverse thrust than standard propellers and twice as much as competing metal props. "Our Hydrothrust propeller produced 650 pounds of thrust in reverse with virtually no change in forward performance," said Stahl. Other enhancements Piranha is able to offer include Hydrobites, which are small flow fences on the propeller blades that control water flow and reduce turbulence vibration. "Injection molding with long fiber composites makes it easy to add feature details like our Hydrobites that would be difficult and expensive to produce in metal," said Stahl.

For more information, please visit www.piranha.com.

To learn more, please contact Avient at
1.844.4AVIENT (1.844.428.4368) or visit
www.avient.com.