Marine Jet Technology Corp
www.marinejettech.com

Fast Ship Propulsion

The Current State of the Art

The Fast Ship Propulsion Problem is widely recognized. Submerged propellers become increasingly inefficient and noisy above 30 knots. It is widely accepted that marine jets are currently the most efficient solution between 35 knots and 60 knots.

Conventional marine jets with fixed inlets and fixed nozzles operate efficiently only in a narrow range. If it is designed to operate efficiently at 30 knots, the jet will not be efficient at 40 knots and vice versa. In either case it will not be efficient at lower speeds or in maneuvering at low speeds. This is inconvenient for a US Navy ship, which can't always run at forty knots to maintain efficient marine jet operation.

The technical reasons for this behavior are very well understood. In brief, conventional marine jet propulsion systems waste power, which could otherwise be converted into thrust force useful in propelling the ship. In particular, they waste power in four very well understood ways:

1. The jet pump requires the motor to run at high rpm most of the time, like driving your car down the freeway in second gear. You can just hear it humming away. It is easy to see why the motor wastes power, but ironically the pump wastes power at the higher rpm, too.

2. Much of the power in the water entering the inlet is wasted at most speeds, so it cannot be recovered as useful thrust force. The drag on the vessel from bringing this water up to the vessel speed is unavoidable. It takes a bigger motor and more fuel to replace this wasted power and to overcome this drag. Hence, "There has never been a marine propulsion problem that a bigger motor wouldn't solve."

3. The power that is recovered in the inlet to the pump forces more water through the system as the vessel speed increases. The pump only operates at peak efficiency at only one water flow, so it can only operate at peak efficiency at only one vessel speed. At all other speeds it wastes power, which is another reason for a bigger motor and a bigger pump to waste even more power.

4. Marine propulsion results from moving water in the opposite direction. "For every action there is an equal and opposite reaction," as old Isaac Newton was fond of saying. Unfortunately, both the action and the reaction consume power. The total power is divided between the two. The power consumed in moving the water in the opposite direction is wasted in terms of propelling the vessel. Some wasted power in the jet is unavoidable, but it would be nice to minimize it along with the other three power-wasting behaviors.

The Propulsion Revolution

Fortunately, this complex problem has a relatively simple solution. Like most everything else these days, this solution relies on an electronic brain. In this case, the electronic brain is programmed to manage all of the power wasting behaviors of the marine jet propulsion system. In fact, it is remarkably successful at simultaneously minimizing the power wasted in all four of the behaviors. For the first time, a marine propulsion system uses a smaller motor to go faster.

How is this possible? Well, in brief, the electronic brain (1) adjusts a variable-pitch propeller pump to run the motor at its most efficient rpm, (2) adjusts an inlet slide to most efficiently recover power from the water coming on board, (3) adjusts the variable nozzle to keep the most efficient water flow through the pump, and (4) in the process maintains approximately the ideal water flow for minimizing the power wasted in the jet.

All of these functions are matters of mathematical certainty, which incorporate hydraulic principles that have been well understood for 150 years. The actual mechanics are also tried and proven. The variable pitch pump, for example, has been in common commercial use since the early 1900s in sizes that would be useful in propelling US Navy ships. Variable pitch propellers, very much like the one used in the pump described here, have been in common use in marine propulsion for many years. All of the other mechanical components and hydraulic functions described here are even older.

It is the integration of these elements under the control of an electronic brain that results in this propulsion revolution.

The question for further research here is not whether the first ship based on this design will be more efficient over a range of speeds between 20 knots and 50 knots than any propeller or conventional jet. That is a matter of high certainty based on hydraulic laboratory data in the public domain. Rather the question for research here is how much faster and how much farther can Navy ships go using this technology. A reasonable goal is a ship that operates as efficiently as any other at 20 knots, but also has the capability to operate efficiently up to 60 knots when operational circumstances require.

Of course, any ship based on this technology will naturally enjoy shallow draft, unprecedented maneuverability, and the ability to operate efficiently either lightly or heavily laden at any speed.

For these reasons, this technology is unavoidably on the critical path to fast combatant ships. It is also unavoidably on the critical path to fast combatant craft, particularly those with hulls designed to mitigate shock. In fact, this system is ideal for propelling such hull designs, where conventional marine jets struggle to get up on plane, make noise, and waste fuel.

Patent Pending