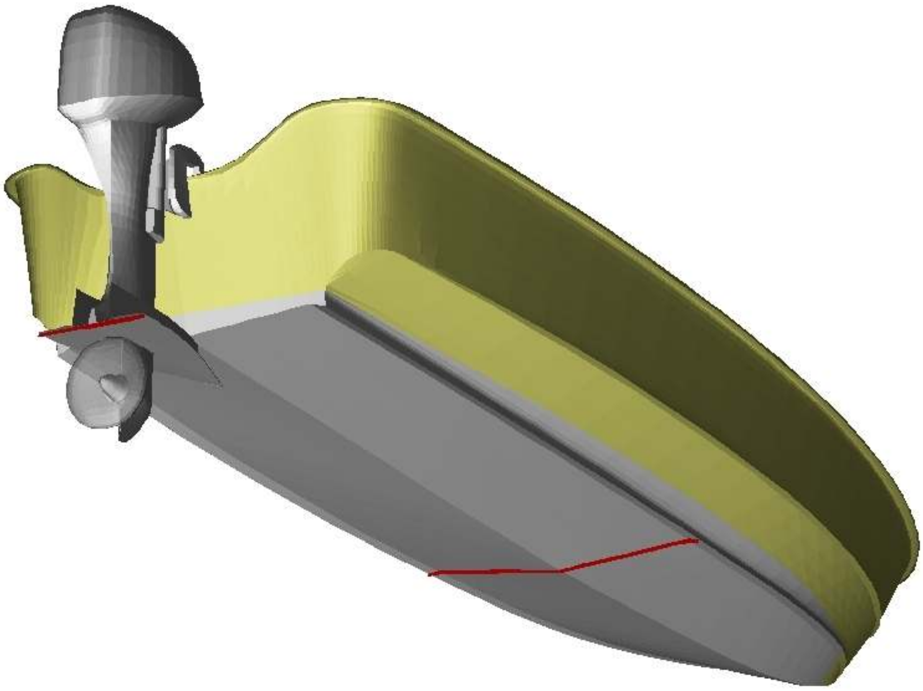
PLANING POWERBOATS WITH

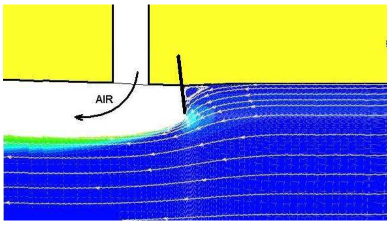
MIDSHIP INTERCEPTOR AND AFT STABILIZER



The purpose of this presentation is to show an alternative for a more efficient powerboat than the commonly used V-bottom boat.

The result of the investigations shows that speed can be increased by 25% with the same power or that the power can be decreased by 40%.

The solution is to put an interceptor amidships to create high lift on a small surface and in that way to reduce the frictional drag.



An interceptor is a small vertical plate that is pushed down under the planing surface. This creates a high lift pressure in front of the interceptor.

An interceptor at the trailing edge of a foil has been used since 1971 in another context.

Vaxholm den 30 September 2008
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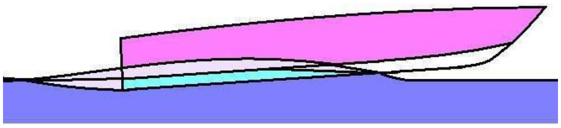
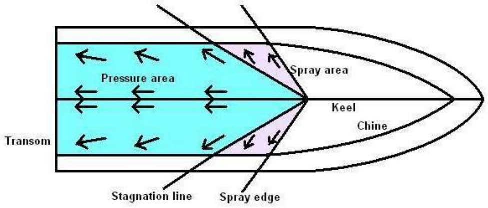
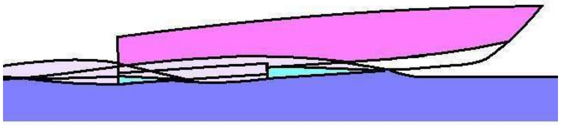


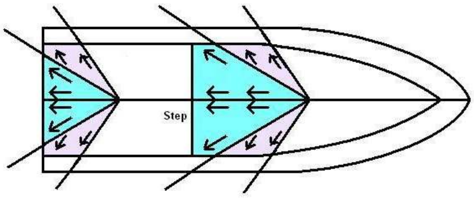
A planing powerboat has a great area of friction. At low speeds, when there is only static lift, this hull also has an unnecessarily great wave drag.

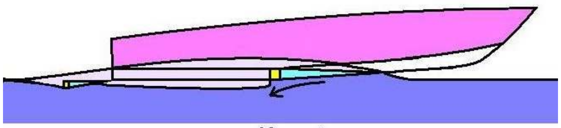


A normal V-bottom is efficient at just one speed with one load and one centre of pressure. Also, it is difficult to achieve the optimum centre of pressure while maintaining longitudinal stability.

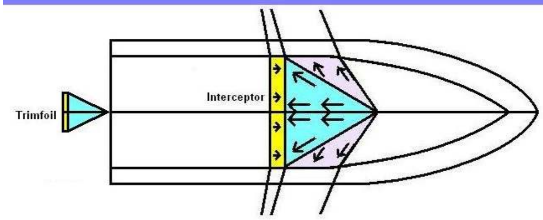


To reduce the frictional area and get control over the centre of pressure the stepped boat can be chosen. But this alternative has high drag at low speed due the suction aft of the step. In the same way as the normal V-bottom boat, the stepped boat has just one load and one speed at which it is efficient.



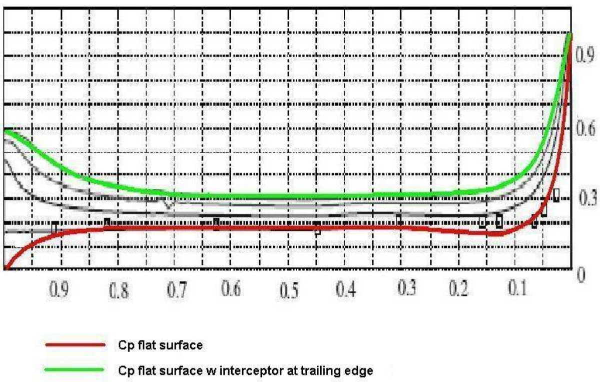


A boat with a midship interceptor has the smallest frictional area in the higher speed region. The aft body can be designed in such way that the drag at low speeds also is low.



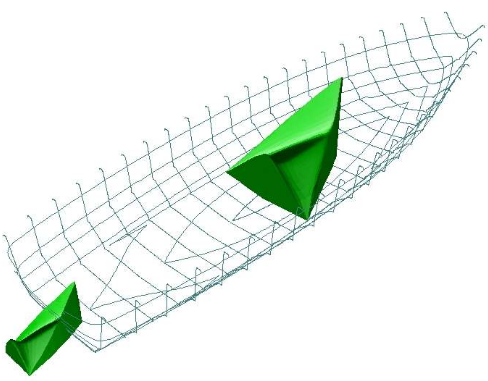
At high speed the drag will be about the same as on a boat with foils, but a boat with a midship interceptor is much simpler and sturdier.

The distribution of pressure on a flat surface has a pronounced peak behind the leading edge and practically no pressure at the trailing edge. The centre of pressure is normally located one fourth of the wetted length from the leading edge.

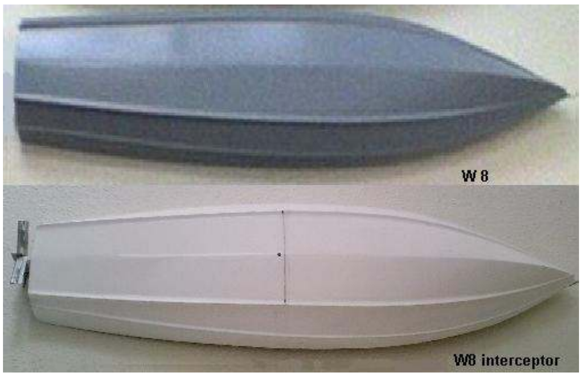


The surface with an interceptor at the trailing edge has the highest pressure at the trailing edge. The centre of pressure is located aft of the middle of the (short) wetted length.

The lifting force from the planing surface and from the interceptor are additive. Together they produce about 80% more lift than usual.

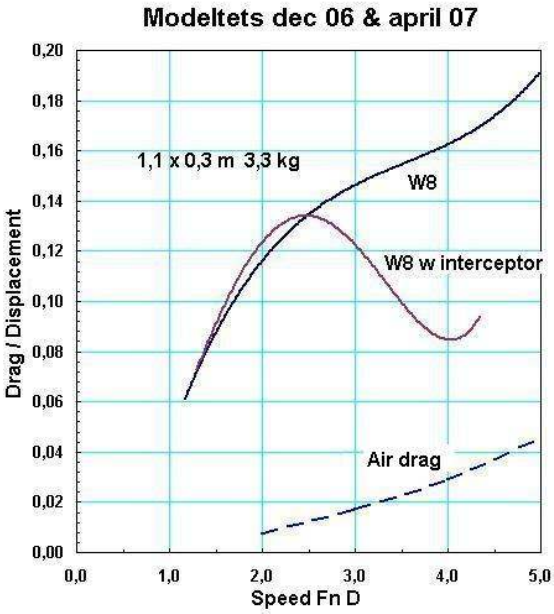


The lift force on a bottom with an adjustable midship interceptor and an aft trim surface, also with an interceptor, can be controlled by trimming the hull so that a minimum of drag is created over a great range of load and speed.



During the winter 2006 and spring 2007 some simple tests was accomplished. These tests confirmed the presumptions presented above.

Only two of the best models are shown here. The boats are double chined and have an optimised beam over the lower chine to create a minimum drag and a soft ride in waves. By making the planing surface as narrow as possible the deadrise can be reduced to increase the lifting power and retain the same soft ride as that of the deep V-bottom.



0,3 ton	5,0 kn	10	15	20	25
1,0 ton	6,0 kn	12	18	24	28
5,0 ton	8,0 kn	16	24	32	40
10 ton	9,0 kn	18	27	37	45

The test results are here shown in dimensionless figures. These figures can be recalculated into all speeds and loads. Above that the results can be compared with those of other investigations.

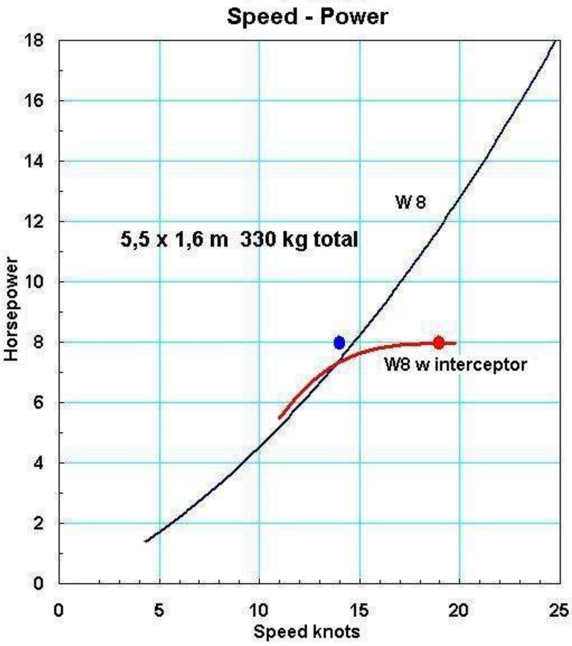
According to these tests a small boat with a total weight of 300 kg will be most efficient at 20 knots and a boat of five metric tons at 32 knots.

The calculated air drag is the same for both boats. As shown in the figure, the air drag is a significant part of the total drag on an easily driven boat.

The results from these tests were so convincing that the next step was to carry out a full-scale test.

In October 2007 a reconstruction of a boat was carried out. The original hull is a Whisper 55, an efficient boat for rowing or for use with a small engine.

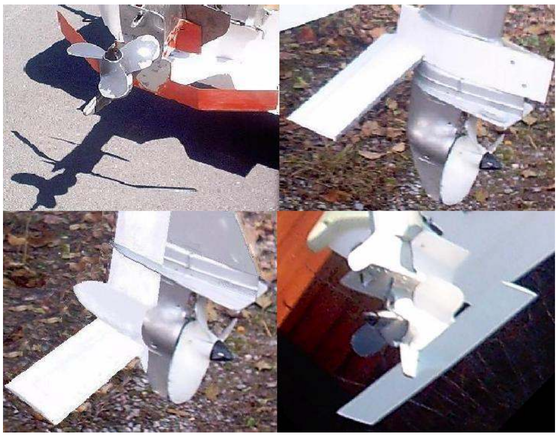
The bottom was lowered a few centimetres amidships to create a marked knuckle at the adjustable interceptor. Aft of that knuckle is a ventilation pipe located to provide air under the aft body at low speeds before the interceptor creates full lift.



As expected, the first trials showed that the speed could be increased by about 25% with the same engine power.

To get as fair a comparison as possible, an engine with long shaft and only eight horsepower was chosen. This is the maximum engine power that the original Whisper 55 was designed for.

The first trim foil showed that it was hard to get proper balance in all directions. This was an unexpected drawback. In the same way it was hard to find a proper propeller for this small engine suitable for the new higher speeds.



Many different trim foils were tested during the spring and summer of 2008. Some of them created great disturbance over the propeller. Others had too small a lift force as they came too close to the surface. Some foils created instability in all directions.

At last the original idea was tested. This solution has the same principle as the forward lifting surface. The present alternative is a flat plate with an interceptor on the trailing edge. This plate is mounted on the “anticavitating” plate.

This solution proved to be the simplest and most efficient. By this means an acceptable balance in all conditions was achieved. Furthermore, this permitted a clean flow through the propeller thus increasing the efficiency of the interceptor.

This report is just a short description of very limited tests on only one boat. The result shows that the technology works as expected. It also shows that small changes can have great consequences.

Future investigations ought to be done to clarify the limits and possibilities of this technology and to answer the following questions.

Which deadrise and beam are most effective and efficient in different sea conditions?

Which is the optimum transverse and longitunal pressure distribution at different interceptor depths at keel and chine, and at different speeds and loads?

Which is the best weight distribution between the two planing surfaces?

Where should the propeller be located to be most efficient?

Can this technology be expanded into a wider speed regime?

I will always be open to more detailed information about this and other developmental projects I am working with.

Welcome

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