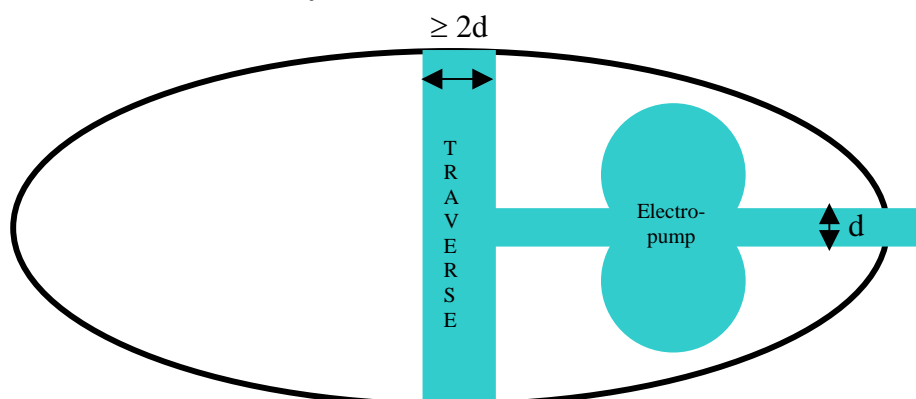


Experimental proof (one more !) of the dissymmetry of a propulsion by reciprocating waterjet

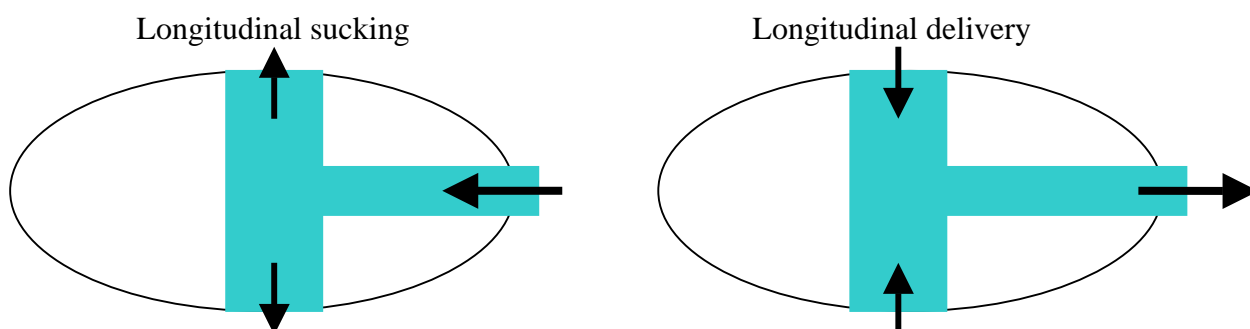
By Jean-Yves

Purpose of the experiment : to show that sucking water on the bow of a ship has a negligible impact; though a jet backward propels.

Principle of the foresee assembly :



- A symmetrical hull (according to transverse and longitudinal axis) to avoid endless discussions.
- Electric pump located in the middle of a pipe of ID $\ll d$.
- Cross-over with Internal diameter equal to more than $2xd$. Thus, on one hand the pressure drops upstream and downstream will be nearly unchanged. And on the other hand, the speeds inside the cross-over will be very low and the resulting forces being opposed they will cancel each other.



Measurement : boat velocity in both cases.

Results :

Test conditions are described in appendix.

Measurement of the boat velocity when propelled by jet. Result: 72mm/s.

Measurement of the boat velocity during sucking. Result not measurable. Velocity lower than 1mm/min.

Knowing that the thrust evolves as the square of the velocity, one can calculate the ratio between pushing and pulling forces. $\eta \leq \left(\frac{1}{60 \times 72}\right)^2 = \frac{1}{18662400}$; i.e. the pulling force (when sucking) is roughly 20 millions times weaker than the pushing one.

Conclusion : This experiment confirms the theory. Sucking ahead has a negligible effect, and the related assumptions used in other documents are justified.

Appendix

Photo of the (so-called) ship.



One can see on the left the batteries compartment,
Lower in the middle of the hull, the cross-over,
In black, the pump,
And on the right the pipe used either for sucking or for delivery.

The little piece of copper which connects the bends (for sucking and for delivery) is only a mechanical support.

Measurement of the pump flow. Result: one little in 64 seconds.

Wetted surface of the hull: 591cm²

Internal diameter of the pipe: 4.4mm

Internal diameter of the cross-over: 10mm

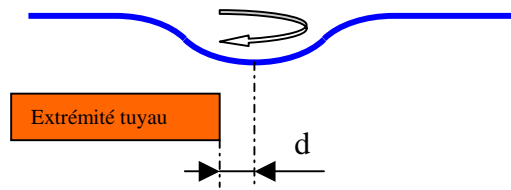
The measurement of the propulsion velocity took place outside on a bench that is 4m long. The first meter was used for initial acceleration, and the last one for stopping. The real measurement was done on the central 2 meters. To eliminate some eventual wind influence, tests were run in both ways.

The first sucking measurement took place on the same bench. The velocity was seen low, but influenced by the wind. The boat was going ahead or astern by some centimeters. New test were run indoor with a shorter and wider bench. Transversally the hull was kept at the centre of the tank by means of two slides (with a play of some millimeters). When the pump was energized, the vibrations got rid of the light permanent friction forces.



Note : Vortex at the suction side

Test conditions and lighting allowed us to observe the water surface and the movement of some particles just above the suction side.



A small basin was created at the water free surface. Its centre was approximately 1.5mm ahead of the pipe. The water was rotating clockwise. (We are in the northern hemisphere).