Low-Cost Experiments in STEM Education

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Physics at Sea

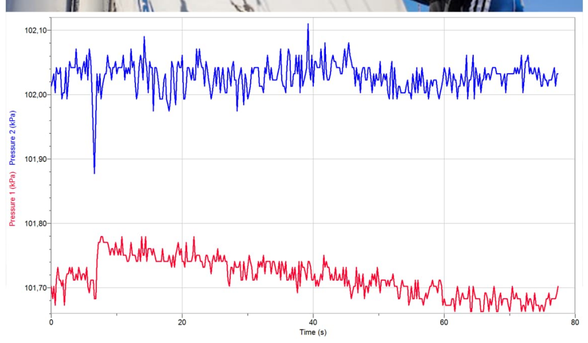
Laboratory experiments

About

Project is part of physics course held in collaboration with two high schools in Turku, TSYK and Turun Klassillinen lukio.

The main idea in this course is to do physics experiments that are connected to sea and sailing.

Usually, one or two new experiments are invented at sea based on the ideas of the students.



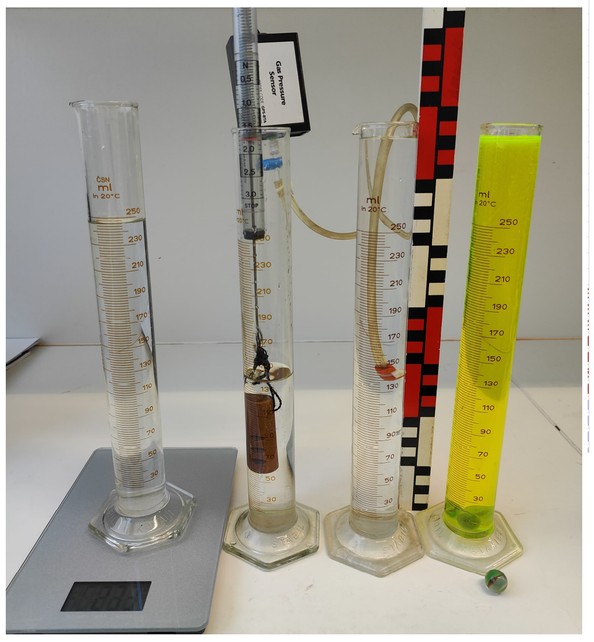
Lift and Drag

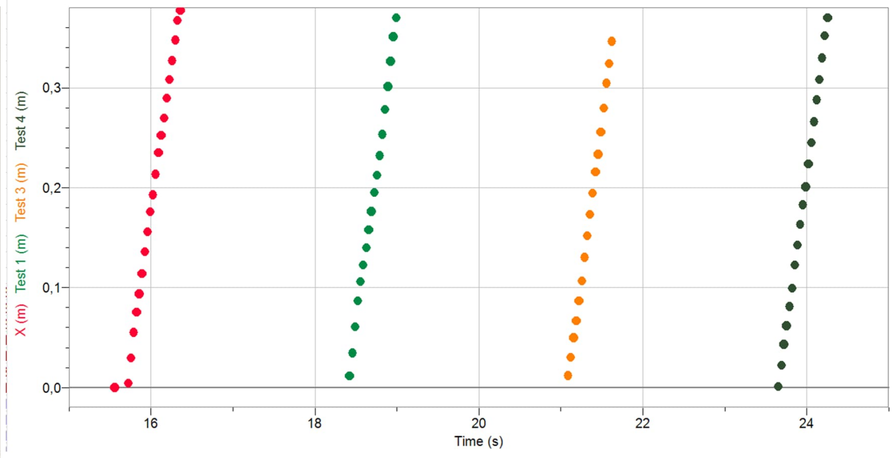
Lift is a key quantity regarding the velocity of the ship. Lift can be explained by momentum and collisions of air particles to sail or by pressure difference on a sail. In experiment on board the pressure difference was used to make approximation on force affecting on sails.

Pendulum in a Boat

Mathematical pendulum was attached on a rail inside the cabin ceiling. Periodic movement was captured by camera and analyzed with suitable software.

Results show that oscillations are independent from the periodic movement of the vessel. In the image below, both the pendulum in a boat and equivalent laboratory pendulum is shown.

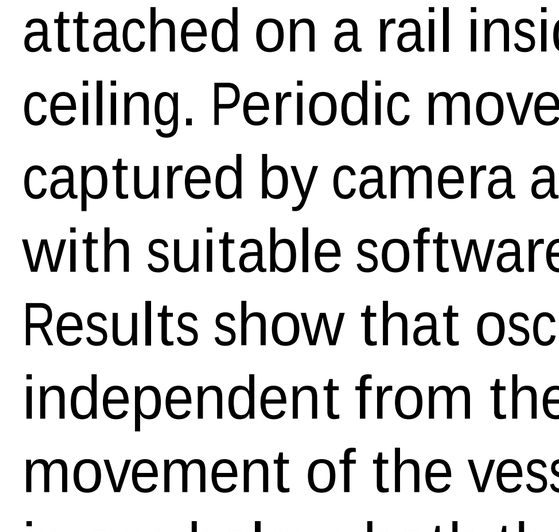


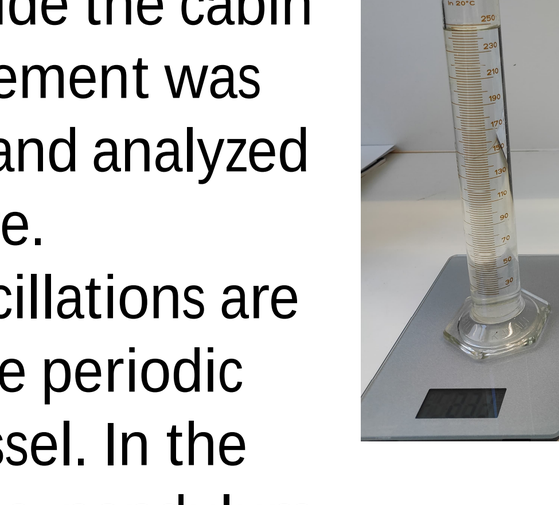


Density of the liquid

Measurements were done with well known methods, but also by determine the terminal velocity of a sphere.

In above figure, there is four different tests. This was done by video analyzing method. Four tests were made, and tests show good coherence and results are discussed at site.





Conclusion: Sea and sailing offers wide range of physical phenomenon, which usually can be transferred to laboratory for simplified experiments.