# COMBUSTION OF THE FUEL–AIR MIXTURE IN THE VOLUME OVER THE FREE WATER SURFACE

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**Abstract:** A physical and mathematical model and a computer program has been developed for three-dimensional calculation of premixed combustion of gaseous fuel–air mixture in a volume above the free surface of water. To test the predictive capability of the model, a laboratory setup was designed and manufactured, including a transparent cylindrical tube with one closed end, a water pool with an optical access, as well as power, ignition, control, and data acquisition systems. A series of experiments on combustion of a stoichiometric propane–air mixture in a volume above a free surface of water is carried out at the setup. The experimental conditions are reproduced in the calculations. The calculation results are compared with the experiment in terms of the shape and position of the flame front and the interphase boundary at different time instants, time histories of pressure in the volume above the free surface of water and the propulsive force acting on the closed end of the tube, the dynamics of displacement of the interphase boundary, and the dependence of the apparent flame velocity on time. In all cases, satisfactory qualitative and quantitative agreement has been obtained between calculations and measurements. The model is further planned to be adapted to the tasks of designing a gas cavity with combustion under the bottom of the boat.

**Keywords:** gas combustion above a free surface of water; fuel–air mixture; semiconfined volume; mathematical model; experiment; buoyancy force; motion of the phase boundary; gas cavity with combustion under the bottom of the boat

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