On the possibility of using an explosive device of a combined type for the ice cover destruction

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The article considers a possibility of using a triple action explosive device of the combined type (shaped, kinetic and high explosive) for ice cover destruction with formation of a specified size opening in ice (polynya). At the first stage, the action of the cumulative jet in the ice barrier results in the open-end hole and zones of weakened ice strength around it. In the second stage, a hard, non-deformable cylindrical container with a pointed head, containing a charge of the explosive, penetrates the ice weakened by the hole and the zones around it. In the third stage, a container with an explosive charge passes through the ice thickness into the water and is blown up at an optimum distance from the bottom edge of the ice. Based on numerical and engineering calculations the size of the opening was estimated as a function of the mass of the explosive charge, the thickness of the ice, and the depth of charge dropping into the water. Depth and diameter of the hole in the ice barrier and the size of the zones of weakened ice strength when it is pierced by a cumulative jet were estimated depending on the design of the shaped charge. The depth of solid cylindrical body penetration into the solid and weakened by the hole ice was estimated depending on the mass, diameter, shape of the head and speed of the moving body as well as the limiting penetration rate, penetration time and maximum overloads when penetrating bodies were of different designs. The results of calculations are compared with the results of laboratory experiments.

Keywords: *explosive device, shaped charge, cumulative jet, high explosive charge, explosive, solid cylindrical body, ice, penetration, destruction*

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