Hydrodynamic aspects in DecarbonICE^{TM} - an innovative maritime carbon capture and storage solution

Type of project: MSc

Project description:
The maritime industry is now developing solutions that will allow it to reach the IMO 2050 target. Since the world fleet is expected to grow in the period until 2050, the 2050 target will translate into an approximately 70% CO_2 emission reduction on a ship by ship basis. The decarbonICE™ technology (https://mdc.center/decarbonice) is a marine carbon capture and storage technology. The technology can be applied on new vessels as well as retro-fitted on existing vessels. The technology will allow for continued use of present fuels and ship designs, with the addition of a cryogenic plant on board each vessel to capture CO_2 and other greenhouse gas (GHG) emissions in a dry ice. The dry ice will be formed into slender blocks. These blocks will be discharged to the sea during normal operations, and they will descend to the bottom of the oceans, where the CO2 will be permanently stored in seabed sediments. The decarbonICE™ solution will be applicable for international shipping operating in water depths of more than 500 meters, and it will lead to CO2 emissions reductions in the order of 80% on a ship by ship basis.
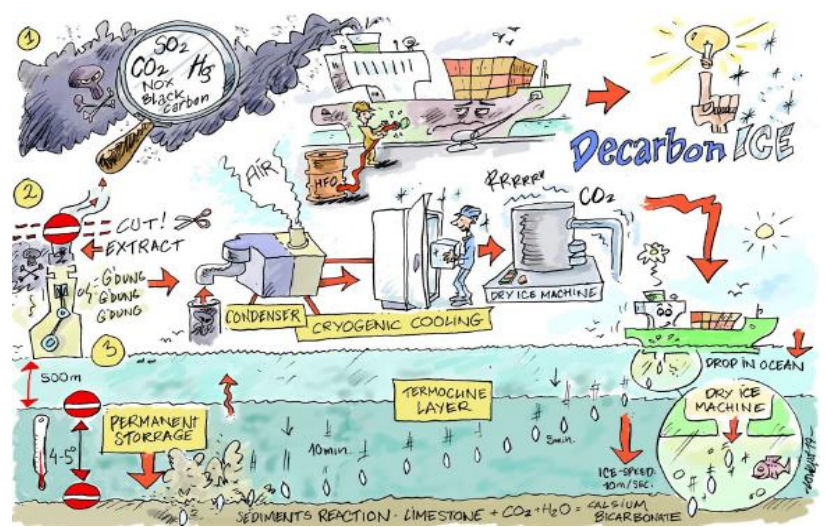
The proposed project will focus on the hydrodynamic aspects in decarbonICE™ technology, which are essential to define the applicability regime of this new technology. That includes, among others,

(1) Developing accurate and efficient model to simulate the the descent and impact of the GHG dry ice from it leaves the ship until it reaches the seabed sediment layer.
(2) Optimization of the size, shape and entry angle of the GHG dry ice blocks.
(3) Calculation of hydrodynamic loads on the GHG dry ice blocks which are important for the strength check of the blocks.

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