Thawing out the challenges of ice loads

Ice loads on the propellers of pods are the focus of one of the "Cooperative Research Ships" working groups. Aiming to develop a mathematical model to determine the ice loads on podded propulsors, this particular project faced some specific challenges. Report outlines this innovative Work. Gerco Hagesteijn & Joris Brouwer, ghagesteijn@marin.nl

The CRS ProPolar work group is a continuation of the Loads on Pods work group, which addressed the hydrodynamic loads of podded propulsors (see MARIN Report No. 95).

To determine the ice loads on a propeller, the model test setup had to be capable of measuring the impact of an ice sheet or ice piece on an 18 cm propeller by means of measuring the highly dynamic forces and torque in all directions. To achieve this, one single lightweight aluminium blade was mounted on the six-component force transducer used in Loads on Pods. The other propeller blades were mounted directly on the shaft.

The ice tests were carried out in cooperation with AARC of Helsinki in its hi-tech ice tank. Since ice testing is a costly business, highly detailed preparations were carried out to ensure a successful measuring campaign during the two ice days that were available.

Ice tests With the ice pod test setup the following test series were carried out: - Milling through a 4 cm thick ice sheet - Milling through a 40 cm thick ice ridge

Synchronised, high-speed video recordings were made from some tests, which gave a unique insight into the propeller ice contact and the corresponding loads. With this test series, which were measured by MARIN, an excellent data set was successfully obtained on unsteady propeller ice loads. The newly developed model test setup elements have proven their merits and are more than ready to be applied in other ice projects. —



High-speed video still of propeller entering ice ridge