Study on Improvement in Ramming Performance of Antarctic Icebreaker

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ABSTRACT

Japanese Antarctic research icebreaker has voyaged in Antarctic severe ice condition every year for transportation of cargoes and scientists to Syowa station and for Antarctic expedition. In the voyage, the icebreaker breaks through ice fields by many times of ramming when she encounters a heavy ice and snow condition. The ramming performance has often influenced on the voyage schedule. In the development of Japan’s new Antarctic research icebreaker, importance for the ramming performance was recognized, and several effective technologies were introduced into the new icebreaker to improve the performance. This paper describes the advance evaluation of the improvement measures.

KEY WORDS: Icebreaker; Antarctic; ramming; snow; friction; water flushing; stainless.

INTRODUCTION

Japan’s new icebreaker Shirase (Fig.1) will take up her first mission for the Antarctic observation and transportation in November 2009. The construction of the new icebreaker had been ordered by the Japan Ministry of Defense from Universal Shipbuilding Corporation. The icebreaker has been named Shirase, which is the same name as the late icebreaker, and delivered in May 2009. Since Japan’s Antarctic research expedition began in 1956, Japanese Antarctic research icebreakers have been taking important roles for half a century on the transportation of cargoes and scientists to Syowa station (Fig.2) and on the observation for Antarctic offshore. Japanese icebreakers, Soya (1956–1962), Fuji (1965–1983) and the late Shirase (1983–2008) had engaged in those missions. In the transition, Japanese icebreakers have been advanced in their icebreaking capability, ice-strengthened construction, propulsion plant system, transportation capacity and so on. Through the voyage experiences of the former icebreakers, importance of ramming performance has been remarkable. The icebreaker breaks through sea ice by many times of ramming when she encounters a heavy ice condition like thick hummock ice. Average ship speed falls significantly by repeatedly running ahead and astern. An advancement of ramming performance is expected to lead to shortening and stabilization of voyage schedule. In the development of the new icebreaker Shirase, several effective technologies were introduced into the icebreaker to improve the ramming performance. One is an improvement of ship bow form. In ramming operation, the icebreaker...