AIS-Satellite data used for Arctic Trafficability studies in the NE-Passage

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ABSTRACT

In July 2010 a Norwegian research satellite for ship surveillance in Arctic areas, the AISSat-1, was launched. Aalesund University College has had access to data from the satellite for study of ship traffic in the Northeast Passage (Northern Sea Route / NSR) during the navigation season in 2010. The traffic and icebreaker operations to the Yenisei river have also been studied throughout the winter 2010/11. Even if this type of satellite surveillance has limitation with regard to continuity and saturation, especially in lower latitudes, the satellite has proved to be a very good tool for surveillance in remote high latitude areas. Coupled with ice information and vessel data the AIS-sat can be of significant value for better understanding of ice distribution, vessel performance, as well as for logistic and economical studies. In this paper the result of the study will be presented and discussed.

KEY WORDS: AIS; ice-navigation; icebreaking; satellite; surveillance; Northeast Passage; Northern Sea route.

INTRODUCTION

Automatic Identification System (AIS) has become an important tool for trafficability studies and risk assessment in coastal areas. The range has been limited by the VHF-band, or approximately line of sight – typical 30 – 40nm. The remoteness and lack of infrastructure in the Arctic and hidden fjord-areas in Norway make such studies very difficult and costly with conventional ground based systems. The Norwegian Coastal Administration (NCA) and the Norwegian Defense Research Establishment has therefore, in June 2010, launched an AIS-satellite in a low polar orbit for this purpose. The satellite which is considered as an experimental research satellite has already indicated very promising performance in the Arctic. Aalesund University College has in cooperation with NCA correlated satellite based ice imagery in studies of ship traffic and ship performance in ice covered waters. In September 2010 for the first time AIS-data was used to track a merchant vessel in transit from Northern Norway to China via the NSR off the Siberian Coast. The downloaded data provided ID, speed, course, etc. of the vessel and the escorting icebreakers. This information was combined with available ice-information from various sources. During the winter of 2010/11 Aalesund University College has successfully used the satellite data to study trafficability and performance of ships navigating in various ice conditions in the different regions of the Arctic. The AIS system is based on the principle that every ship transmits the message in a dedicated slot in a limited time window. This means that the system can be saturated if an extremely high number of massages are received. In a conventional ship based system with VHF – line of sight coverage, such saturation can hardly occur. The situation will be different if the signals are received on the AIS-satellite in low polar orbit. When the satellite passes over areas with high number of ships the receiver will be saturated and much information consequently excluded or not updated. Experience from our tests did not identify saturation as a problem in the arctic areas. The paper presents details on the arctic performance of the satellite as well as example of traffic flow and ship performance when operating in ice covered waters along the coast of Siberia. The study gives also to some extent an indicator on the interpretation of the available ice-charts.

AUTOMATIC IDENTIFICATION SYSTEM (AIS)

The Automatic Identification System (AIS) for ships was introduced by the International Maritime Organization (IMO) for all SOLAS vessels (> 500GT) in the years before 2008. In addition some states have introduced carriage requirement for the fishing fleet and smaller vessels. AIS is basically an anti collision system for vessels at sea but do also have a limited communication link for messaging. Vessels are broadcasting messages (position, speed, course, cargo, destination, etc.) on two channels, 87 and 88 in the maritime VHF band. Update rate is based on status of operation. High speed crafts transmit primary data every two seconds, while vessels at anchor transmits every three minutes. Messages can be received on neighbouring vessels and shore stations within VHF range – line of sight or approximately 30nm. Capacity and automatic transmission and allocation of slots are based on the fact of relatively limited range and number of vessels within range. Despite the relatively weak signal the AIS messages can also be received by a VHF receiver in space for wide area observation. The IMO requirement accept information indicated on a small display on the AIS unit (Fig. 1), but most vessels display the data on an electronic chart system (ECDIS).