



AISSat-1

– Norway's first observation satellite

For the first time, Norway is making use of a Norwegian satellite for managing resources, environment and safety at sea in the High North.

AISSat-1 was developed at FFI and was launched from India on July 12th, 2010.

Organising vessel traffic.

The Automatic Identification System (AIS) is a messaging system for tracking and management of vessel traffic. All vessels greater than 300 gross tons are required to carry an AIS transponder broadcasting key vessel data such as identity, speed and heading to other vessels in their vicinity. The transponder includes a receiver for messages from neighbouring vessels, thereby allowing vessel traffic to be plotted on electronic charts or radar screens. AIS messages are broadcast on two dedicated channels in the maritime VHF band with a typical range of approximately 30-40 nautical miles. The average message rate is 10 messages/minute.

Many coastal states, including Norway, have deployed AIS base stations along their coastlines to receive AIS messages from coastal ship traffic. The Norwegian Coastal Administration maintains a coastal AIS network, providing continuous real time vessel traffic data. The information is shared with operational military headquarters

and the Coast Guard. Further offshore, the data collection is less complete, relying largely on Coast Guard ships and maritime patrol aircraft.

AIS in space

The advantage of receiving AIS messages on board a satellite in space is the wide coverage. The satellite can therefore act as an efficient observer in space, covering large ocean areas. Early studies performed by FFI suggested that the AIS signal is sufficiently powerful to be received by a satellite in low Earth orbit below 1000 km.

A receiver with a wide field of view, however, will have some difficulties receiving AIS messages from dense vessel traffic areas. This relates in particular to areas in the North Sea, the western parts of the Mediterranean, the West coast of the USA and areas in Asia. The AIS signal wavelength is rather long and prevents the use of directional VHF antennas on board the small low-cost satellites (nano-satellites).

The AISSat concept

FFI has investigated how AIS can contribute to improved Maritime Situational Awareness in the High North and along the coast. The investigation shows that the vessel traffic density is such that a satellite in low Earth orbit equipped with an AIS receiver can monitor the traffic volume in these waters. This then formed the basis for a

study on a small national satellite for observation of maritime activities in Norwegian ocean areas.

The study started in 2005 as a joint venture between the Norwegian Space Centre, Kongsberg Seatex AS and FFI. The results were very encouraging, particularly for observations in the High North. The Norwegian Space Centre decided to fund a demonstration satellite and FFI was selected to manage the project and named the satellite AISSat-1.

AISSat-1

The AIS receiver was developed by Kongsberg Seatex AS. It is a software defined radio that can be reprogrammed in space to optimise its performance based on experience accumulated during the mission.

Following a careful evaluation, a small satellite platform shaped as a 20 cm wide cube was selected for AISSat-1. This platform had already been developed by the Space Flight Laboratory at the University of Toronto, thereby resulting in the lowest cost satellite available for the mission.

AISSat-1 was manufactured, tested and prepared for flight by the Space Flight Laboratory. The satellite was launched by an Indian rocket to a circular polar orbit 630 km above

the Earth on June 12th, 2010 at 05:52 local Norwegian time.

An AISSat-1 ground station was established at Kongsberg Satellite Services' premises at Spitsbergen. A Mission Control Centre was built at FFI to operate the satellite and to control its state of health. AISSat-1 forwards AIS messages to the ground station in real time when within view of the Svalbard ground station. It can also store and forward AIS messages from other ocean areas around the globe. This is useful for showing how global vessel activity relates to activities in local Norwegian waters.

Results

The launch of AISSat-1 was a complete success, and the satellite delivered AIS messages to the control centre already during the very first day in orbit.

The first AIS messages immediately showed that AISSat-1 improves the Maritime Situational Awareness in Norwegian areas. In a single 10 minute satellite pass, the maritime traffic situation in the entire High North was mapped and reported.

Usefulness

The Norwegian Coastal Administration is the primary receiver of AIS messages, and distributes the data to other government agencies.



▲ FFI Principle scientist Bjorn T Narheim, initiator of the AISSat-1 project, with Canadian colleagues Alexander Beattie (left) and Daniel Kekez (right). Foto:FFI

AIS messages are now routinely used by Norwegian authorities to improve maritime traffic and resource management in the High North. AISSat-1 will support and improve the ocean surveillance currently performed by Coast Guard vessels and aircraft. Vessel movements can now be followed more systematically. The wide coverage also enables support to search and rescue operations in these areas. Together with data from radar satellites, AISSat-1 can also contribute to apprehension of ships engaged in illegal dumping of hazardous waste.

Mission success

As a demonstration mission, AISSat-1 is already a success. The satellite was designed, built and launched on schedule and within the allocated budget.

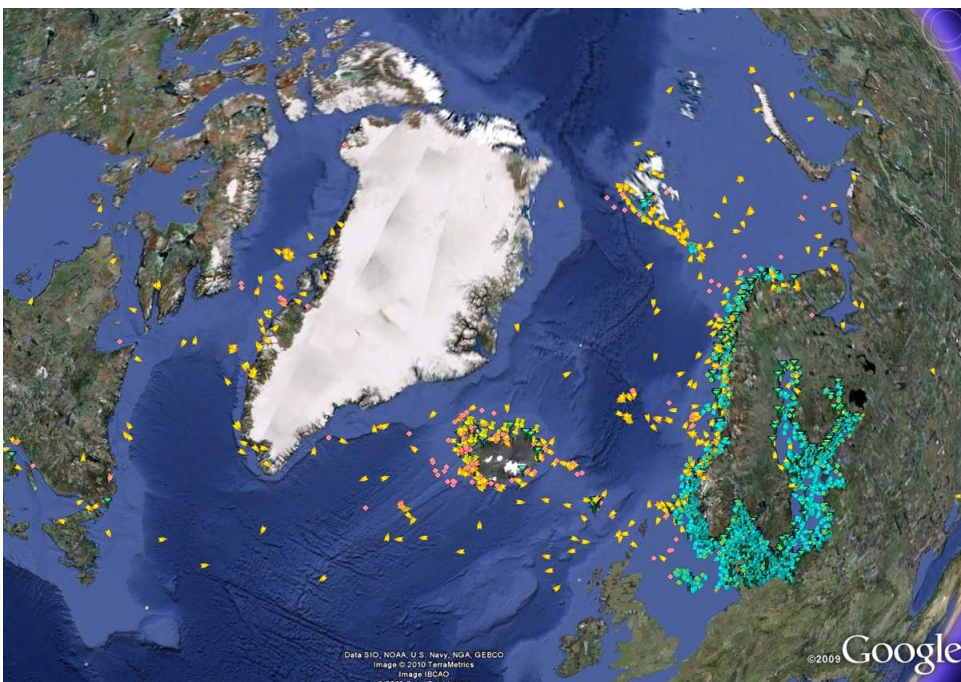
The AISSat-1 project has also achieved significant international recognition. The European Space Agency has already involved FFI and Norwegian industry in several studies on a satellite based AIS system for Europe.

AISSat-2 is currently being built and is scheduled for launch in the second half of 2012. The two satellites will then take Norway one step closer to a more operational system with increased capacity and enhanced reliability.

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▲ The very first AIS data from AISSat-1. The yellow and pink symbols show the contribution of AIS data from AISSat-1 together with existing AIS data from the Norwegian coastal network (green). Illustration: Google/FFI