

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Small Space Science Missions (2)

Author: Mr. Ulrik Wilken Rasmussen
Aalborg University, Denmark, wilken@space.aau.dk

Mr. Troels Laursen
Aalborg University, Denmark, trlau@space.aau.dk

Mr. Nikolaj Bisgaard Pedersen
Aalborg University, Denmark, markem@space.aau.dk

Prof. Jesper A. Larsen
Aalborg University, Denmark, jal@es.aau.dk

EVALUATING AIS DATA QUALITY FOR SPACE BASED SHIP MONITORING USING THE
AAUSAT3 PROTOTYPE**Abstract**

Purpose: In the development of an Automatic Identification System (AIS) receiver for the AAUSAT3 CubeSat, it is important to estimate the quality of AIS reception. AIS is an addition to the radar systems used by ships, in an attempt to improve safety at sea. The system broadcasts messages autonomously to nearby ships with a transmission rate based on the ships navigational information. AIS uses a TDMA scheme to coordinate communication and avoid package collisions with other AIS transponders. The maritime authority uses land based ground stations to monitor ships around coastlines. AIS reception requires line-of-sight, which is difficult to ensure in rough environments because the installation and maintenances can be difficult. This has introduced the idea of using satellite based monitoring of these areas. The objective for the student satellite, AAUSAT3, is to evaluate the possibility of receiving AIS messages from a low orbit CubeSat. The satellites field of view covers multiple TDMA zones, which makes it necessary to estimate the loss rate caused by collisions when receiving messages across transmissions zones.

Methodology: To estimate the quality of the AIS receiver developed for AAUSAT3, a method has been developed to analyse the AIS messages ship wise. The method builds on estimating the different transmission rates, by analysing the AIS messages according to the ITU-R1371-3 standard. It uses this estimation to extrapolate the missing AIS messages of the ships and calculate the packet loss percentage for each ship.

Results: A prototype of AAUSAT3 was tested on a balloon flight in northern Sweden in October 2009 as part of the REXUS/BEXUS programme. More than 25000 correct AIS messages were received during the 3 hour test from both the Norwegian sea and the Gulf of Bothnia. The data received from the balloon flight contained 339 unique MMSI numbers. By using the developed model it was found that the AIS message loss was 84,1% in average.

Conclusion: Based on the experience from the prototype of AAUSAT3, the message loss is not only caused by collisions in the transmission but also low signal strength and different quality of the antennas on ships. The method indicates that satellite based AIS monitoring is plausible, even with a transmission loss this high. The developed method can furthermore be used to estimate other AIS transponders quality.