

## VHF radio coverage considerations

### Description of the (graduate) internship

Saab Technologies develop, produce and implement vessel traffic systems (VTS) for customers all over the world. One of the technologies used to create situational awareness and also to communicate between vessels is AIS (automatic identification system). Saab is a global leader in AIS technology and produces a range of stationary and mobile AIS equipment.

AIS is an automatic tracking system that uses transceivers on ships and/or shore based positions. Information provided by AIS equipment, such as unique identification, position, course, and speed, can be displayed on a screen or an electronic chart display and information system (ECDIS) and be used to trigger alarms. AIS can also transmit (small) text messages.

AIS uses radio transmissions in the marine VHF radio band in the frequency range between 156 and 174 MHz. Marine voice communications and digital selective calling (DSC) use the same marine VHF radio band.

Good reception of VHF transmissions is key to successful AIS operation. The first requirement to a well functioning AIS (and VHF voice communications system) is: "*Provide VHF radio coverage between ships and shore within a specified area*".

Good VHF coverage in turn requires line of sight (LoS) between a ship and a shore based station. Mounting of VHF antennas in a high place increases range. For the shore based station, if radar is available at the same site, Saab will prefer to mount the VHF antennas high up in the radar tower. This tower is often erected at a high location itself.

The best place to mount VHF antennas in the radar tower would be on the top platform, giving a 360 degrees view. This is not feasible since the view of the radar antenna, which is mounted on the top platform, would be obstructed. Consequently, VHF antennas will be mounted on one or more sides of the radar tower construction, depending on how many VHF antennas are used. Side mounted antennas suffer from shielding by the tower construction, and special measures must be taken to enable 360 degrees coverage.

This internship aims to investigate the following problem:

**"What would be the optimal antenna configuration to provide full radio coverage in tower mounted VHF systems?"**



The investigation may look into (amongst other things):

- antenna types
- number of antennas deployed
- position of the antenna(s)
- any other constraints or variables

Special attention in the investigation must be given to undesired effects that may be experienced when using multiple antennas, like for instance:

- interference of antenna radiation patterns (near field and far field);
- adverse effects in cabling and splitters like dampening, resonance and interference;
- adverse phase effects when received signals are fed into an AIS base station.

Software simulations of the above phenomena are much welcomed (Saab does not have the required software available but the university probably will).

The assignment can be divided into the following steps:

1. TBD in consultation with Saab personnel

## What do we offer

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## Required qualifications

- *Bachelor or master technical study*
- *Ability to communicate in Dutch and English*
- *Analytical thinking, pro-active, passionate, flexible and creative*

**Start:** *date (d-mm-yyyy) or per direct or ....*

**Period:** *4 months, 5 days per week or 3 to 6 months or ....*