QuadSAT

Case Study

Proving capabilities of drone-based system to test satcoms on navy vessels

The Royal Danish Navy consists of the Navy Command which includes a National Maritime Operations Centre and three naval squadrons located primarily at two naval bases in Frederikshavn and Korsør.

Objectives

- **Verify effectiveness of a drone-based system to measure the satcom antenna performance onboard a ship**
- **Prove effectiveness of using the system to identify and set blockage zones**
- **Explore needs of naval forces in terms of RF equipment accuracy and calibration**

Detecting and managing degradation before it leads to failure and outage is extremely important, especially in harsh environments such as this. With that information at hand, the Navy is able to replace or repair faulty equipment before it becomes a problem, thereby keeping crews connected at all times.

Objective

The Royal Danish Navy uses satellite equipment for a whole host of use cases, from keeping its vessels connected at sea to communications in the ports. It also uses a great deal of other equipment, such as radars, ESM, and sonars, which is vital to the safety of its squadrons.

The 1st squadron of the Royal Danish Navy wanted to investigate whether a drone-based solution could deliver the accuracy needed to test this equipment at various stages of its lifecycle. In order to do that, we set about a pilot project, initially designed to explore the system's potential for measuring antenna radiation diagrams on board vessels, with a view to future testing and calibration of other Navy equipment, such as radars, ESM, and sonars.

Testing satellite equipment on board a vessel was a good place to start as it can typically be challenging, timeconsuming, and expensive. At the same time, any mistakes during testing could give the team false reassurances and lead to problems with connectivity once at sea. 1st Squadron therefore needed to be certain that it could deliver a high level of accuracy to deliver that certainty similar to what is achieved with existing standards such as ITU-R S.580.

Site acceptance test

Site acceptance testing is important for any satcoms application, giving users confidence that the site is capable of performing as required. Navy ships are no exception. During this demonstration, QuadSAT could ensure the vessel's VSAT system was operating optimally under in-field conditions before going into operation. This can also provide an accurate data set for link budgeting, giving the Navy a better overview of the gains and losses on any given satellite link.

Preventative maintenance

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Solution

QuadSAT's innovative drone-based system for test and verification of antennas and radio frequency equipment is fully automated, flexible, and location independent. The state-of-the-art technology is integrated with a custom RF payload as well as automation and measurement software. A broad range of testing missions can be undertaken, anytime, anywhere, depending on user requirements. The QuadSAT team was able to setup its drone-based solution on site at the 1st Squadron Navy Base. Connection to the antenna under test was done through the ships ACU, allowing for uninterrupted operation of the antenna with no downtime for commissioning. The team used GPS positioning to plan the most suitable flight path to perform the necessary tests of the Navy ship, F360 Hvidbjørnen. QuadSAT carried out a number of tests including compliance, 360 degree blockage zone, and no-sat tracking tests. This resulted in a number of raster scans at various angles, as well as principle cuts, with and without satellite tracking

Results

This pilot was able to successfully prove the methodology and suitability for drone-based testing of antenna radiation on installed VSATs. It also proved favourable comparison with standards like ITU-RS.580. The team was able to easily access data on the antenna under test (AUT) using the antenna control unit, which enables fast, hassle free and in-service testing of the AUT.
This initial demonstration opens up the opportunity for other low-effort, high-value tests on the currently installed VSATs. This could include cross pol isolation tests, frequency sweeps, radome effect tests, and gain tests, amongst others.

Why QuadSAT?

- **Simply and quickly test satcoms equipment on ships before operation**
- **Able to perform a wide-range of important tests**
- **High level of accuracy to keep vessels connected**
- **Ensure optimal operation and detect and manage degradation before failure**

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