

FMH606 Master's Thesis

Title: Development and Testing of ASTERIX category 240 Radar Display

USN supervisor: Hans-Petter Halvorsen

External partner: Sea Surveillance AS

Task background:

Sea Surveillance AS is a part of Seabrokers Group (<https://www.seabrokers.no>), based in Bergen, Norway operating since 2003.

A typical marine scanning radar emits pulses radially from a rotating transmit/receive antenna. To display a radar image on a display requires that the original radar video from the sensor is acquired and scan converted, from polar coordinates to rectangular coordinates. An open standard for radar video distribution has emerged in recent years and a number of commercially available radars output the video signal digitally using the ASTERIX category 240 standard. Specialised surveillance data processing software to decode the category 240 messages and scan convert the images are available, however not open source (as far as we know). The motivation to make this software is to have a free open-source tool that can be used for troubleshooting and display of the radar signals. For example if the radar is running with 2000 pulses per second (prf = 2kHz) and the radars range is digitised into 1000 samples for each pulse then the CAT-240 stream represents a set of 2000 messages per second, where each message encodes 1000 samples of video data.

Task description:

Main Task: Develop software to decode and display radar video distribution messages that use the ASTERIX format for transportation of Radar Video data as defined in the ASTERIX category 240 standard [1] and the general ASTERIX standard [2].

A commercial navigation grade marine radar scanner capable of outputting ASTERIX category 240 radar video with a view over Bergen harbor will be made available by Sea Surveillance and should be used for development and testing of the application.

The following sub tasks should be done in this project:

- Explore Marine Radar Applications in general and in context of this project. Common use cases
- Explore ASTERIX category 240 standard in general and in context of this project
- Defining requirements, design and implement a system for monitoring of category 240 radar video. The system needs to be flexible and configurable so it can be used in different scenarios and use cases. Examples:
 - Read and decode CAT-240 packets comprising header and data [1][2]

- Present data as a Radar A-scope on selected radial(azimuth), comparable to the display of an oscilloscope
- Present data as Radar B-scope, cartesian diagram. 2-D “top down” representation of space. Where the x-axis represents the azimuth, and the y-axis represents the range.
- Present data as Radar PPI-display (plan position indicator). Scan converted polar coordinate display with the radar position in the origin. The most used and known radar display.
- Provide information on the range, bearing
- Configurable radar video input source, and decoding settings
- Video processing. E.g. gain, threshold, interpolation
- Possibility to input a static heading for azimuth offset(rotation) of the display.
- Explore network requirements in context of category 240 radar in general and this project
- Testing, Installation and Deployment of System
- Include necessary scientific aspects, methods, and analysis
- The system needs to be properly documented so it possible for others to use and extend the system after the project is finished

References:

[1] EUROCONTROL, “EUROCONTROL-SPEC-0149-0240: CAT240 - EUROCONTROL Specification for Surveillance Data Exchange ASTERIX,” Available: <https://www.eurocontrol.int/publication/cat240-eurocontrol-specification-surveillance-data-exchange-asterix>.

[2] EUROCONTROL, “EUROCONTROL-SPEC-0149 EUROCONTROL Specification for Surveillance Data Exchange Part I,” Available: <https://www.eurocontrol.int/publication/eurocontrol-specification-surveillance-data-exchange-part-i>.

Student category: IIA, both campus and online, but also for industry master students that want to take a project outside their own company.

The task is suitable for online students (not present at the campus): Yes. Most of the work can be done online.

Practical arrangements: None

Supervision:

As a general rule, the student is entitled to 15-20 hours of supervision. This includes necessary time for the supervisor to prepare for supervision meetings (reading material to be discussed, etc).

Signatures:

Supervisor (date and signature):

Student (write clearly in all capitalized letters):

Student (date and signature):