# LONG RANGE SENSORS

## Introduction

VTS equipment provides the VTS Authority with real-time data from short range line-of-sight sensors, such as radar, CCTV and AIS. On occasions, the use of information, derived from long-range sensors (typically long range radar, satellite communications systems and satellite AIS), can provide supplementary information. It may assist in locating vessels that have not arrived on schedule or detect vessels that arrive unannounced. It allows authorities to assess potential security risks or, should the need arise, provide input data for search planning in case of a SAR incident.

Typical long range sensors include:

* LRIT (Long Range Identification and Tracking);
* Satellite AIS (SAIS);
* HF Radar;
* Satellite-based Synthetic Aperture Radar (SARSAT).

This section provides an overview of each of the above and identifies the applicability, benefits and limitations of these sensors to VTS Authorities.

## Long Range Identification and Tracking (LRIT)

LRIT is a mandatory carriage requirement for SOLAS vessels. It provides a ship position report at regular intervals based upon the area of operation. The normal reporting interval is every 6 hours. LRIT data is received by International Data Centres (IDC) and is available to the flag authority and to the maritime authorities of transit and destination countries.

In circumstances where a vessel has arrived unexpectedly or gone missing, the historical LRIT information may provide the additional information needed for a security assessment or the planning of search activities.

LRIT is an established service and, subject to approval by the national maritime authority, the VTS Authority can access the International Data Centre and integrate appropriate LRIT data.

It should be noted that LRIT data normally carries an airtime cost per position report and that the IDC may charge for the provision of the data.

As the applications for LRIT data continue to evolve, other uses and benefits may be determined and implemented.

## Satellite AIS

An AIS satellite listens to AIS transmissions within its footprint area and stores the data on-board until it passes over a ground station, to which the data can be downloaded. Satellite AIS has a potentially global coverage, particularly now that dedicated VHF channels are allocated to satellite AIS.

The AIS satellite may receive several AIS transmissions in the same time slot, particularly in dense traffic areas. Such data collisions may make it impossible to properly decode the individual AIS messages, resulting in inaccurate or completely wrong positions, despite the use of advanced de-collision algorithms.

An AIS satellite will only be able to download data when it is in range of a ground station. This means that the data received by the VTS Authority will not be real time and may be up to 2 hours old (or possibly more).

AIS satellite systems comprise several satellites in different constellations, i.e. a polar-orbiting constellation or a mix of equatorial and polar orbiting satellites. The effect of different orbiting constellations will impact when and for how long ground stations can be accessed to download AIS data. The more frequently the satellite can download the data, the less latency between the received data and the real time position of the actual vessels.

Satellite AIS data is provided through a Service Provider to which the VTS Authority will need to subscribe and is now becoming increasingly available via commercial as well as national government-sponsored satellite AIS operators.

The main difference between the terrestrial and satellite AIS data, besides the geographic coverage, is the data latency, i.e. the age of the AIS message when it is actually received by the VTS system. This is generally not a problem, because long range data is used for strategic purposes, where accuracy is less relevant than coverage.

Satellite AIS is an established service that does not require any special design, configuration or installation on the part of the VTS Authority as these are handled by the satellite AIS Service Providers. Once the VTS Authority has subscribed to the AIS satellite service, it will be able to integrate the satellite AIS data as appropriate for its operational requirements.

As the applications for satellite AIS data continue to evolve, other uses and benefits may be determined and implemented.

## HF Radar

One rarely used technology that can offer long range detection of vessels is HF radar. HF radar has one major advantage over other long range detection technologies in that it does not require cooperation from the vessels to be detected.

There are generally two types of HF radars, those that use the low level earth surface 'hugging' refraction duct and those that use reflection from the layer to layer boundaries in the ionosphere above the earth (sky wave). Both system types suffer from unpredictable propagation path characteristics, which can support medium and large object detection (metal ships) to hundreds of nautical miles in some conditions, but often offers very little detection performance. This makes specification of achievable performance and detection 'availability' a challenge to both radar customers and radar suppliers. The vagaries of the propagation paths can also introduce unpredictable positional measurement errors affecting both angle and range even when an object is clearly detected.

HF radar installation requires some careful selection of suitable coastal terrain which may not suit all potential VTS locations. Similarly, suitable sites will rarely support the necessary infrastructure (power, communications, access for installation and maintenance) and these need to be factored into the installation and operational costs.

Finally, optimising the nature of HF radar may impose high workload on specialised, highly trained operators.

If the limitations are acceptable, this technology offers valuable passive detection in open waters, expensive to obtain by other means (airborne sensors and satellite). Realistically, however, HF radar systems are not used for VTS purposes.

## Synthetic Aperture Radar (SARSAT)

Satellite-based Synthetic Aperture Radar (SARSAT) can provide vessel target information at ranges beyond that of shore-based sensors, including HF Radar. However, such services will probably only provide a single image of a specific area once per day through a few orbiting satellites. Images are stored on-board the satellite until they can be downloaded as the satellite passes over a ground station. The image is processed, following download from the satellite, to detect ships within the area and radar information (without identity) can be derived that can be used to recognise the type of vessel. This type of service is for analysis of vessel movement and not for any form of near real time monitoring. In addition to the latency between the required image capture and the download when passing over a ground station, there is also a further latency related to the processing of the received data.

SARSAT may, for example, be useful for detecting illegal fishing activity in remote areas of a country’s Exclusive Economic Zone and for detecting oil spills and pollution.

SARSAT is available from a variety of established service providers and does not require any special design, configuration or installation on the part of the VTS Authority. The VTS Authority will need to subscribe to a SARSAT image service and costs are involved on a per image basis. Once access to such a service has been established, the VTS Authority will be able to integrate the SARSAT target data as appropriate for his operational requirements.