



SeaVision Data Sources

Lesson 1.3

07/01/2020

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Lesson 1.3 Learning Objectives

Upon successful completion of this lesson, the student will be able to:

- Identify the capabilities and information provided from the following SeaVision data sources:
 - Automatic Identification System (AIS)
 - Fairplay by Information Handling Service (IHS) Markit
 - Coastal RADAR
 - Satellite Synthetic Aperture RADAR (SAT-SAR)
 - Visible Infrared Imaging Radiometer Suite (VIIRS)



SeaVision Data Sources

- SeaVision integrates multiple government and commercial data sources to aid in developing a Regional Maritime Picture (RMP)
 - Maritime Safety & Security Information System (MSSIS)
 - Terrestrial AIS
 - Satellite AIS
 - Fairplay by Information Handling Service (IHS) Markit
 - World Registry of Ships (WROS) Data
 - Vessel Details
 - Coastal RADAR
 - Satellite Synthetic Aperture RADAR (SAT-SAR)
 - Visible Infrared Imaging Radiometer Suite (VIIRS)

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- Maritime Safety and Security Information System (MSSIS): developed by Department of Transportation (DOT) Volpe Center. MSSIS is a freely shared, unclassified, near-real time data collection and distribution network. MSSIS promotes collaboration and data sharing amongst international participants through sharing of Automatic Identification System (AIS) position reports.
- Learn more about MSSIS here: <https://mssis.volpe.dot.gov/Main/>



Automatic Identification System (AIS)

- AIS
 - Transmitted over marine VHF radio frequencies
 - AIS is a system allowing vessels to automatically report their position and navigational information as well as receive other vessels positions within range
- Terrestrial AIS
 - AIS base station is located at a coastal ground site
 - Allows for real-time AIS data collection
 - Allows you to connect to the MSSIS network via the internet
 - Data is free with purchase of AIS receiver/antenna/GPS
- Satellite AIS
 - Collected by low earth orbit satellites
 - Requires a downlink station
 - Latencies and sparsity in AIS tracks
 - Data must be purchased

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- The primary intent of Automatic Identification Systems (AIS) is to aid in the avoidance of vessel collisions by providing positional data (latitude and longitude) and attributes (such as speed, name, size, type, etc.) of equipped vessels. AIS plays an increasingly important role in enhancing the Maritime Domain Awareness of many countries around the world. AIS allows the automatic exchange of real-time vessel movement data, including static and voyage-related information, between ships or between ships and shore stations.
- Key Types of AIS Data Include:
 - Vessel Name / Vessel Type
 - International Maritime Organization (IMO) Number
 - Maritime Mobile Service Identity (MMSI) Number
 - Vessel Call Sign
 - Length, Beam, Draft
 - Ship Position (Latitude & Longitude)
 - Speed Over Ground (SOG) / Course Over Ground (COG)
 - Heading / Rate of Turn (ROT)
 - Estimated Time of Arrival



Fairplay by Information Handling Service (IHS) Markit

- Fairplay is a repository for IMO ship registry data.
 - Registration
 - Crew
 - Inspections
 - Port History

The screenshot displays the vessel details for 'As Penelope'. On the left, a list of attributes includes: Source (TERRESTRIAL AIS), Time (2019 May 29 04:11:07 UTC), Age (1h 26m 59s ago), Position (12° 11' 3" N, 100° 58' 11" E), Speed (17.9 kts), Heading (138°), Course (136°), MMSI (636092863), IMO Number (9294537), Flag (Liberia), Call Sign (D5RB3), Ship Type (7-Cargo), Length (209 m), Beam (30 m), Draft (10.5 m), Navigation Status (5-Moored), Destination (HkHkg), and ETA (06/01 @ 02:30 UTC). Below this is a map showing the vessel's path. On the right, a search bar contains the MMSI (636092863) and IMO Number (9294537) with a 'FIND' button. Below the search bar are tabs for Summary, Details, EEZ History, Port History, and Rules. The 'REGISTRATION' table is visible, listing the following data:

REGISTRATION	
Fairplay Sid	75128
Name	As Penelope
Imo Number	9294537
Call Sign	D5RB3
Mmsi	636092863
Flag	Liberia
Operator	MCC Transport Singapore Pte

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- IHS/Fairplay: SeaVision integrates World Registry of Ships (WROS) data with incoming positional reports to provide extensive vessel information to the user via Vessel Details.
- <https://ihsmarkit.com/index.html/>
- The data is searchable and used as criteria in user-defined Rules. This dataset is the basis for the automatically calculated safety and security risk scores in Warnings.



Coastal RADAR

- RADAR tracks are sourced from a SeaVision participant nation's shore-based sea RADAR network
- Tracks may be correlated with AIS position reports for individual vessels



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- Coastal RADAR: RADAR tracks are sourced from a SeaVision participant nation's shore-based sea RADAR network. RADAR tracks may be correlated with AIS positional reports for individual vessels.



Terrestrial AIS/Coastal RADAR

- **Hardware Requirements**
 - Computer workstation
 - GPS antenna
 - RADAR outputting TTM messages (optional)
 - Internet Connection
 - AIS RX base station
- **Software Requirements**
 - Volpe's TV32
 - Stunnel
 - Windows OS



Upload AIS and RADAR data into MSSIS Network

Step 1: Local AIS base station receives regional AIS

Step 2: AIS base station outputs AIVDM messages for display in TV32

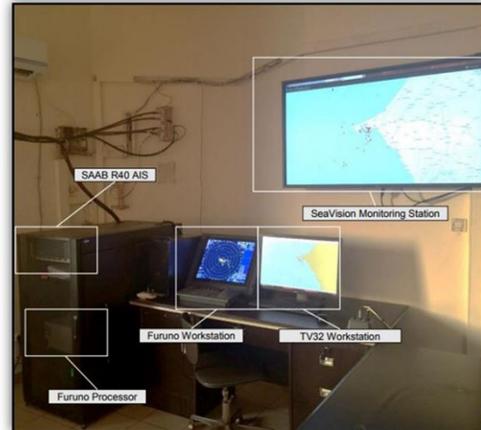
Step 3: TV32 routes AIVDM messages to MSSIS Server

Step 4: Agency, Interagency, Regional, and Global partners access AIS via SeaVision

Optional RADAR Configuration

RADAR outputs TTM messages to TV 32

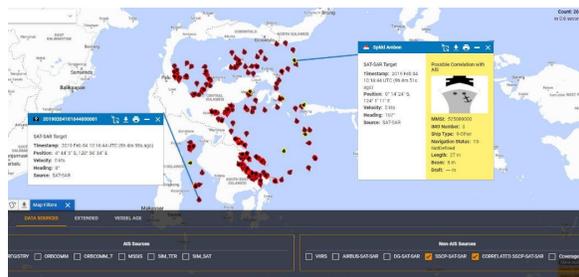
Coastal Surveillance Site Example





Satellite Synthetic Aperture RADAR (SAT-SAR)

- Benefits
 - Very large coverage area
 - Works in all weather, day or night
 - Well suited for ship detection
 - Can see through clouds
- Limitations
 - Lower resolution than electro-optical images
 - Doesn't look like a picture
 - Ships required to have a reflective surface
 - Delays and infrequent coverage
- Results
 - Ships are detected in image and displayed as position report in SeaVision.



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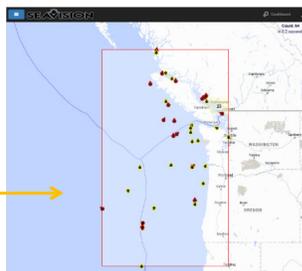
- Synthetic-Aperture RADAR (SAR) is a form of RADAR that is used to create two-dimensional images or three-dimensional reconstructions of objects.
- Satellites with Synthetic Aperture RADAR (SAT-SAR) orbit the Earth in a sun-synchronous, polar orbit and data acquisitions can be made day or night, independent of cloud coverage.
- SeaVision displays satellite imagery data provided by the Naval Research Laboratory (NRL) and can correlate this data with AIS positional reports.



AIS/RADAR/SAT-SAR Fusion

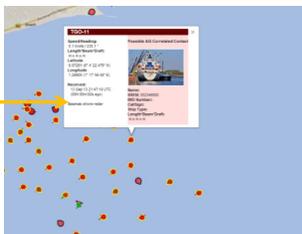
- SeaVision correlates Coastal RADAR and SAT-SAR with AIS
- Confirmed identification of RADAR/SAT-SAR ship detection

Fused SAR with AIS



Ship Detections from SAR Image

Fused RADAR with AIS

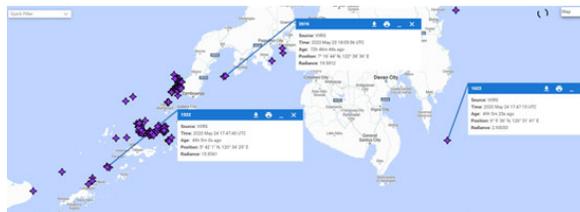


Coastal RADAR Detections



Visible Infrared Imaging Radiometer Suite (VIIRS)

- VIIRS primary mission is weather. However, an algorithm was developed for reporting the locations of boats based on satellite sensing of electric lighting



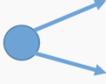
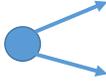
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- Visible Infrared Imaging Radiometer Suite (VIIRS): A joint National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA) project that provides nighttime imagery of man-made light sources emanating from ships and other man-made sources at sea.
- Learn more about VIIRS here:
 - <https://viirsland.gsfc.nasa.gov/index.html>



SeaVision Data Sources

Data Source	Range	Delay into SeaVision
AIS 	Terrestrial	20-40 NM Near Real-Time (NRT) 30 sec - 3min
	Satellite	Footprint of Satellite 1-3 Hours
RADAR 	Coastal/Vessel	20-60 NM Near Real-Time (NRT) 30 sec - 3min
	SAT-SAR	Footprint Of Satellite 1-3 Hours
VIIRS 	Footprint of Satellite	24 Hours

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SeaVision Data Sources Summary

- Automated Identification System (AIS)
 - Terrestrial and Satellite
- Information Handling Service (IHS) Markit
 - Fairplay
- Coastal RADAR
 - Correlated with Terrestrial AIS
- Satellite Synthetic Aperture RADAR (SAT-SAR)
 - Correlated with AIS
- Visual Infrared Imaging Radiometer Suite (VIIRS)



Questions?

