AIS Training

AIS Technology in Digital Yacht Products Explained

Digital Yacht Ltd
www.digitalyacht.co.uk
TEL + 44 1179 554474

What is AIS ?

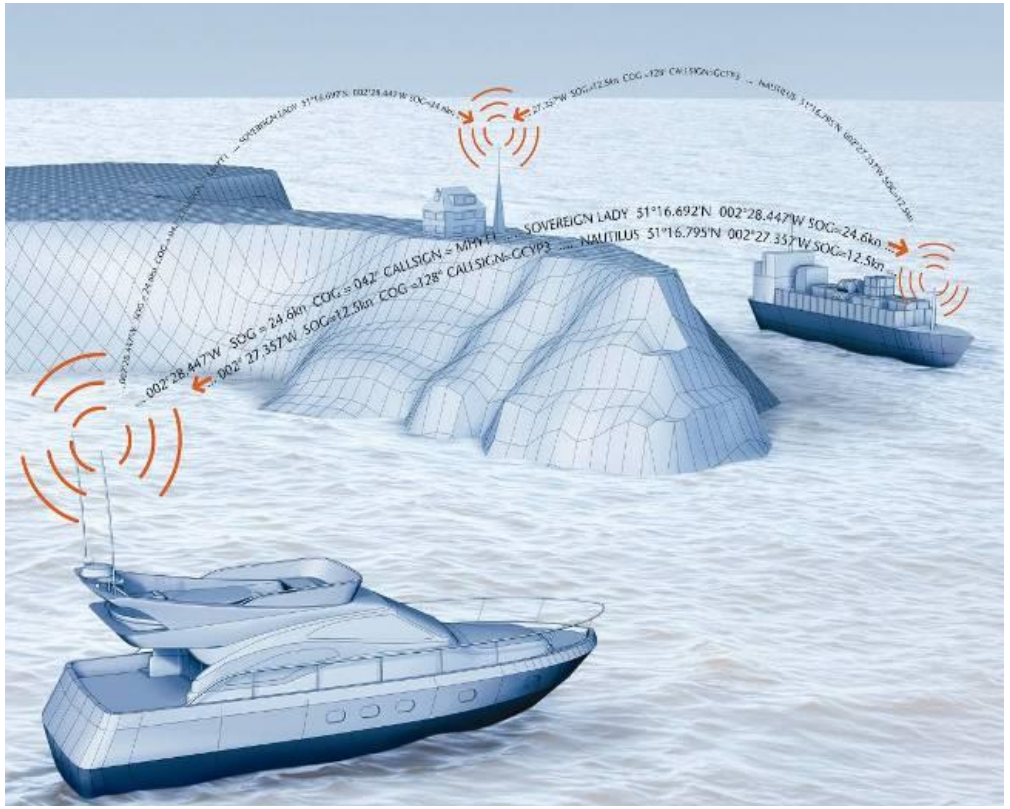
- The Automatic Identification System (AIS) is the biggest advance in marine navigation since RADAR
- AIS uses GPS, VHF and Digital Signal Processing (DSP) to communicate data between vessels
- Vessels can Transmit their position and Receive other vessel's positions (Transponder) or just Receive other vessel’s positions (Receiver)
- An AIS transponder is a mandatory fit on all vessels greater than 300 tonnes or carrying 12 or more passengers

THE TECHNICAL STUFF

- **AIS uses two VHF frequencies;**
    1. **161.975 MHz**
    2. **162.025 MHz**
- **AIS is subject to the same constraints as VHF radio i.e. line of sight range**
- **AIS data is transmitted in NMEA 0183 serial protocol but at a higher 38,400 baud rate**
- **There are two NMEA sentences reserved for AIS;**
    1. **!AIVDM (other vessels)**
    2. **!AIVDO (own vessel)**
- **AIS Data is also transmitted in NMEA2000 protocol and a total of 21 PGNs have been published for AIS**
- **A transponder must have a GPS position, whilst a receiver does not have to have one**

What AIS Does

- There are two classes of AIS;
  - Class A – for mandated commercial vessels
  - Class B – for smaller non-mandated vessels
- At regular intervals based on AIS class, navigational status and speed, a transponder will transmit the vessel's;
  - GPS Position, SOG and COG
  - Heading and Rate of Turn
  - MMSI number
- Every 6 minutes, a transponder will transmit the vessel's "Static Data";
  - Vessel Name, Call Sign and MMSI
  - Dimensions and Vessel Type
  - Voyage Data (Destination/ETA)*
  - Navigational Status*



* Note - Class A Transponders Only

Types of AIS

Type	Example	Description
Class A Transponder		Mandatory Fit on large commercial vessels Transmits and Receives Dedicated type approved “Minimum Keyboard+Display” (MKD) Typical Price £2000
Class B Transponder		Lower cost transponder for leisure and non-mandated craft Transmits and Receives Normally a “black box” solution Typical Price £500
AIS Receiver		Cost effective way for small craft to see “big ships” Only Receives Normally a “black box” solution Typical Price £150

Comparisons of Class A and B

Comparison of Functionality

Function	Class A	Class B
Transmit Power	12.5W	2W
Transmit Rate	Up to every 2-3secs	Every 30 secs
Minimum Keyboard + Display (MKD)	YES	NO
Technology	SOTDMA	CSTDMA
Guaranteed Time Slot Allocation	YES	NO
Voyage Data	YES	NO
External GPS Connection	YES	NO
Price (approx)	£2000	£500

Comparison of Transmit Rates

Ship's Dynamic Conditions	Class A	Class B
Ship at Anchor or Moored	3 Mins	3 Mins
SOG 0-2 knots	10 secs	3 mins
SOG 2-14 knots	10 secs	30 secs
SOG 2-14 knots and changing course	3.3 secs	30 secs
SOG 14-23 knots	6 secs	30 secs
SOG 14-23 knots and changing course	2 secs	30 secs
SOG > 23 knots	2 secs	30 secs
Ship Static Information	6 mins	6 mins

Comparison of Transmitted Data

Data Transmitted	Class A	Class B
MMSI + Vessel Name + Call Sign	YES	YES
Position + COG + SOG	YES	YES
True Heading	YES	YES
Rate Of Turn	YES	NO
Nav Status	YES	NO
IMO Number	YES	NO
Type of Vessel	YES	YES
Vessel Dimensions	YES	YES
ETA + Destination + Draught	NO	NO

What AIS Looks Like

Each vessel is displayed in its position on the chart

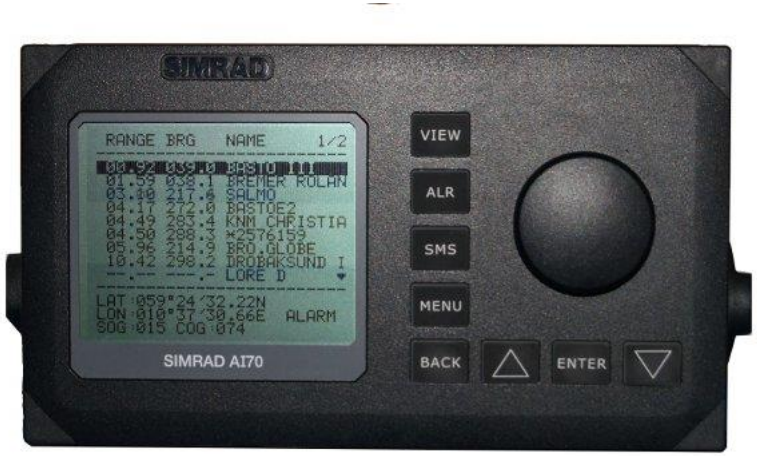
Targets constantly moving to reflect real time position and direction

Warning of collision or ‘close’ proximity automatically provided

By selecting any vessel displayed on the screen all static and dynamic data is displayed

Your own position is displayed on the chart

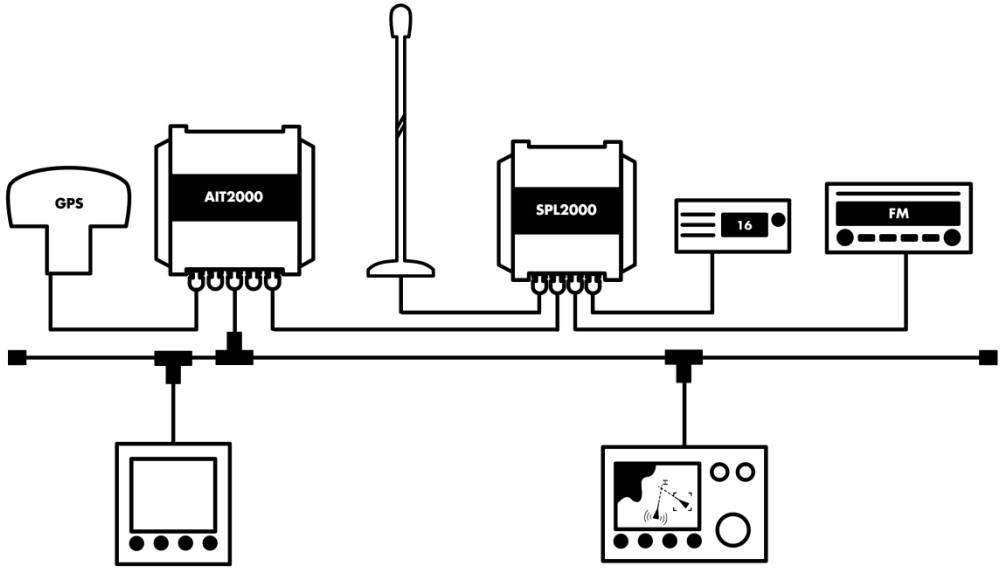
Displaying AIS



Although AIS data is always the same, it can be displayed in a variety of ways

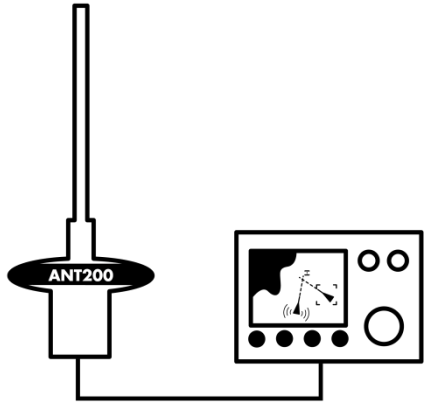
Typical AIS Installations

Full Class B installation with splitter and N2K

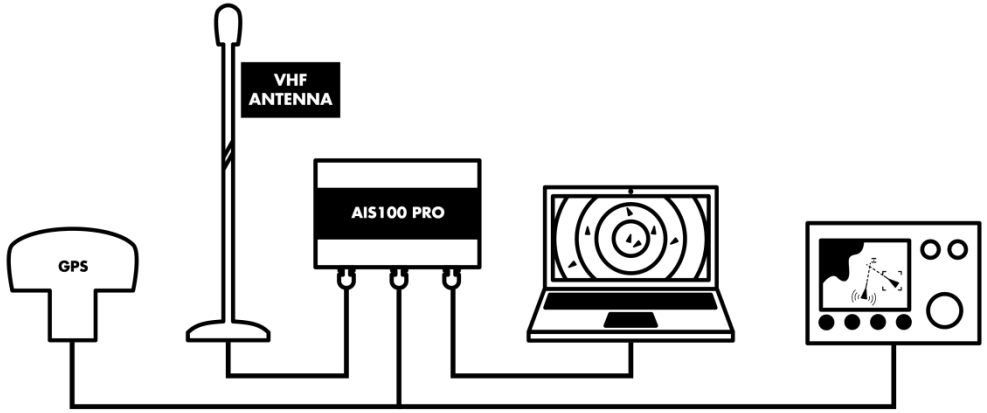


USB Powered AIS Receiver for laptop PC

AIS Receiver for Small Open Cockit Boat



PC+Plotter AIS Receiver Installation



Benefits of AIS – Collision Avoidance

- Receive clear and regular position reports of all AIS equipped vessels in your area
- Set CPA and TCPA alarms
- Identify and make a DSC radio call to a dangerous vessel using their MMSI number

Benefits of AIS – Identification

- Receive MMSI number, vessel name and boat type of all AIS equipped vessels
- Find any of your friends' boats "Buddy Tracking"
- Friends and family can use online AIS services to track your trip/race from home

Benefits of AIS – Safety + Security

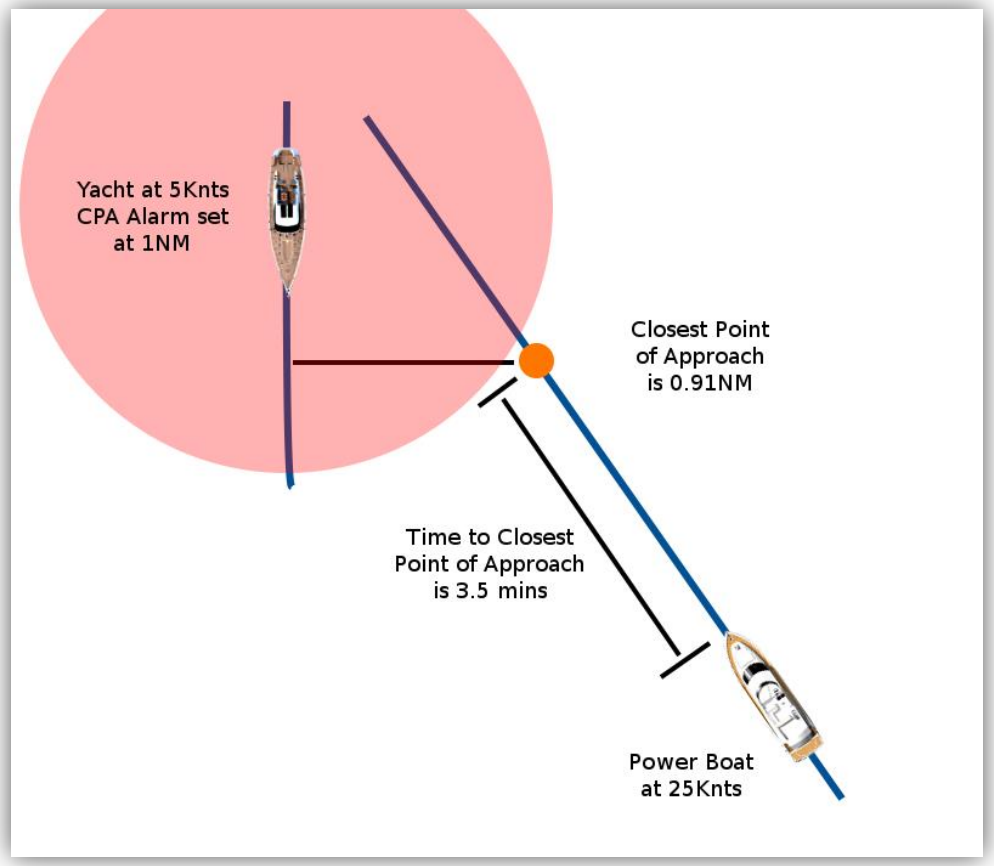
- Emergency services are now using AIS
- AIS SARTs are ideal for close proximity MOB rescue
- Quick and easy vessel identification for maritime services

Benefits of AIS – “See Round Corners”

- “See Around Corners”
- Vessels, AtoNs, Rescue Craft displayed as objects not “blobs”
- Low power and low cost alternative to radar for small boats

Benefits of AIS – CPA and TCPA

- Most chart plotters, navigation software and apps that are AIS compatible have some from of collision alarm
- The system calculates the Closest Point of Approach (CPA) of every AIS target and also the Time to CPA (TCPA)
- Users can set alarm values for CPA and TCPA which trigger an audible and visual alarm when dangerous targets are detected



Class B for Small Craft

To Transmit or not to Transmit….that is the question !

- With only a £350 price difference between a Receiver and a Class B Transponder, many people will buy a transponder rather than a receiver
- Theoretically, if every small craft fitted a Class B Transponder tomorrow, we could see a reduction in the update frequency and range of Class B targets
- In reality, such a situation would require thousands of Class B Transponders in a very small area and such gatherings of small craft generally only occur in good conditions
- Diligent use of the “Silence Button” on Class B transponders, only transmitting in poor visibility or when crossing shipping lanes should be considered good practice

Class A for Small Craft

- Class A Transponders have been traditionally only found on commercial mandated vessels
- This was mainly due to price (approx £4000) but recently prices have come down (approx £2000) and now some pleasure vessels are starting to look at Class A
- Class A has some real advantages for certain pleasure vessels;
  - ✓ 12.5W Transmit Power
  - ✓ Fast Update Rate (2-3 sec)
  - ✓ Guaranteed Time Slot
  - ✓ Built-In display
  - ✓ Better Coverage on AIS Tracking Sites
- For large high speed power boats the 30sec update rate of Class B is too slow
- For Blue Water Sail Boats, the 2W transmit power of Class B does not give enough range

Single Channel versus Dual Channel

Single Channel

- Some early and current AIS receivers are single channel e.g. Nasa AIS 3 and Smart Radio SR161
- One RF receiver that is switched between the two AIS channels every 30 secs or more
- Targets received on single channel receivers can take twice as long to update

Vs

Dual Channel

- All Digital Yacht AIS units feature a high performance Dual Channel receiver
- Two RF receivers each one dedicated to the two AIS channels
- Maximum number of received targets with no update delays or missed targets

Splitter versus Dedicated Antenna

Pros
- Single Antenna Solution
- Top of mast for Maximum Range
- Easy Installation – no cables to run
- No loss of performance

Cons
- 4x the cost of dedicated antenna
- Misses targets while VHF transmits

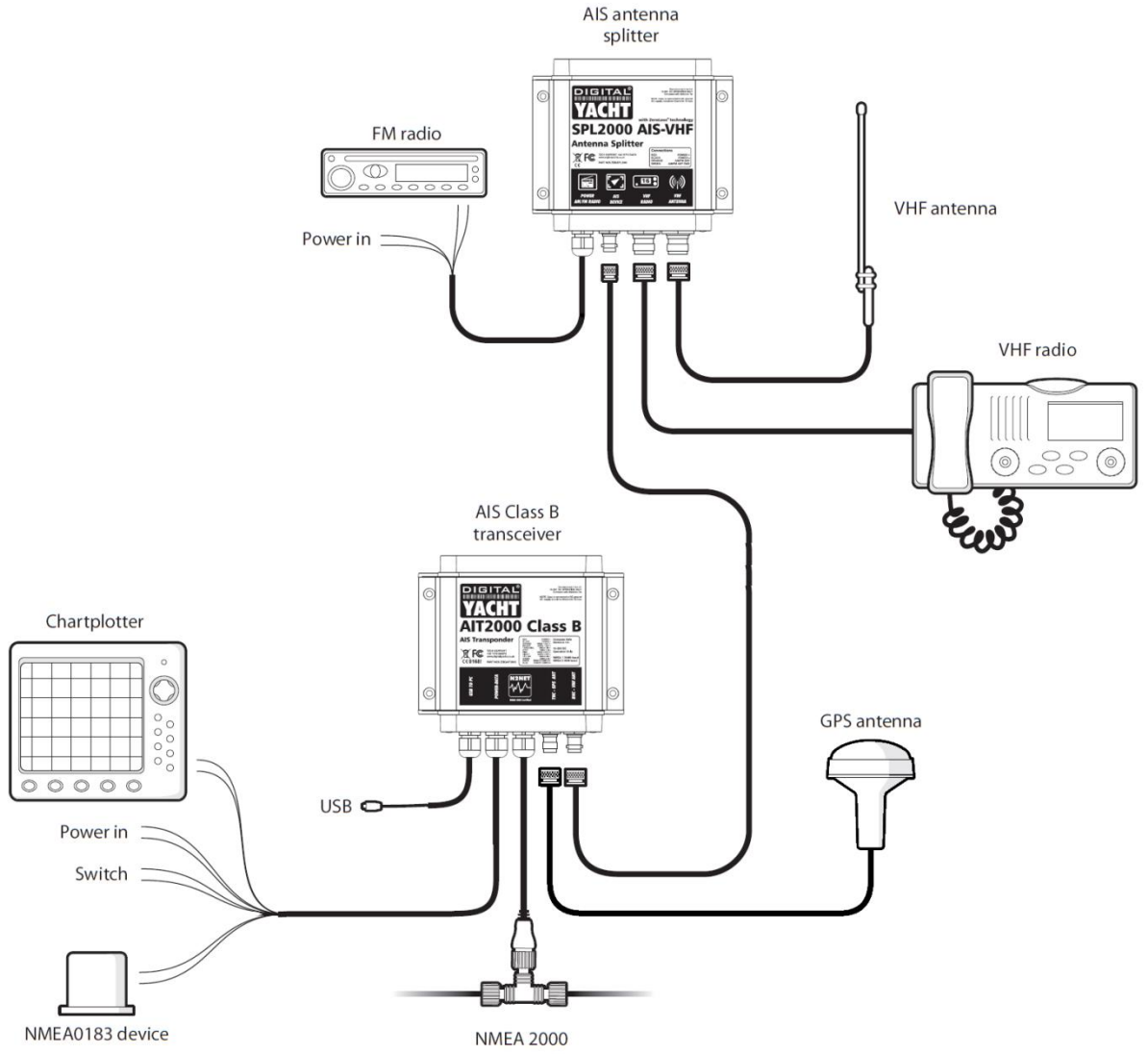
Vs

Pros
- Low Cost
- Backup Emergency Antenna for VHF
- Not affected by VHF voice activity

Cons
- Less Range if mounted at deck level (10-15NM)
- Installation can be time consuming/costly
- “Not Another Antenna !”

Splitter – How it Works

- Single Antenna is shared by the AIS and VHF
- Two intelligent switches inside the splitter sense when AIS or VHF is transmitting
- A Class B AIS transmission only lasts 26mS so the detection and switching is very fast
- VHF gets priority and whilst transmitting no AIS reception is possible
- When neither system is transmitting both systems are connected to the aerial and can receive at the same time
- Some older splitters use to introduce a 3dB (half power) loss on VHF and AIS reception
- No losses in transmission as only one system connected to antenna
- Latest SPL2000 features “Zero Loss” Technology where the signal from the antenna goes through a pre-amplifier before being split

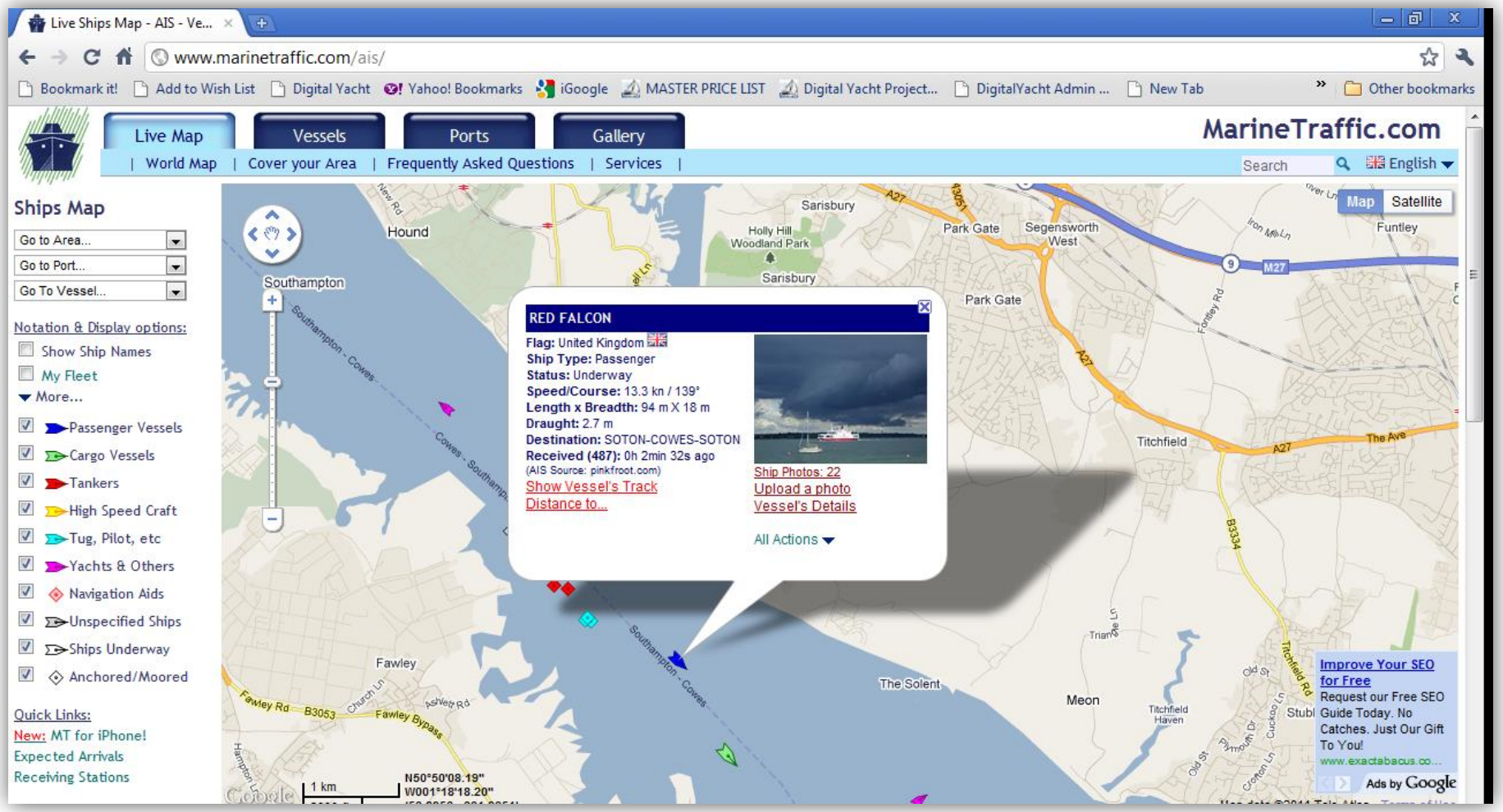


AIS SARTs

- AIS SARTs have recently been approved for GMDSS use
- An AIS SART is basically a low power Class A transmitter (1W)
- It transmits its position every minute and also outputs a Safety Related Message (SRM) every four minutes
- Once activated, an AIS SART should start transmitting it’s position within 1min and continue to transmit for 96hrs
- Battery life is 3 years and an AIS SART should be fully waterproof to 10m for 5mins
- When held 1m above sea level the AIS SART should be received by all AIS units within 5NM radius

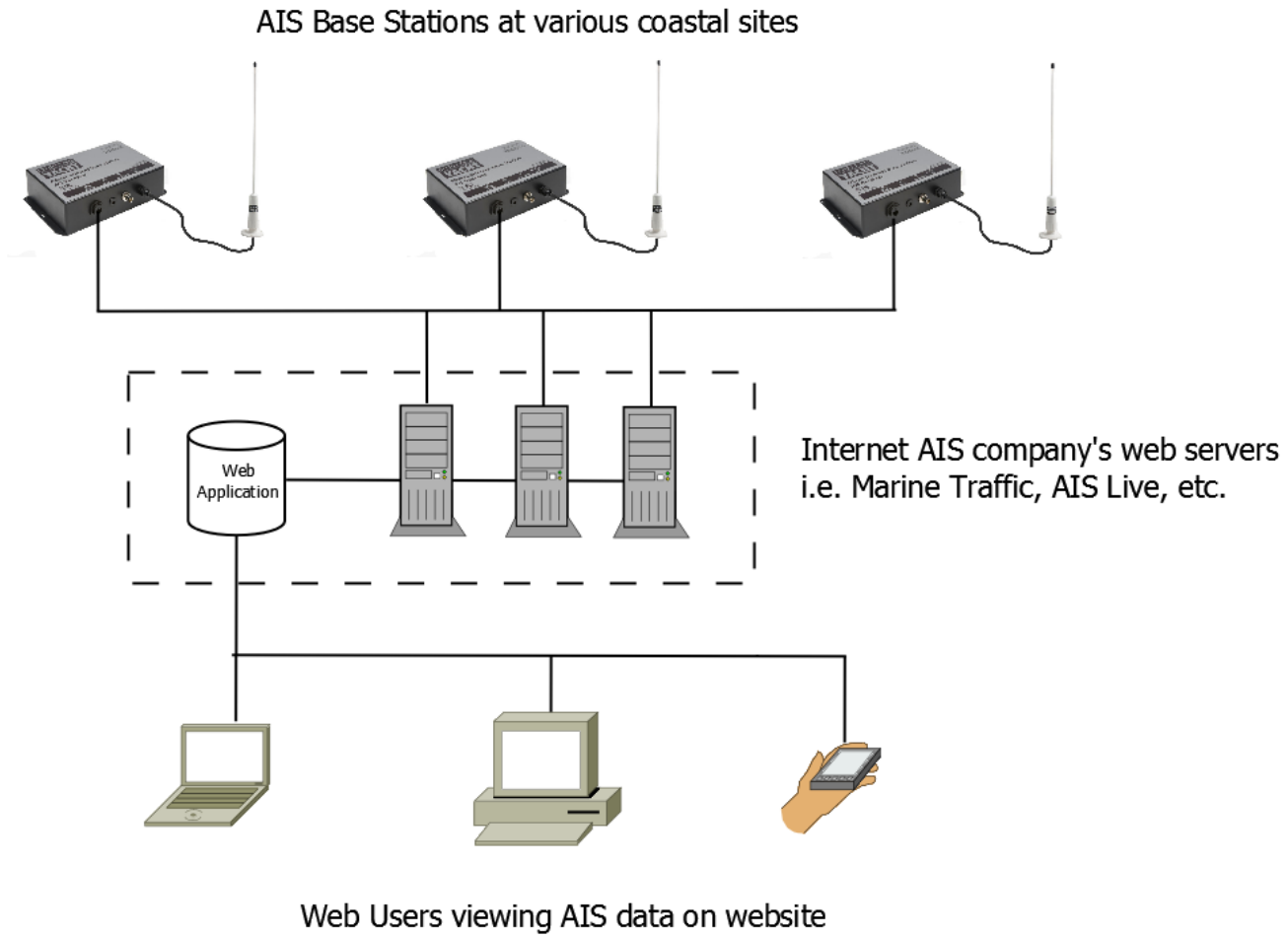
Online AIS Tracking Sites

- More and more customers are using on-line AIS websites to track their vessel
- They expect to be seen and do not appreciate the limitations of the systems



How Online AIS Sites Work

- A network of AIS Receivers (base stations) collect the real time AIS reception and send it to a web server via the base stations internet connection



Online AIS Receiver Network

- The on-line system is only as good as its network of base stations and on Marine Traffic you can click More>Stations to see the network displayed

Online AIS Coverage for Class B

- The base station network is not perfect and “holes” in coverage exist
- The superior range of Class A means larger coverage with less “holes”

Tracking AIS via Satellite

- Companies like exactEarth and Orbcom can now track Class A AIS units via satellite
- It is possible to track Class B but they cannot guarantee reception
- Currently this type of tracking is expensive but prices are sure to come down