Next Generation AIS

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What I’ll cover...

- Quick overview of AIS
- New developments
- Integration, new devices, new functionality
- Things to keep in mind with AIS
AIS Front Page News!

USS Fitzgerald Collision: High Speed, No AIS, Heavy Traffic

Financial Times
Opinion: Maritime accidents and safety
Tanker sinking puts spotlight on role of tracking systems

Norwegian Space Center Orders New AIS Microsatellite
What is AIS?

- AIS = Automatic Identification System
- Primary use: collision avoidance
- AIS is a broadcast transponder system, operating in the VHF maritime mobile band (channels 87B & 88B)
- Transmits ship information such as identification, position, course, speed and more to other vessels and shore
- Uses 9 digit MMSI (Maritime Mobile Service Identity) as unique identifier
- Types of AIS devices
  - Class A: mandated for use on SOLAS and other types of commercial vessels
  - Class B: for use on recreational and small commercial vessels (CSTDMA & SOTDMA)
  - Other devices: AIS receivers, SART, MOB, AtoN, trackers
- Transponders use integrated GPS to fix own position and transmit info via VHF
- Approximate transmit range: Class A = 30+ miles, Class B CS = 5-7 miles, Class B SO = 15 miles, AIS MOB = ~2 miles
- Class B must be preprogrammed with vessel info by dealer
- NOT a replacement for radar or other watch methods
How AIS communicates to avoid collisions

The yacht’s AIS (1) is exchanging info with a freighter (2)

receiving signals from a virtual AtoN (Aids to Navigation) (3)

receiving a signal from a channel marker (4)

displaying the distance and bearing to an MOB via an AIS beacon (5)

and calculating if on a collision course with a fishing boat (6)

Courtesy of Vesper Marine
Using AIS

KALEETAN WSF (WY2512)
MMSI: 366772990
Passenger Ship
Underway with engine at 16.7 kn
CPA 0.18 NM in 1 min 26 secs
121°M 0.82 NM from boat
# Who is required to use AIS?

<table>
<thead>
<tr>
<th>TYPES OF VESSEL REQUIRING AIS</th>
<th>AIS CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Towing vessels &gt;26 feet and &gt;600 HP</td>
<td>Class A</td>
</tr>
<tr>
<td>Passenger vessels &gt;150 passengers</td>
<td>Class A</td>
</tr>
<tr>
<td>&gt;65 feet and &lt;150 passengers</td>
<td>Class A</td>
</tr>
<tr>
<td>Operate in VTS area or &gt;14 knots</td>
<td>Class A</td>
</tr>
<tr>
<td>Don’t operate in VTS area &amp; &lt;14 knots</td>
<td>Class B</td>
</tr>
<tr>
<td>Dredges Operating near commercial channels</td>
<td>Class A</td>
</tr>
<tr>
<td>Operating outside shipping fairways</td>
<td>Class B</td>
</tr>
<tr>
<td>Vessels moving certain dangerous cargo</td>
<td>Class A</td>
</tr>
<tr>
<td>Commercial fishing vessels &gt;65 feet</td>
<td>Class B</td>
</tr>
<tr>
<td>All other commercial self-propelled vessels that are &gt;65 feet</td>
<td>Class A</td>
</tr>
</tbody>
</table>
New developments in AIS
Class B SOTDMA AIS Transponders

- New type of Class B AIS transponder now available
- Different from existing CSTDMA* Class B
  - 5 watts vs. 2 watts
  - Therefore more transmit range (~10-15 miles)
  - Uses SOTDMA** (same as Class A)
  - Higher reporting rate
  - Higher grade time management & priority over Class B CS
  - Supports message 27: long range / satellite AIS

- AMEC WideLink B600 AIS SOTDMA Class B
  - Black box with NMEA 0183, NMEA 2000, USB
  - Pricing: $699 (Wi-Fi version $899)

- em-trak AIS B400
  - Integrated color screen, C-MAP support, Wi-Fi
  - Pricing: $1,249

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*CSTDMA = Carrier Sense Time Division Multiple Access

**SOTDMA = Self Organized Time Division Multiple Access
### AIS Classes:
- Class A
- Class B/SO
- Class B/CS

<table>
<thead>
<tr>
<th></th>
<th>Class A</th>
<th>Class B/SO</th>
<th>Class B/CS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transmit Power (Watts)</strong></td>
<td>12.5 W / 2 W (low-power)</td>
<td>5 W / 2 W (low-power)</td>
<td>2 W</td>
</tr>
<tr>
<td><strong>Primary Access Scheme</strong></td>
<td>Self-organizing Time-Division Multiple Access (SOTDMA)</td>
<td>SOTDMA</td>
<td>Carrier-sense TDMA non-competing with SOTDMA units</td>
</tr>
<tr>
<td><strong>Position Reporting Rate</strong></td>
<td>Either every 2, 3 ½, 6 or 10 s based on speed and course change. Every 3 min. when ≤ 3 kts.</td>
<td>Either every 5, 15 or 30 s based on speed (2-14, 14-23, &gt;23 kts). Every 3 min. when ≤ 2 kts.</td>
<td>Every 30 s Every 3 min. when ≤ 2 kts.</td>
</tr>
<tr>
<td><strong>Static Data Reporting Rate</strong></td>
<td>Every 6 min</td>
<td>Every 6 min</td>
<td>Every 6 min</td>
</tr>
<tr>
<td><strong>Frequency Range</strong></td>
<td>25 kHz bandwidth between 156.025 MHz to 162.025 MHz</td>
<td>25 kHz bandwidth between 156.025 MHz to 162.025 MHz</td>
<td>25 kHz bandwidth at minimum between 161.500 MHz to 162.025 MHz</td>
</tr>
<tr>
<td><strong>Dedicated DSC Receiver for Channel Management</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Time-shared</td>
</tr>
<tr>
<td><strong>Position Source / WGS-84 to 1/10,000 of minute of arc</strong></td>
<td>Internal Global Navigation Satellite System &amp; connection to an External Electronic Positioning System (EPI)</td>
<td>Internal GNSS</td>
<td>Internal GNSS</td>
</tr>
<tr>
<td><strong>Digital Interfaces</strong></td>
<td>2 Input-Output &amp; Multiple Presentation Outputs</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>Multiple Keyboard Display (MKD)</td>
<td>MKD</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>Safety Text Messaging</strong></td>
<td>Receive &amp; Transmit</td>
<td>Receive &amp; Transmit</td>
<td>Transmit Optional, and only with non-alterable pre-configured messages</td>
</tr>
<tr>
<td><strong>Application Specific Messages</strong></td>
<td>Receive &amp; Transmit</td>
<td>Receive &amp; Transmit (up to 3 slots)</td>
<td>Receive Optional, cannot Transmit</td>
</tr>
<tr>
<td><strong>Transmit Data</strong></td>
<td>All</td>
<td>No Rate of Turn, Navigation Status, Destination, ETA, Draft, or IMO#</td>
<td>No Rate of Turn, Navigation Status, Destination, ETA, Draft, or IMO#</td>
</tr>
</tbody>
</table>
AIS Satellite tracking

Courtesy of exactEarth
Satellite AIS

- AIS VHF transmission limited to line of sight but satellites have the potential to receive AIS transmissions
- Multiple AIS satellite systems in orbit
  - International Space Station in 2010
  - ExactEarth, ORBCOMM, Spacequest, Spire, gov’t
- But issues with a satellite receiving so many AIS signals
  - AIS slot management limited to 4500 messages per minute
- exactEarth: new chipset technology for exactTrax-enabled AIS Class B (AMEC, Vesper …)
- AIS Message 27: long-range automatic identification system broadcast message for Class A and Class B “SO”
- MarineTraffic: track a single vessel for $157.25 per year
  - “Note that Satellite AIS tracking may be less effective for vessels equipped with Class B AIS transponders due to their lower transmission power.”
- Consider Class B SOTDMA (5 watt) or even Class A (12.5 watt) if going offshore and want satellites (and friends and family) to see you
- Other options might make more sense for offshore tracking (SPOT, SkyMate)
USCG Update

• Biggest issue with AIS? Transponders with incorrect information!
  • AIS with bad encoding on Jan 22: 50% of Class A, 46% of Class B
  • Includes MMSI, IMO Number, Call Sign or Name differences, vessel length of 0 meters, undefined ship type or draft of 0.0 meters
  • Class B must be programmed by the dealer!
  • See https://www.navcen.uscg.gov/pdf/AIS/AISGuide.pdf for guidance
  • Check your vessel here: https://www.navcen.uscg.gov/aisSearch/index.php

• Issues with too many targets i.e. Class B transponders left on
• Still working on MMSI challenges for buoy trackers, AtoNs
Integration, new devices and new functionality
Vesper Marine WatchMate App & smartAIS

The free Vesper Marine WatchMate App configures and monitors a Vision or XB-8000 transponder

- Duplicates Vesper Vision functions on mobile device
- View & prioritize target info
- Set alarms based on profiles
- Remote control of transponder settings
- Switch in and out of Silent mode
- Anchor watch
- Get man overboard alerts
- Check the operational status of the AIS transponder
- Perform configuration & firmware upgrades
Vesper Marine’s NEW deckWatch App

The free Vesper Marine deckWatch gives you the ability to monitors all critical information straight from your wrist with a Vision or XB-8000 transponder.

*Available on Android Wear 2.0

- View AIS Targets
- Receive collision warning alarms
- Control and view the Anchor Watch alarm.
- View own GPS Position, Course, Speed and more!
- Manage and receive MOB alarms.
AIS Mobile Apps

TARGET TRACKING
RADAR VIEW

WatchMate smartAIS
iNavX on iPad
MarineTraffic on iPhone
OpenCPN on Android

Plus hundreds more on iOS, Android, Windows, Mac
Integration and multiplexing

• Most transponders today can interface with virtually any marine network
  • NMEA 2000, NMEA 0183
  • USB, Wi-Fi

• Some (e.g. Vesper XB8000) can multiplex data from many sources / protocols and route to other devices
  • E.g. stream AIS & GPS plus wind, depth, heading to iPad or PC
AIS with chartplotter capabilities

- Em-trak A400 & B400 AIS Transponders
- Class B SO (5 W) or Class A (12.5 W) models
- Color screen with C-MAP chart chip support
- Wi-Fi, NMEA 2000, NMEA 0183, opt. USB
AIS MOB: Ocean Signal MOB1 – AIS & DSC

Graphic provided by Ocean Signal
AIS SART & EPIRB

- SART (Search and Rescue Transponder) required on 300+ ton vessels
- Traditional SARTs use radar
- Now AIS SARTs are certified for use
- Great rescue solution coupled with EPIRB
- Priced about $500
- McMurdo working on a combo EPIRB / AIS SART
AIS trackers

• Fishing nets / buoys and other small floating objects can be hazards for boaters
• Plus boaters want to track tenders
• New type of AIS device can be used to track and alert other boats of their existence and position
• AIS trackers are self-contained AIS transponders with integrated battery, VHF and GPS antennas, SOS button
• Solutions exist (AMEC & em-trak) and are in use in every country except the USA
• Getting an AtoN MMSI in the US is “complicated”
AIS Computer!?! 

• Comar SLR350Ni: network based AIS receiver with integrated computer
• Based on popular land station SLR350N
  • Widely used for setting up a MarineTraffic monitoring station
• Dual channel AIS receiver
• Built-in computer running Raspberry PI 3
  • 4 USB, HDMI, microSD, Ethernet & Wi-Fi (client and server)
  • Runs open source software such as OpenCPN
  • Fully programmable for virtually any local / remote AIS monitoring scenario
• Just add monitor, keyboard, mouse, USB power, VHF antenna
Other AIS considerations
VHF Antenna Considerations

• AIS devices require VHF antenna
• Any good VHF antenna will work
• Position is #1 factor – by far
• Antennas need separation
  • At least 4 feet from other VHF
  • GPS antenna less critical
  • Consider combo antennas
• Any metal causes multi-path interference
  • E.g. stays, masts, arches, bimini
• Cable & connectors also important
• Antenna splitters are a great solution
• AIS can be poor in marinas – test in open water

Don’t do this!
MarineTraffic ≠ Realtime AIS

AIS should not be relied on for vessel tracking, especially with MarineTraffic
Same time but ... different information
Turn Off AIS While Away

• Volume of Class B transponders is now having a negative impact on AIS
• Safety issue: so many targets, you can’t see other nav features
• Especially a problem on older chartplotters e.g. Garmin 3000 series
  • Limited targets, some not visible
• Also notice lack of vessel info (MMSI only displayed)
• Turn off your Class B AIS transponder when you are in a marina PLEASE!!!
Questions?

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Thank you and safe boating!