

# Module 1: Automatic Identification System (AIS) Data

<http://ais-portal.usace.army.mil/>

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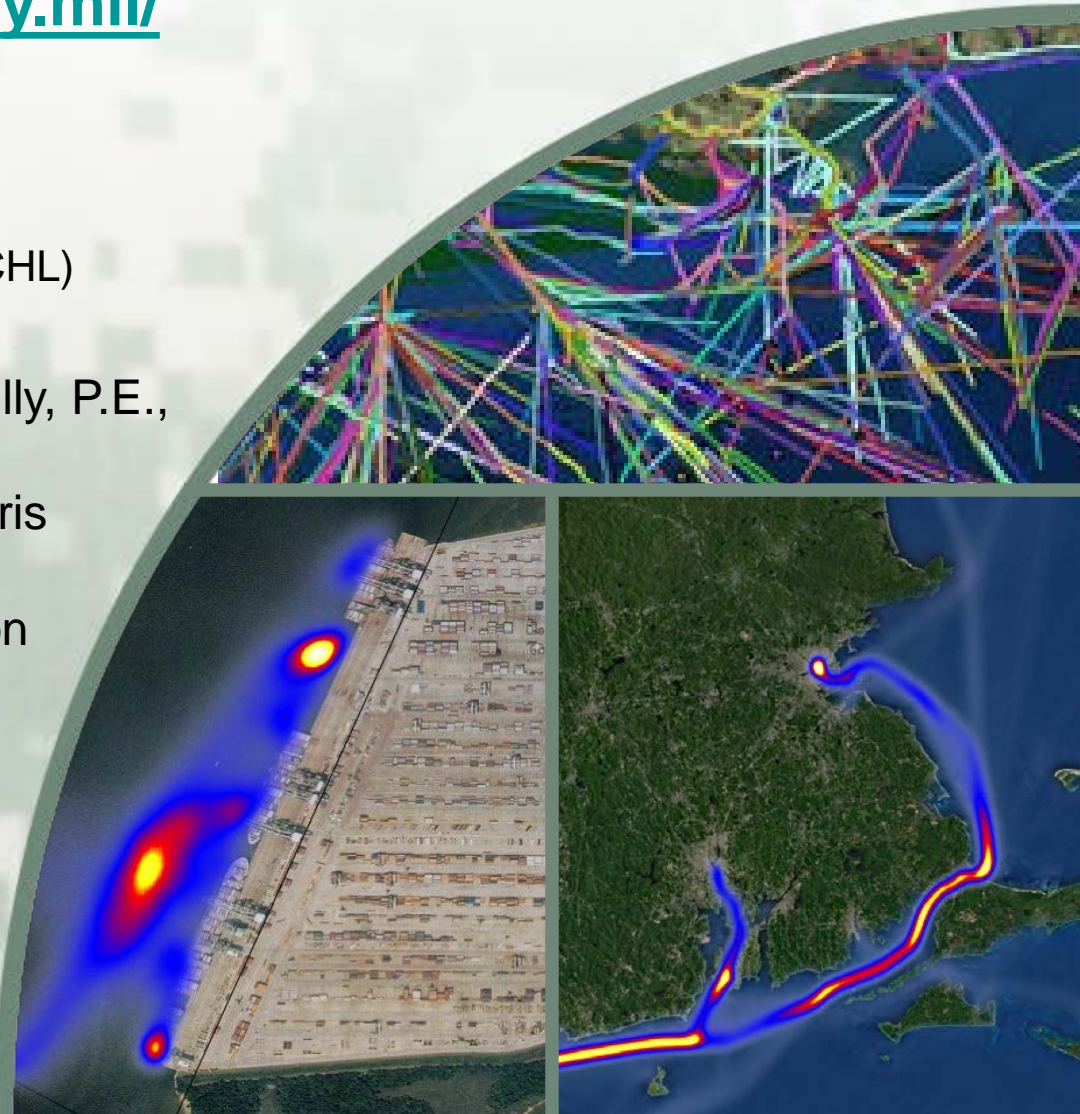
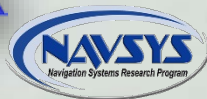
Susan Herrle, Steven Antrim, Shannon  
Langford (ARA, Inc.)

### AISAP User Workshop

SWD – Dallas, TX  
31 AUG 2016



US Army Corps  
of Engineers®

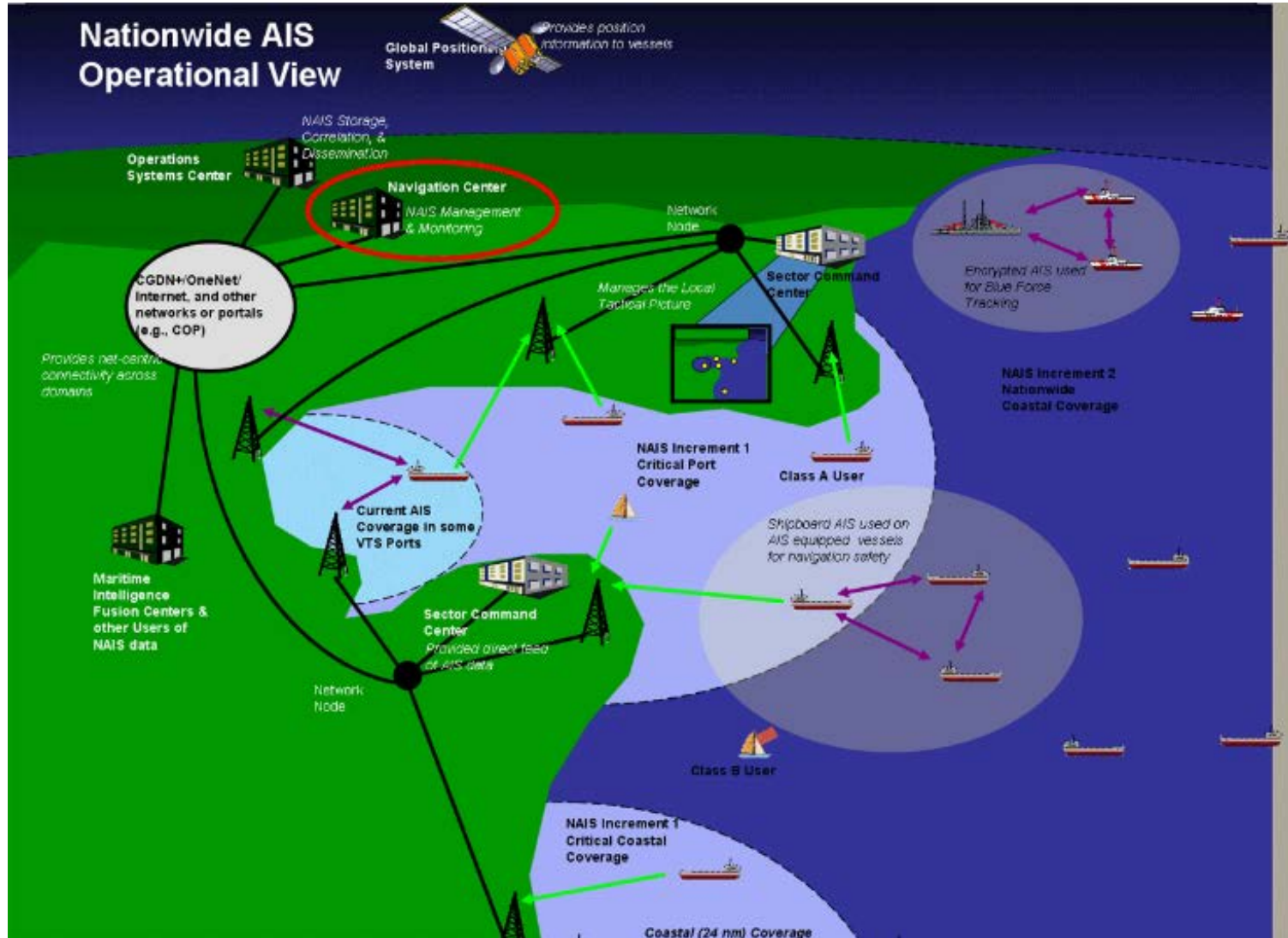


# AIS Concept

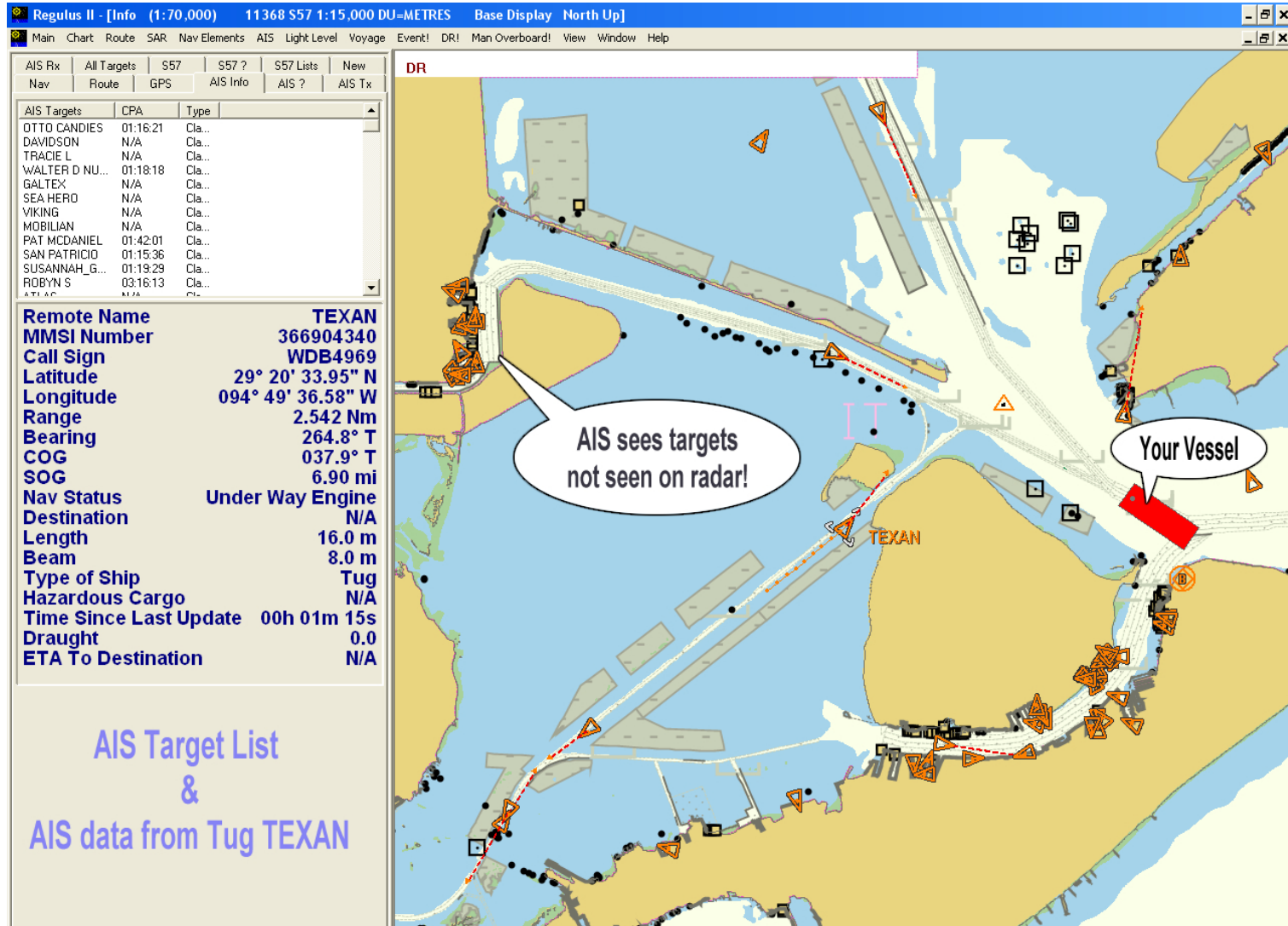
- Improved real-time Maritime Domain Awareness
- Ship/Shore/Satellite communication
- Uses VHF marine radio and CDMA protocols.
  - ▶ Line of sight
  - ▶ Limited data capacity per message



# AIS Concept



# AIS Shipboard Display



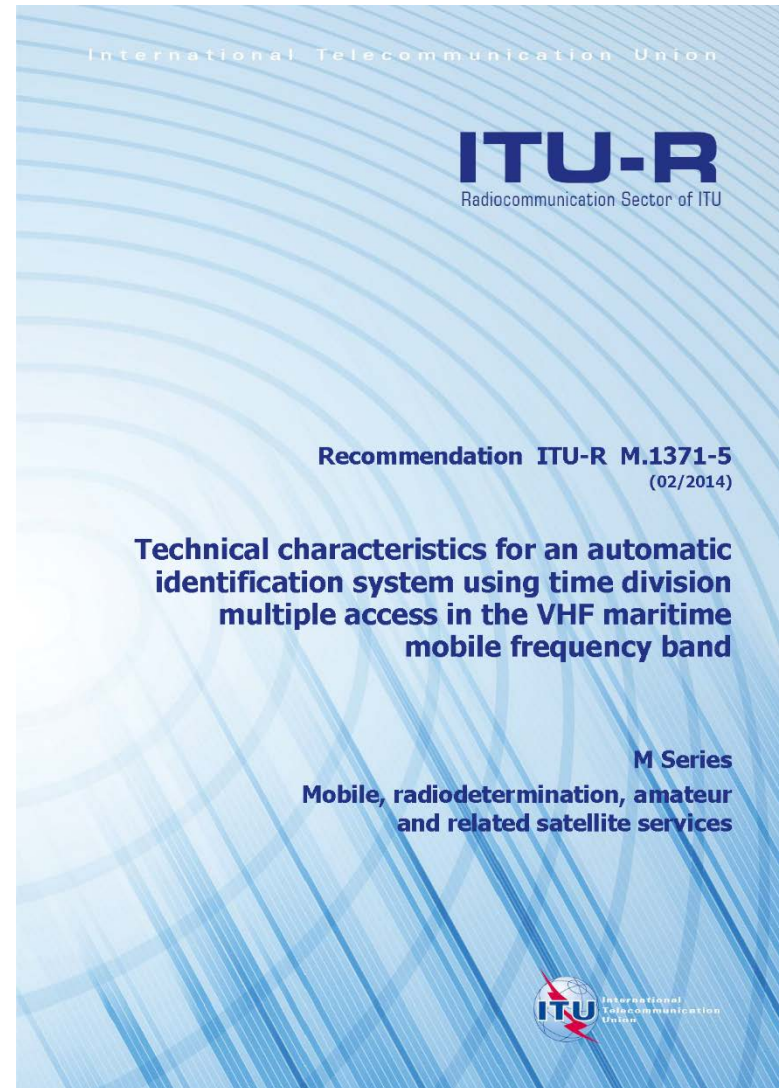
# AIS Carriage Requirements

- In the United States, AIS carriage requirements are set by [33 CFR 164.46\(b\)](#),
- Effective March 2, 2015, the following vessels must have AIS carriage:
  - Self-propelled vessel of 65 feet or more in length, engaged in commercial service,
  - Towing vessel of 26 ft or more in length and more than 600 horsepower, engaged in commercial service,
  - Self-propelled vessel that is certified to carry more than 150 passengers,
  - Self-propelled vessel engaged in dredging operations,
  - Self-propelled vessel engaged in the movement of dangerous cargo or flammable or combustible liquid cargo,
  - Fishing industry vessels.



# AIS Standard Specification

- International Telecommunication Union sets AIS data standard
- Use the latest version
- <https://www.itu.int/rec/R-REC-M.1371/en>



# AIS Data

```
SampleAISdata.log - Notepad
File Edit Format View Help
\n:48166,s:b003669977,c:1335916797*2B\!AIVDM,1,1,,B,15MwBW0010q=UGP@qbq5S1L00400,0*51
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\n:778112,s:b003669979,c:1335916797*12\!AIVDM,1,1,,A,15MvAs0P01I<bevA2UL=swwp0T00,0*7E
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\g:1-2-10378,n:236626,s:r08VCCCH,c:1335916801*58\!AIVDM,2,1,1,B,55N0fGP0AKFiL@??OCM0T1ht<v2222222222000`C555jGe50AiH4QARcc,0*3C
\g:2-2-10378,n:236627*1C\!AIVDM,2,2,1,B,RCQk1DjA1H0,2*2A
\n:456834,s:b003669978,c:1335916801*11\!AIVDM,1,1,,B,4h30wnAuiA000q<;D@17Ng02L4F,0*32
\g:1-2-81589,n:164716,s:r08TPVR1,c:1335916801*40\!AIVDM,1,1,,A,1815<3@02<qHFRF?sD4LE9p40@:,0*03
\g:2-2-81589,n:164717*1A\!AIVDM,2,2,4,A,888888888880,2*20
\g:1-2-35778,n:53391,s:b003669980,c:1335916801*6F\!AIVDM,2,1,4,A,5507cP02<=3=L=SWS;@<4iHTr222085TpF2222161@j3:57g08hhCADSk`88,0*0E
\g:2-2-35778,n:53392*25\!AIVDM,2,2,4,A,888888888880,2*20
\n:53393,s:b003669980,c:1335916801*21\!AIVDM,1,1,,B,15NKj3000jqEetRA8?g3@2R40@14,0*23
\g:1-2-45243,n:48195,s:b003669977,c:1335916802*62\!AIVDM,2,1,3,A,55NK;C000001L@KC378e8U=AV0j2222222222004p?555d<0:R3mDm3k`88,0*66
\g:2-2-45243,n:48196*23\!AIVDM,2,2,3,A,888888888880,2*27
\n:48197,s:b003669977,c:1335916802*26\!AIVDM,1,1,,A,15NHboPP00I=p@4@i3o9D0v42815,0*52
\g:1-2-126495,n:256934,s:r08TPHI1,c:1335916802*7A\!AIVDM,1,1,,A,13P7sa300Aq><IH@CW3aC7Kn0<1M,0*76
\g:2-2-126495,n:256935*26\!AIVDM,2,2,3,A,888888888880,2*27
\g:1-2-126496,n:256936,s:r08TPHI1,c:1335916802*7B\!AIVDM,1,1,,B,19N58f000Kq?t80@Caj`v`2080p,0*39
\g:1-2-81598,n:164734,s:r08TPVR1,c:1335916819*49\!AIVDM,1,1,,A,13P7sa300Aq><IH@CW3aC7Kn0<1M,0*76
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\g:1-2-54167,n:778557,s:b003669979,c:1335916819*5D\!AIVDM,2,1,8,A,55NIB8000001L@GW?3L@T41tpB04ppTF22222000@11240005@000000000,0*5D
\g:2-2-54167,n:778558*14\!AIVDM,2,2,8,A,0000000000,2*2C
\n:778559,s:b003669979,c:1335916819*10\!AIVDM,1,1,,B,15MqFM0000q<;qjA0sI50nHV0<3?,0*45
\g:1-2-45251,n:48414,s:b003669977,c:1335916819*67\!AIVDM,2,1,1,A,55NIB8000001L@GW?3L@T41tpB04ppTF22222000@11240005@000000000,0*54
\g:2-2-45251,n:48415*2E\!AIVDM,2,2,1,A,0000000000,2*25
\n:53629,s:b003669980,c:1335916818*2D\!AIVDM,1,1,,A,15N9P0gP00IDd0hA3V54IgvT00SU,0*63
\n:53630,s:b003669980,c:1335916818*25\!AIVDM,1,1,,B,15Mw`BPP0kIEv?pa8:p:fwv`0400,0*5D
\n:117992,s:b003669981,c:1335916818*12\!AIVDM,1,1,,B,15NF1w?P01IALv@A1sRQvV28:w,0*68
\n:778560,s:b003669979,c:1335916819*1A\!AIVDM,1,1,,A,15N5s;gP00I=0r`@tNuIn?v`0@:u,0*4E
\g:1-2-54168,n:778561,s:b003669979,c:1335916819*57\!AIVDM,2,1,9,B,59Nwrw12>3><7PaC@005>0<58T4000000000001?F@d??5AWNJSQEp31S1@C,0*43
\g:2-2-54168,n:778562*12\!AIVDM,2,2,9,B,Th000000000,2*12
\n:457186,s:b003669978,c:1335916819*19\!AIVDM,1,1,,B,35Ms8G5P00I;qA8A0Ut:<?vT0000,0*36
\g:1-2-45252,n:48416,s:b003669977,c:1335916819*66\!AIVDM,2,1,2,B,59Nwrw12>3><7PaC@005>0<58T4000000000001?F@d??5AWNJSQEp31S1@C,0*48
\g:2-2-45252,n:48417*2F\!AIVDM,2,2,2,B,Th000000000,2*19
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\n:778563,s:b003669979,c:1335916819*19\!AIVDM,1,1,,B,35Ms8G5P00I;qA8A0Ut:<?vT0000,0*36
\n:778564,s:b003669979,c:1335916819*1E\!AIVDM,1,1,,B,17Mt1S0P00I<b>vA2F@r90vV0400,0*12
```



NMEA format; translators are available.



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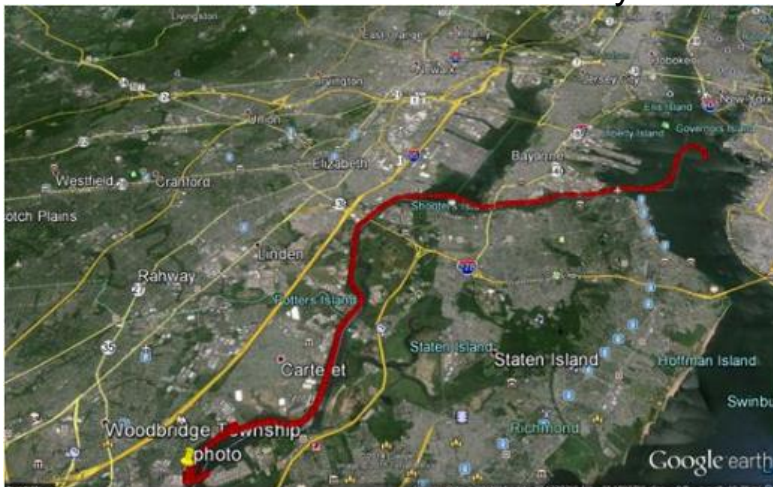


# AIS Data Example

Example  
Vessel



Location: Arthur Kill between  
New York and New Jersey

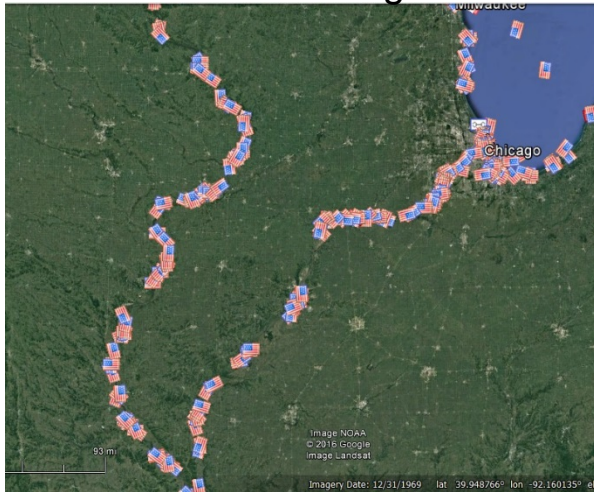


Plotted AIS Position Reports  
Down Sampled to 5 Minutes

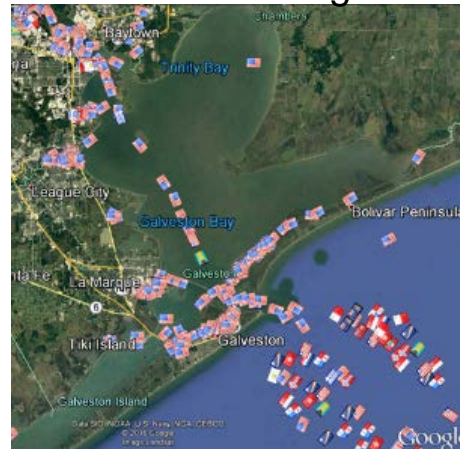


# NAIS Coverage Examples

Upper Miss., Illinois Waterway,  
and Lower Lake Michigan



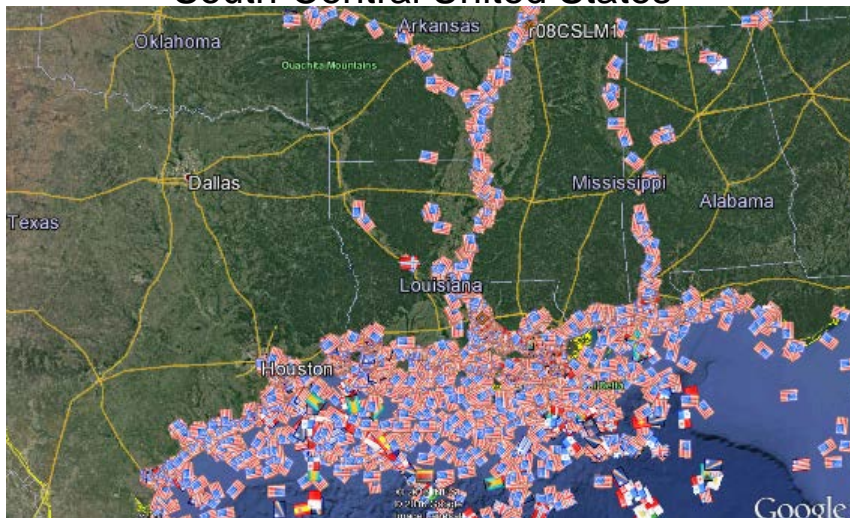
Galveston Bay, GIWW,  
Outer Anchorage



Mississippi River and the  
Port of Vicksburg



South-Central United States



# Primary AIS Message Fields

Parameter	Description
Message ID	Identifier for this Message 1, 2 or 3
Repeat indicator	Used by the repeater to indicate how many times a message has been repeated. See § 4.6.1, Annex 2; 0-3; 0 = default; 3 = do not repeat any more
User ID	Unique identifier such as MMSI number
Navigational status	0 = under way using engine, 1 = at anchor, 2 = not under command, 3 = restricted maneuverability, 4 = constrained by her draught, 5 = moored, 6 = aground, 7 = engaged in fishing, 8 = under way sailing, 9 = reserved for future amendment of navigational status for ships carrying DG, HS, or MP, or IMO hazard or pollutant category C, high speed craft (HSC), 10 = reserved for future amendment of navigational status for ships carrying dangerous goods (DG), harmful substances (HS) or marine pollutants (MP), or IMO hazard or pollutant category A, wing in ground (WIG); 11 = power-driven vessel towing astern (regional use), 12 = power-driven vessel pushing ahead or towing alongside (regional use); 13 = reserved for future use, 14 = AIS-SART (active), MOB-AIS, EPIRB-AIS 15 = undefined = default (also used by AIS-SART, MOB-AIS and EPIRB-AIS under test)
Rate of turn ROTAIS	0 to +126 = turning right at up to 708° per min or higher 0 to -126 = turning left at up to 708° per min or higher Values between 0 and 708° per min coded by $ROT_{AIS} = 4.733 \sqrt{ROT_{sensor}}$ degrees per min where $ROT_{sensor}$ is the Rate of Turn as input by an external Rate of Turn Indicator (TI). $ROT_{AIS}$ is rounded to the nearest integer value. +127 = turning right at more than 5° per 30 s (No TI available) -127 = turning left at more than 5° per 30 s (No TI available) -128 (80 hex) indicates no turn information available (default). ROT data should not be derived from COG information.
SOG	Speed over ground in 1/10 knot steps (0-102.2 knots) 1 023 = not available, 1 022 = 102.2 knots or higher

Parameter	Description
Position accuracy	The position accuracy (PA) flag should be determined in accordance with Table 50 1 = high ( $\leq 10$ m) 0 = low ( $> 10$ m) 0 = default
Longitude	Longitude in 1/10 000 min ( $\pm 180^\circ$ , East = positive (as per 2's complement), West = negative (as per 2's complement). 181 = (6791AC0 <sub>h</sub> ) = not available = default)
Latitude	Latitude in 1/10 000 min ( $\pm 90^\circ$ , North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140 <sub>h</sub> ) = not available = default)
COG	Course over ground in 1/10 = (0-3 599). 3 600 (E10 <sub>h</sub> ) = not available = default. 3 601-4 095 should not be used
True heading	Degrees (0-359) (511 indicates not available = default)
Time stamp	UTC second when the report was generated by the electronic position system (EPFS) (0-59, or 60 if time stamp is not available, which should also be the default value, or 61 if positioning system is in manual input mode, or 62 if electronic position fixing system operates in estimated (dead reckoning) mode, or 63 if the positioning system is inoperative)
Special manoeuvre indicator	0 = not available = default 1 = not engaged in special manoeuvre 2 = engaged in special manoeuvre (i.e. regional passing arrangement on Inland Waterway)
Spare	Not used. Should be set to zero. Reserved for future use.
RAIM-flag	Receiver autonomous integrity monitoring (RAIM) flag of electronic position fixing device; 0 = RAIM not in use = default; 1 = RAIM in use. See Table 50
Communication state	See Table 49
Number of bits	



# AIS Message Fields: Ship Static and Voyage Related Data

Parameter	Description
Message ID	Identifier for this Message 5
Repeat indicator	Used by the repeater to indicate how many times a message has been repeated. Refer to § 4.6.1, Annex 2; 0-3; 0 = default; 3 = do not repeat any more
User ID	MMSI number
AIS version indicator	0 = station compliant with Recommendation ITU-R M.1371-1 1 = station compliant with Recommendation ITU-R M.1371-3 (or later) 2 = station compliant with Recommendation ITU-R M.1371-5 (or later) 3 = station compliant with future editions
IMO number	0 = not available = default – Not applicable to SAR aircraft 0000000001-0000999999 not used 0001000000-0009999999 = valid IMO number; 0010000000-1073741823 = official flag state number.
Call sign	7 x 6 bit ASCII characters, @@@@ = not available = default. Craft associated with a parent vessel, should use “A” followed by the last 6 digits of the MMSI of the parent vessel. Examples of these craft include towed vessels, rescue boats, tenders, lifeboats and liferafts.
Name	Maximum 20 characters 6 bit ASCII, as defined in Table 47 “@@@@@@@@@@@@@@@@” = not available = default. The Name should be as shown on the station radio license. For SAR aircraft, it should be set to “SAR AIRCRAFT NNNNNNN” where NNNNNNN equals the aircraft registration number.

Parameter	Description
Type of ship and cargo type	0 = not available or no ship = default 1-99 = as defined in § 3.3.2 100-199 = reserved, for regional use 200-255 = reserved, for future use Not applicable to SAR aircraft
Overall dimension/ reference for position	Reference point for reported position. Also indicates the dimension of ship (m) (see Fig. 42 and § 3.3.3) For SAR aircraft, the use of this field may be decided by the responsible administration. If used it should indicate the maximum dimensions of the craft. As default should A = B = C = D be set to “0”
Type of electronic position fixing device	0 = undefined (default) 1 = GPS 2 = GLONASS 3 = combined GPS/GLONASS 4 = Loran-C 5 = Chayka 6 = integrated navigation system 7 = surveyed 8 = Galileo. 9-14 = not used 15 = internal GNSS
ETA	Estimated time of arrival; MMDHMM UTC Bits 19-16: month; 1-12; 0 = not available = default Bits 15-11: day; 1-31; 0 = not available = default Bits 10-6: hour; 0-23; 24 = not available = default Bits 5-0: minute; 0-59; 60 = not available = default For SAR aircraft, the use of this field may be decided by the responsible administration
Maximum present static draught	In 1/10 m, 255 = draught 25.5 m or greater, 0 = not available = default; in accordance with IMO Resolution A.851 Not applicable to SAR aircraft, should be set to 0
Destination	Maximum 20 characters using 6-bit ASCII; @@@@@@@@@@@@@@@@ = not available For SAR aircraft, the use of this field may be decided by the responsible administration
DTE	Data terminal equipment (DTE) ready (0 = available, 1 = not available = default) (see § 3.3.1)
Spare	Spare. Not used. Should be set to zero. Reserved for future use
Number of bits	Occupies 2 slots



# Formatted Data Example

## Primary Fields:

MMSI	NAME	RECEIVER	TX_DTTM	LAT	LON
366611111	ZR		1/9/2013 13:05	39.017125	-74.646383

COURSE_OVER_GROUND	NAV_STATUS	POS_ACCURACY	RATE_OF_TURN	SPEED_OVER_GROUND	HEADING
45	Under way using engine	FALSE	0	9	45

## Static Fields:

MMSI	IMO_NUMBER	CALL_SIGN	NAME	SHIP_AND_CARGO_TYPE
366611111	7200000	WCU1111	ZR	Tug

DIM_BOW	DIM_STERN	DIM_PORT	DIM_STARBOARD	NAV_SENSOR	ETA	DRAUGHT
9	21	5	3			14.2

Note: Identifying information has been changed



# AIS Data Availability

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PortVision AIS Enterprise Solutions Services Industry Focus News & Blog Support

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## Maritime business, real results.

Oceaneering provides maritime business systems that enhance efficiency, reduce cost, and increase safety and security across the globe. Our PortVision Advantage and PortVision Plus AIS ship tracking services support over 3,500 users worldwide. In 2016 we launched PortVision 360, the next generation in AIS-based maritime business

Tap into PortVision's 30-billion record data warehouse for historical reporting, animated incident playback, AIS data, and business intelligence. Support demurrage forecasting and analysis, incident response, market research, compliance, training, negotiation, and litigation activities.

Grid of AIS electronic components including transmitters, receivers, and display units with price tags such as \$256.67, \$198.76, \$252.10, \$899.00, \$1,296.38, \$639.95, \$436.95, \$2,269.82, \$399.09, \$490.09, and \$232.09.

Grid of various AIS antennas with price tags such as \$94.49, \$102.00, \$294.59, \$125.09, \$117.22, \$119.00, \$104.86, \$145.00, \$173.20, \$69.95, and \$99.00.

MarineTraffic Live Map Vessels- Ports- Photos Participate- Services-

Map showing AIS data tracks over the United States and Mexico. Key locations labeled include Vancouver, Winnipeg, Chicago, and Mexico. The map displays dense green and red tracks indicating vessel movement and AIS signal strength.

Detailed grid of various AIS antennas and components, including different antenna shapes, sizes, and mounting brackets.



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# Archival NAIS Data

- US Coast Guard Navigation Center:  
<http://www.navcen.uscg.gov/>
  - ▶ Most large commercial ships
  - ▶ Near complete coverage of US Coastal Ports; Inland coverage from USACE (LOMA)
  - ▶ Granular in time (seconds)
  - ▶ Spatial accuracy of GPS
  - ▶ Highly detailed remote sensing vessel data
    - Dynamic: TIME, Course, Speed, Heading +
    - Static: Name, Dimensions, Type, Country +





# NAVIGATION CENTER

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UNITED STATES COAST GUARD



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## Request NAIS Data

- Historical Data Request Form
- Data Feed Request Form
- Return to NAIS Main Page
- NAIS Data Formats
- NAIS HDR Delivery Methods

## Mission Areas

- Global Positioning System
- Nationwide DGPS
- Nationwide AIS (NAIS)
- AIS (Overview, Messages, etc.)
- Long Range Identification and Tracking
- Local Notice to Mariners
- Light Lists Publications (2016)
- Light Lists (Weekly Updates)
- Civil GPS Service Interface Committee
- LORAN C (archive)

## Subscribe / Report (free)

- Local Notice to Mariners (Weekly)
- GPS Operational Summary (Daily)
- NANUs (upon occurrence)
- Join CGSIC
- Report an ATON Discrepancy
- Report a GPS Problem
- Report an NDGPS Problem
- Report an LRIT Problem
- Report an NAIS Problem
- Contact Us

## Maritime Information

- Electronic Charts Approval
- Maritime Safety Information Downloads
- Maritime Telecommunications
- CG Nat'l Distress System
- Global Maritime Distress and Safety System
- Marine Safety Information Broadcasts
- MF & HF Channels
- Nav Pubs and Documents
- Radio Watch Requirements
- Vessel Traffic Services
- VHF Channels & Freqs
- USCG 'Homeport' Website

## HISTORICAL DATA REQUEST

**NOTE TO ALL USERS:** If you are experiencing difficulty in submitting this Historical Data Request Form, click [here](#) to contact us and report the issue.

Processing and delivery times vary depending on the complexity of the request, amount of data involved, and availability of staff.

Please note that the data processing times **DO NOT** include the approval processing time. It could take up to 10 additional business days to receive final approval for each request.

All fields indicated by an asterisk are required for a valid submission. Please review the [NAIS Data Sharing Categories and Requirements](#).

*Requesting Level A or Level B Entity Name (include office symbol and Address):		Date (mm/dd/yyyy):
<input type="text"/>		08/05/2016
Remaining Characters 3000		Automatic default of the current date that cannot be changed.
*Government, Federal Government contract, or USCG Port Partner Point of Contact:	*Email Address:	*Phone: (10 digit number)
<input type="text"/>	<input type="text"/>	<input type="text"/>
Technical Point of Contact:	Email Address:	Phone: (10 digit number)
<input type="text"/>	<input type="text"/>	<input type="text"/>
*Intended Use Of NAIS Data (please be specific). For USCG Requests - please explain why NAIS information available through other systems (e.g., C2PC, WebCOP, MISLE, EGIS, MARVIEW, etc.) will not meet your needs.:		
<input type="text"/>		
Remaining Characters 3000		

\*Will this information be used for law enforcement or legal action?  Yes  No  Possibly  
(Note: If "Yes" is selected, check the "Raw NMEA 0183 Data File" format box below if required for legal proceedings.)

## DATA OUTPUT INFORMATION

\*In what format (NAIS DATA Formats) would you prefer to receive the data? Please check the appropriate box(es) as they apply to your specific request. (Please keep in mind that the processing time/level of effort (LOE) may increase with each additional option selected.)

Raw NMEA 0183 Data File:  (Standard for Interface Marine Electronic Devices in ...)





# AISAP Data Request Screen

The screenshot displays the AISAP Data Request interface. On the left is a 'Query Tool' form, and on the right is a satellite map of a coastal area with a blue AIS track overlaid.

**Query Tool**  
After completing the form, click 'Submit Request' to send your request to the Corps for processing. An email will be sent to the provided email address when the request is finished.

Email:

Start Time:

End Time:

Which Vessels?  All MMSIs  Selected MMSIs

Draw a bounding box or enter the coordinates manually.

Upper Left Lat:

Upper Left Lon:

Lower Right Lat:

Lower Right Lon:

Min Speed (knots):

Max Speed (knots):

Sampling Rate:

Num Records/Vessel:

The map on the right shows a satellite view of a coastline with a blue AIS track. A black bounding box is drawn around the track. A scale bar at the bottom left of the map indicates 1km and 0.6mi. The bottom right of the map area contains the text: <http://www.navigationdatacenter.us/ports/ports.htm> | USDA FSA, DigitalGlobe, GeoEye... **POWERED BY esri**

