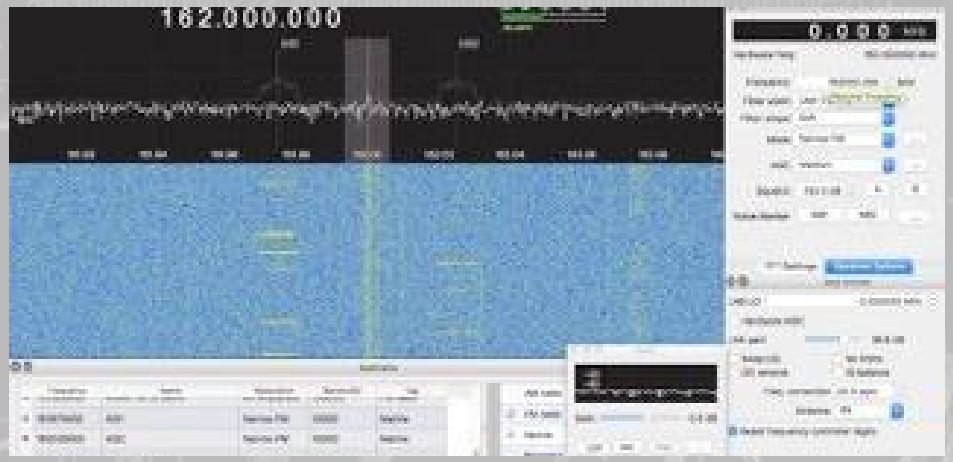
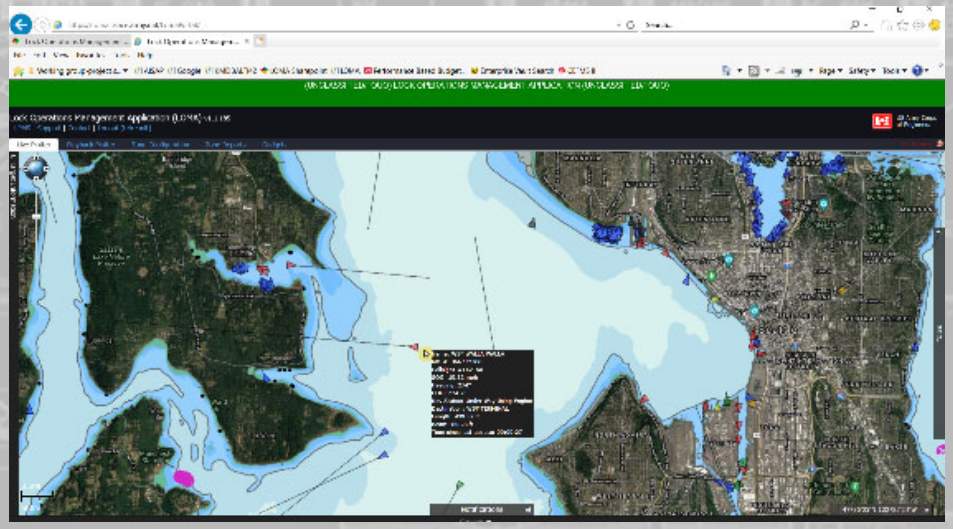
Automatic Identification System
AIS 101

- What it is
- What it can and can't do
- How do I get it?
(or, how does it get to me)?





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10 May 2021

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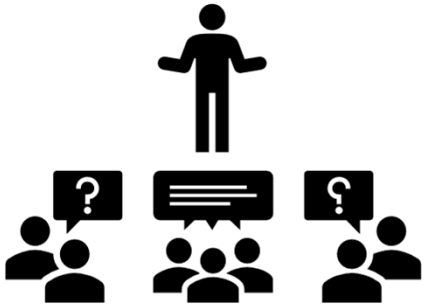
COASTAL AND HYDRAULICS LABORATORY

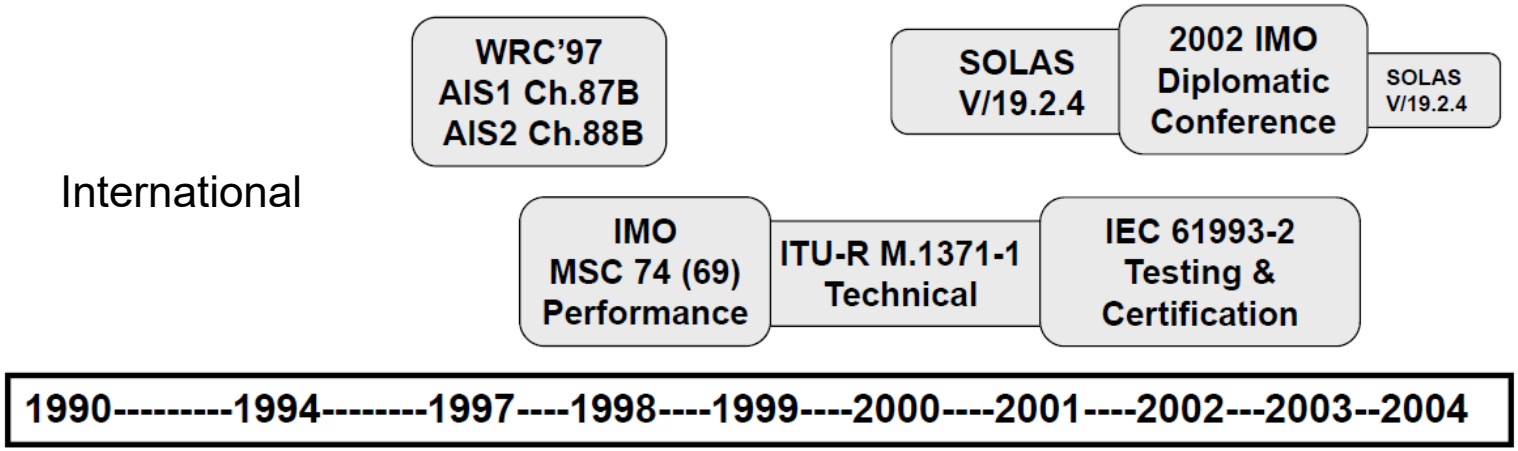
AIS 101 – So many questions!



- What is AIS?
  - Data?
  - Tracking system?
  - Transponder?
  - Communications system?

- Where did it come from?
- Who is involved in it?
- What does it look like?
- How does it work?
- Where is it?
- How can I get it or how does it get to me?
- What other cool things can AIS do?
  - (if we have time)

AIS Timeline



Stolen from Jorge Arroyo, USCG

The players – success has a million parents…

International Maritime Organization
- Sets overall requirements – performance standards
- Mandates carriage (through competent authorities)

International Telecommunications Union
- Radio frequency management
- Defines technical characteristics

International Electrotechnical Commission
- Sets standards for “the box(es)”

International Association of Marine Aids to Navigation and Lighthouse Authorities
- Shoreside component, operational guidance

US Coast Guard
- US AIS competent authority
- US carriage requirements
- Operates Nationwide AIS infrastructure

What AIS is supposed to do

IMO

ANNEX 3

RECOMMENDATION ON PERFORMANCE STANDARDS FOR AN UNIVERSAL SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM(AIS)

1 Scope

1.1 These performance standards specify the requirements for the universal AIS.

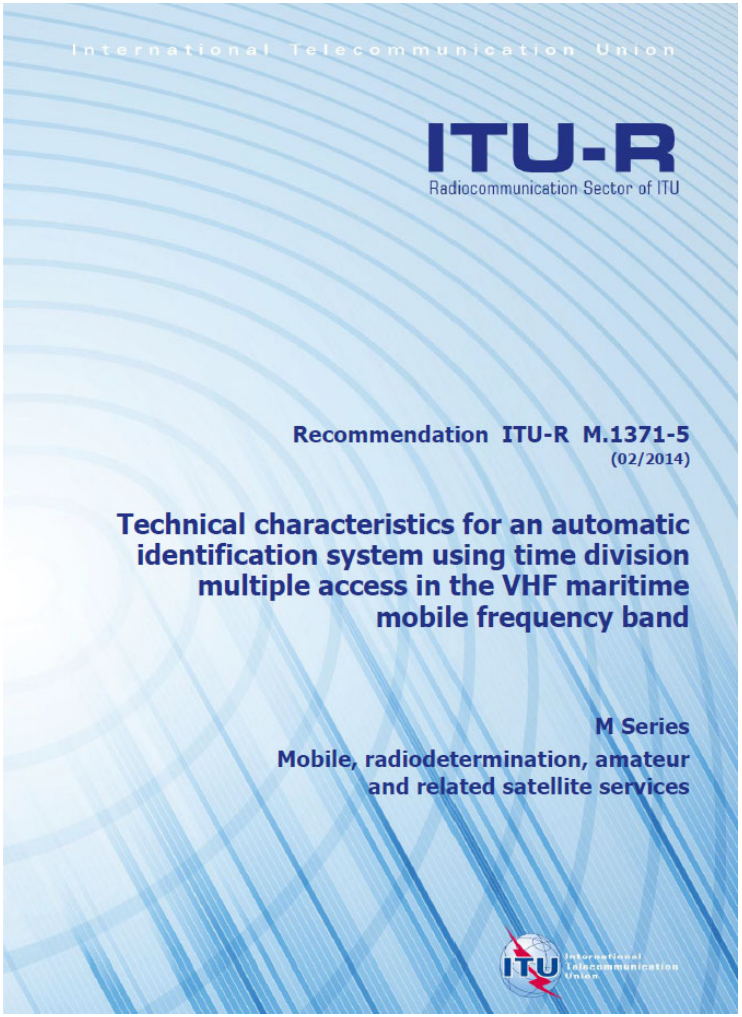
.1 in a ship-to-ship mode for collision avoidance;

.2 as a means for littoral States to obtain information about a ship and its cargo; and

.3 as a VTS tool, i.e. ship-to-shore (traffic management).

1.3 The AIS should be capable of providing to ships and to competent authorities, information from the ship, automatically and with the required accuracy and frequency, to facilitate accurate tracking. Transmission of the data should be with the minimum involvement of ship's personnel and with a high level of availability.

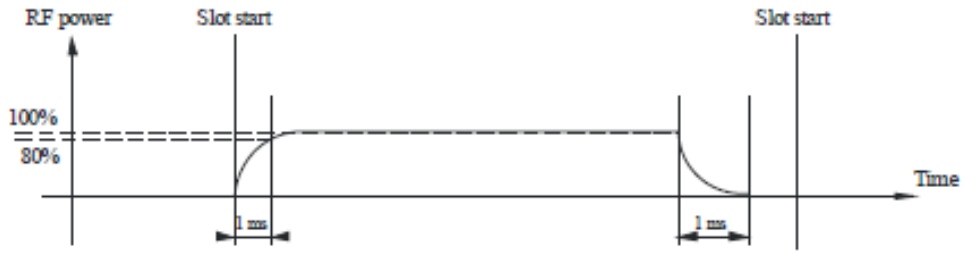
How will AIS do what IMO says?



ITU-R.M1371-5 (or just “1371”)

Specifications:
– Types of AIS equipment
– Reporting rate
– Radio characteristics
– Data encoding and transmission
– Message structure, types and descriptions

FIGURE 5

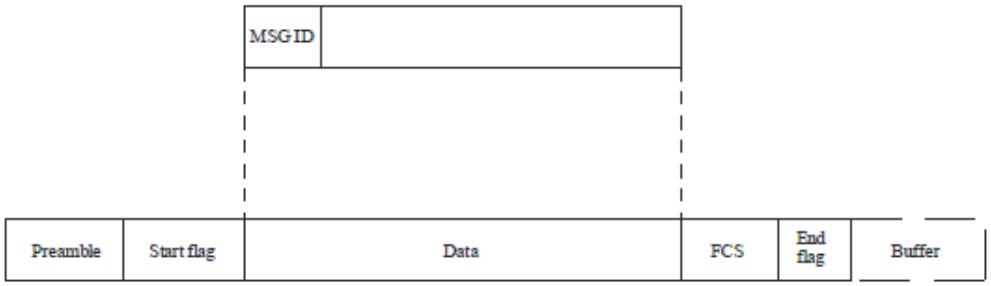


M.1371-05

3.3.7 Message structure

Messages, which are part of the access schemes, should have the following structure shown in Fig. 16 inside the data portion of a data packet:

FIGURE 16



M.1371-16

TABLE 1

Class A shipborne mobile equipment reporting intervals[2]

$hip’s dynamic conditions	Nominal reporting interval
Ship at anchor or moored and not moving faster than 3 knots	3 min[(1)]
Ship at anchor or moored and moving faster than 3 knots	10 s[(1)]
Ship 0-14 knots	10 s[(1)]
Ship 0-14 knots and changing course	3 1/3 s[(1)]
Ship 14-23 knots	6 s[(1)]
Ship 14-23 knots and changing course	2 s
Ship >23 knots	2 s
Ship >23 knots and changing course	2 s

(1) When a mobile station determines that it is the semaphore (see § 3.1.1.4, Annex 2), the reporting interval should decrease to 2 s (see § 3.1.3.3.2, Annex 2).

TABLE 46

Message ID	Name	Description	Priority	Access scheme	Communi-cation state	M/B
1	Position report	Scheduled position report; (Class A shipborne mobile equipment)	1	SOTDMA, RATDMA, ITDMA(1)	SOTDMA	M
2	Position report	Assigned scheduled position report; (Class A shipborne mobile equipment)	1	SOTDMA(9)	SOTDMA	M
3	Position report	Special position report, response to interrogation; (Class A shipborne mobile equipment)	1	RATDMA(1)	ITDMA	M
4	Base station report	Position, UTC, date and current slot number of base station	1	FATDMA(3), (7), RATDMA(2)	SOTDMA	B
5	Static and voyage related data	Scheduled static and voyage related vessel data report; (Class A shipborne mobile equipment)	4(5)	RATDMA, ITDMA(11)	N/A	M
6	Binary addressed message	Binary data for addressed communication	4	RATDMA(10), FATDMA, ITDMA(2)	N/A	M/B
7	Binary acknowledge-ment	Acknowledgement of received addressed binary data	1	RATDMA, FATDMA, ITDMA(2)	N/A	M/B
8	Binary broadcast message	Binary data for broadcast communication	4	RATDMA(10), FATDMA, ITDMA(2)	N/A	M/B
9	Standard SAR aircraft position report	Position report for airborne stations involved in SAR operations, only	1	SOTDMA, RATDMA, ITDMA(1)	SOTDMA ITDMA	M
10	UTC/date inquiry	Request UTC and date	3	RATDMA, FATDMA, ITDMA(2)	N/A	M/B
11	UTC/date response	Current UTC and date if available	3	RATDMA, ITDMA(2)	SOTDMA	M
12	Addressed safety related message	Safety related data for addressed communication	2	RATDMA(10), FATDMA, ITDMA(2)	N/A	M/B
13	Safety related acknowledge-ment	Acknowledgement of received addressed safety related message	1	RATDMA, FATDMA, ITDMA(2)	N/A	M/B
14	Safety related broadcast message	Safety related data for broadcast communication	2	RATDMA(10), FATDMA, ITDMA(2)	N/A	M/B
15	Interrogation	Request for a specific message type (can result in multiple responses from one or several stations)(4)	3	RATDMA, FATDMA, ITDMA(2)	N/A	M/B
16	Assignment mode command	Assignment of a specific report behaviour by competent authority using a Base station	1	RATDMA, FATDMA(2)	N/A	B

TABLE 46 (*end*)

Message ID	Name	Description	Priority	Access scheme	Communi-cation state	M/B
17	DGNSS broadcast binary message	DGNSS corrections provided by a base station	2	FATDMA(3), RATDMA(2)	N/A	B
18	Standard Class B equipment position report	Standard position report for Class B shipborne mobile equipment to be used instead of Messages 1, 2, 3(8)	1	SOTDMA, ITDMA(1), CSTDMA	SOTDMA, ITDMA	M
19	Extended Class B equipment position report	No longer required; Extended position report for Class B shipborne mobile equipment; contains additional static information(8)	1	ITDMA	N/A	M
20	Data link management message	Reserve slots for Base station(s)	1	FATDMA(3), RATDMA	N/A	B
21	Aids-to-navigation report	Position and status report for aids-to-navigation	1	FATDMA(3), RATDMA(2)	N/A	M/B
22	Channel management(6)	Management of channels and transceiver modes by a Base station	1	FATDMA(3), RATDMA(2)	N/A	B
23	Group assignment command	Assignment of a specific report behaviour by competent authority using a Base station to a specific group of mobiles	1	FATDMA, RATDMA	N/A	B
24	Static data report	Additional data assigned to an MMSI Part A: Name Part B: Static Data	4	RATDMA, ITDMA, CSTDMA, FATDMA	N/A	M/B
25	Single slot binary message	Short unscheduled binary data transmission (Broadcast or addressed)	4	RATDMA, ITDMA, CSTDMA, FATDMA	N/A	M/B
26	Multiple slot binary message with Communi-cations State	Scheduled binary data transmission (Broadcast or addressed)	4	SOTDMA, RATDMA, ITDMA FATDMA	SOTDMA, ITDMA	M/B
27	Position report for long-range applications	Class A and Class B "SO" shipborne mobile equipment outside base station coverage	1	MSSA	N/A	M

TABLE 48[23]

Parameter	Number of bits	Description
Message ID	6	Identifier for this Message 1, 2 or 3
Repeat indicator	2	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	30	Unique identifier such as MMSI number
Navigational status	4	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 substance or IMO hazard or pollutant category A, wi driven vessel towing astern (regional use), 12 = power-driven vessel pushing ahead o 13 = reserved for future use, 14 = AIS-SART (active), MOB-AIS, EPI 15 = undefined = default (also used by AI AIS under test)
Rate of turn ROTAIS	8	0 to +126 = turning right at up to 708° per 0 to –126 = turning left at up to 708° per m Values between 0 and 708° per min coded $ROT_{AIS} = 4.733\ SQRT(ROT_{sensor})$ where ROT_{sensor} is the Rate of Turn as inp Indicator (TI). ROT_{AIS} is rounded to the n +127 = turning right at more than 5° per 3 –127 = turning left at more than 5° per 30 –128 (80 hex) indicates no turn informatio ROT data should not be derived from CO
SOG	10	Speed over ground in 1/10 knot steps (0-1 1 023 = not available, 1 022 = 102.2 knots
Position accuracy	1	The position accuracy (PA) flag should be Table 50 1 = high (≤10 m) 0 = low (>10 m) 0 = default
Longitude	28	Longitude in 1/10 000 min (±180°, East = positive (as per 2's complement), West = negative (as per 2's complement). 181 = (6791AC0$_h$) = not available = default)
Latitude	27	Latitude in 1/10 000 min (±90°, North = positive (as per 2's complement), South = negative (as per 2's complement). 91° (3412140$_h$) = not available = default)
COG	12	Course over ground in 1/10 = (0-3 599). 3 600 (E10$_h$) = not available = default. 3 601-4 095 should not be used
True heading	9	Degrees (0-359) (511 indicates not available = default)

TABLE 48 (*end*)

Parameter	Number of bits	Description
Time stamp	6	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	2	0 = not available = default 1 = not engaged in special manoeuvre 2 = engaged in special manoeuvre (i.e. regional passing arrangement on Inland Waterway)
Spare	3	Not used. Should be set to zero. Reserved for future use.
RAIM-flag	1	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	19	See Table 49
Number of bits	168	

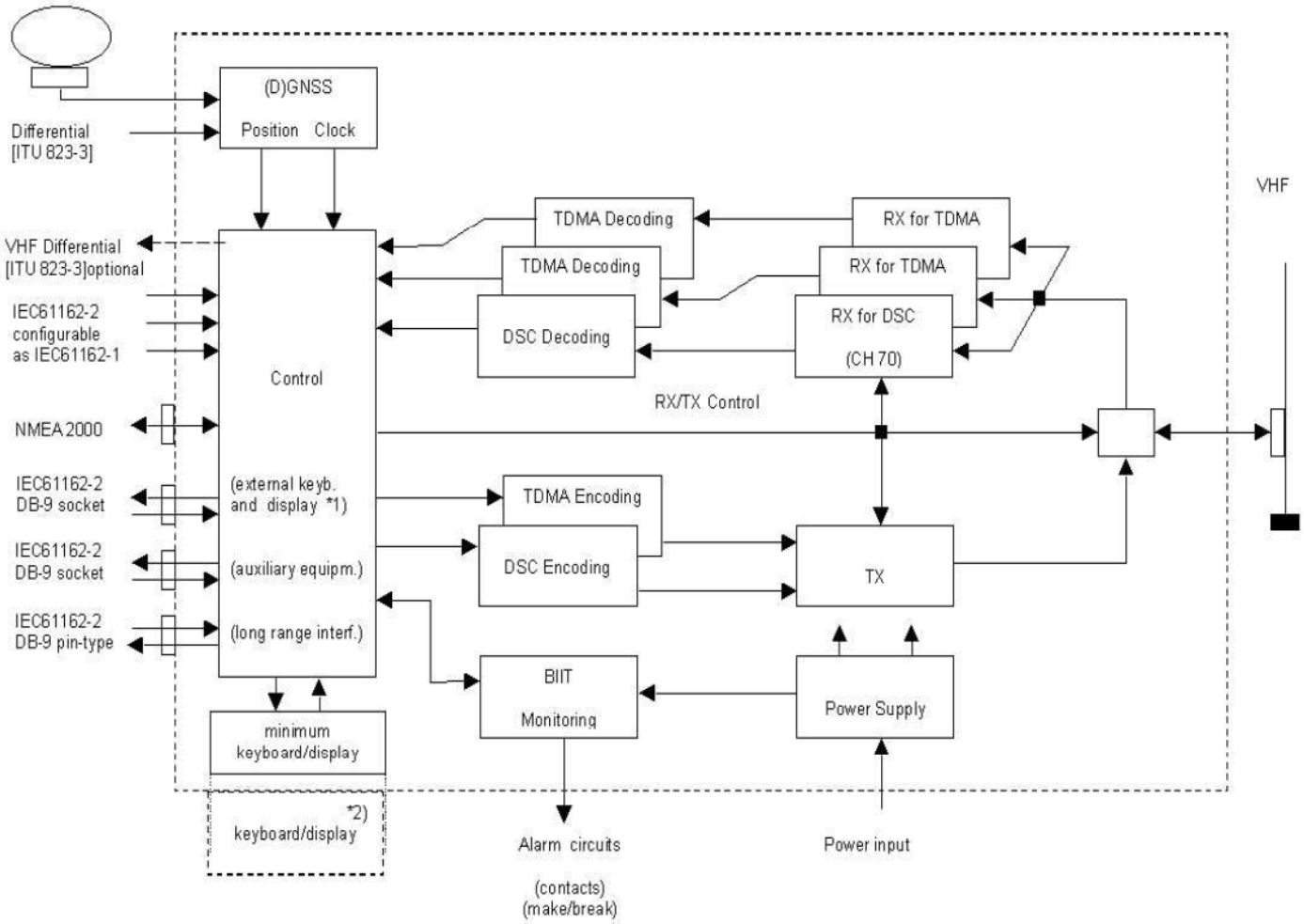
TABLE 52

Parameter	Number of bits	Description
Message ID	6	Identifier for this Message 5
Repeat indicator	2	Used by the repeater to indicate how n repeated. Refer to § 4.6.1, Annex 2; 0- more
User ID	30	MMSI number
AIS version indicator	2	0 = station compliant with Recommen 1 = station compliant with Recommen 2 = station compliant with Recommen 3 = station compliant with future editi
IMO number	30	0 = not available = default – Not appli 0000000001-0000999999 not used 0001000000-0009999999 = valid IMC 0010000000-1073741823 = official fl
Call sign	42	7 x 6 bit ASCII characters, @@@@@ Craft associated with a parent vessel, s 6 digits of the MMSI of the parent ves towed vessels, rescue boats, tenders, li
Name	120	Maximum 20 characters 6 bit ASCII, a "@@@@@@@@@@@@@@@@@@@@" The Name should be as shown on the s it should be set to "SAR AIRCRAFT equals the aircraft registration number

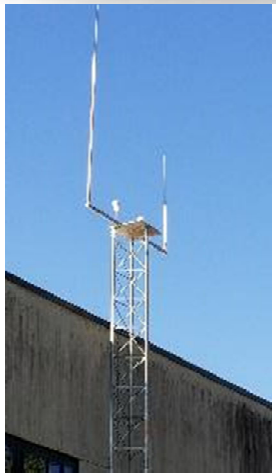
TABLE 52 (*end*)

Parameter	Number of bits	Description
Type of ship and cargo type	8	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	30	Reference point for reported position. Also indicates the dimension of ship (m) (see Fig. 41 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	4	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	20	Estimated time of arrival; MMDDHHMM 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	8	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	120	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	1	Data terminal equipment (DTE) ready (0 = available, 1 = not available = default) (see § 3.3.1)
Spare	1	Spare. Not used. Should be set to zero. Reserved for future use
Number of bits	424	Occupies 2 slots

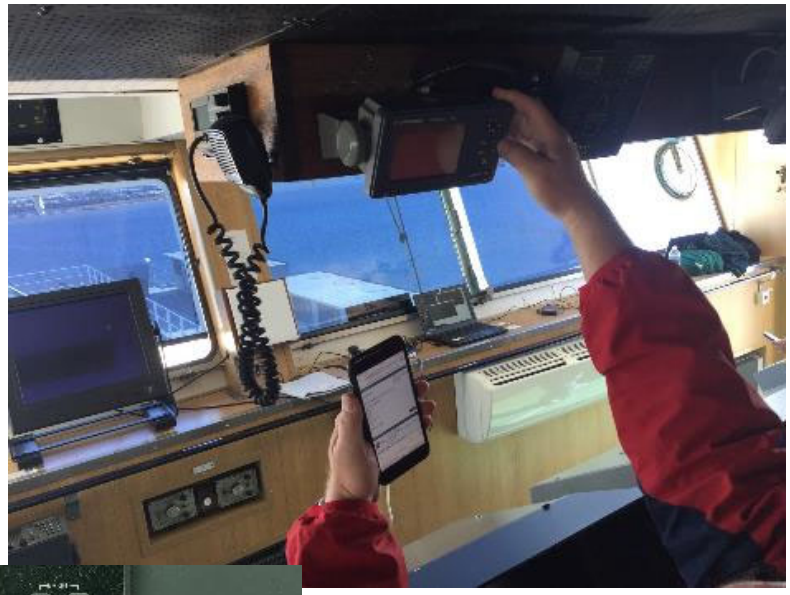
What does AIS look like… to an engineer:

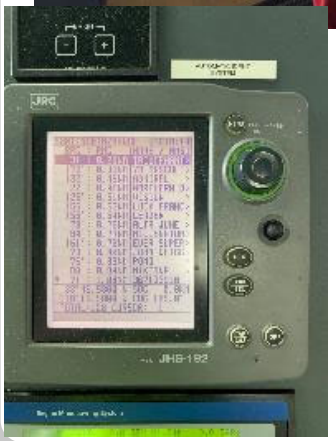


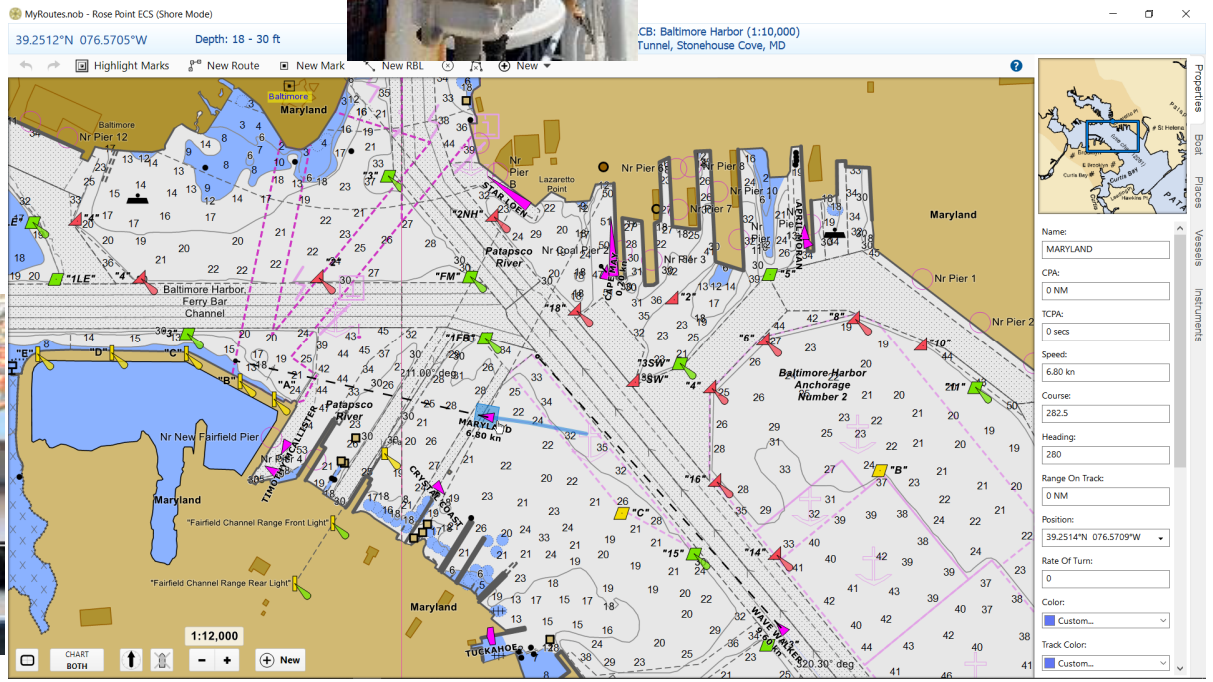
What does AIS equipment look like?



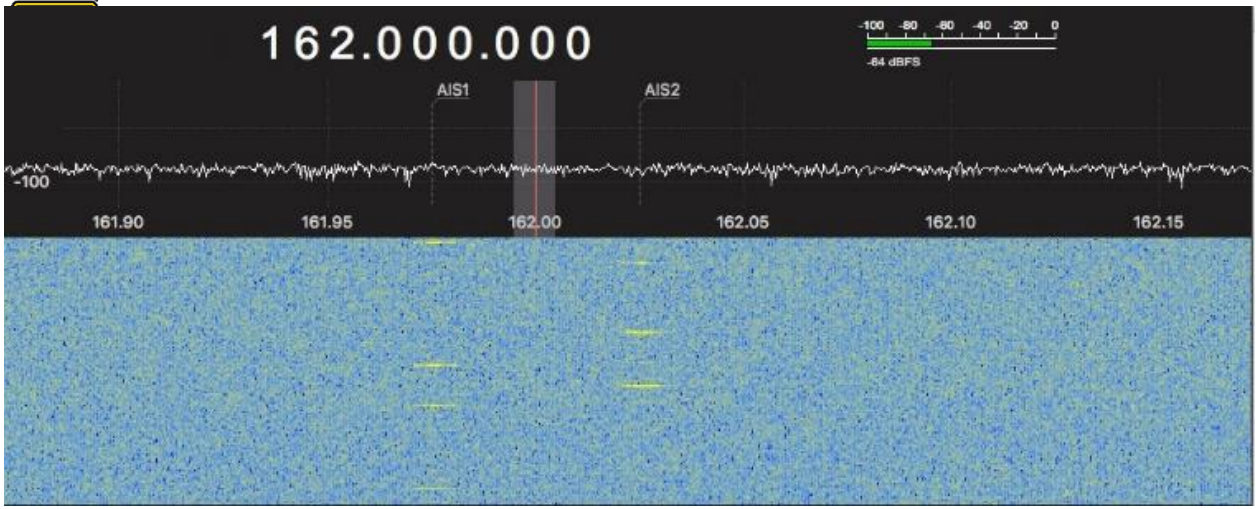
What does AIS look like… on a ship?

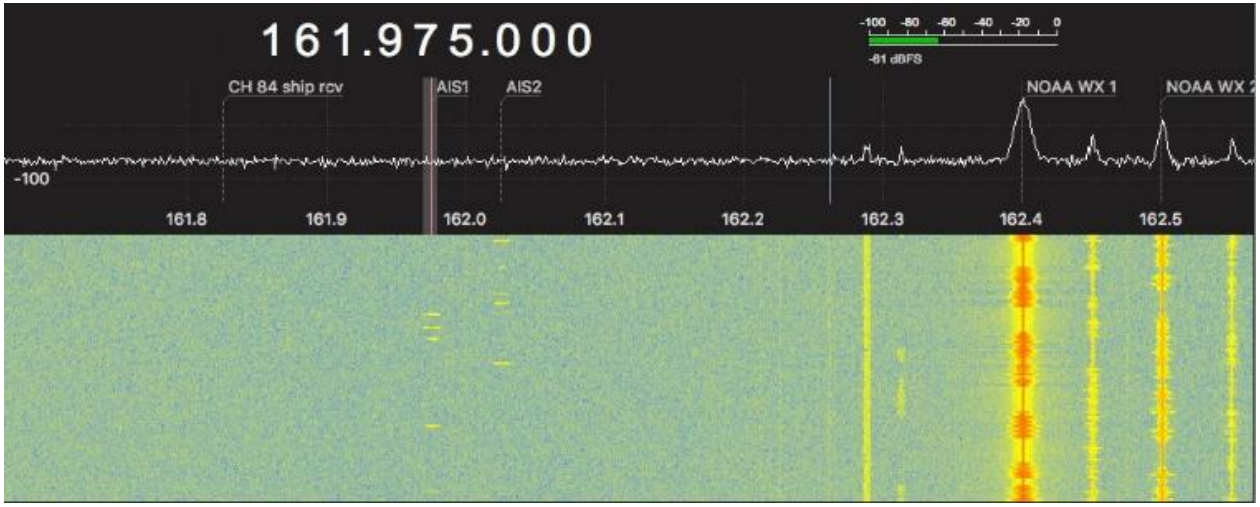






What does AIS look (and sound) like on the radio?





What does AIS data look like?

```
\n:342288,s:b003669978,c:1471371635*1B\!SAVDM,1,1,,B,15NN;mPP00q;jhbA1IvJ>Ow426A@,0*75
\n:622509,s:b003669954,c:1471371636*1B\!SAVDM,1,1,,A,15NIe<PP00IRN@vA8Cj8L?w208C`,0*70
\n:793047,s:b003669953,c:1471371636*18\!SAVDM,1,1,,A,15NTfUPP01IS5hv@bED:fOw400Rv,0*76
\n:793050,s:b003669953,c:1471371636*1E\!SAVDM,1,1,,B,35NSdC1P00qRwd`@cO9s<?w42DNJ,0*26
\n:61912,s:b003669955,c:1471371636*2D\!SAVDM,1,1,,A,15NW@d`P00IPgFN@l9t1Igw22@CU,0*1C
\g:1-2-34138,n:520371,s:b003669956,c:1471371636*5E\!SAVDM,2,1,8,A,55Mwe=P00001L@?;O;50D@E8p4hE>2222222220q3hc@<29j700Q@ECCkU7d,0*0B
\g:2-2-34138,n:520372*19\!SAVDM,2,2,8,A,Pp568888880,2*15
\n:537862,s:b003669710,c:1471371634*10\!SAVDM,1,1,,B,13TtQf0000o?s88EVFUafb8v0<1h,0*77
\n:237301,s:b003669987,c:1471371637*1A\!SAVDM,1,1,,A,14Q;928000G@1WrK@LpoI4740<1N,0*16
\n:237302,s:b003669987,c:1471371637*19\!SAVDM,1,1,,B,15NoD`?P00o?vR6K>l=;r?w20@Cb,0*55
\n:735341,s:b003669704,c:1471371637*1C\!SAVDM,1,1,,B,14eGDVh000G<jc6L7eiHjS120D3j,0*3E
\g:1-2-7583,n:2401,s:D05MN-DB-TUCBS1,c:1471371633*1E\!SAVDM,1,1,5,A,13Q;7SP01hrlavNFEit<vbDv0@Ca,0*2D
\g:1-2-5086,n:6367,s:D01MN-NE-WESBS1,c:1471371633*15\!SAVDM,1,1,5,B,15NFJM0000JvKRfHvkIBRqk406A@,0*67
\g:1-2-5981,n:11780,s:D05MN-DB-CPMBS1,c:1471371633*36\!SAVDM,1,1,0,A,35PH6`@OhcraV2pFC>iQciJv0Q2@,0*61
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\g:1-2-0974,n:12178,s:D01MN-NE-BRIBS1,c:1471371633*35\!SAVDM,1,1,7,B,B5`V8d@00>g3qr6:<atagwhUoP06,0*6C
\g:1-2-8491,n:10338,s:D01MN-SE-WARBS1,c:1471371633*3F\!SAVDM,1,1,9,B,15NW3M0P01rsF?tGluUrGgw420R@,0*02
\g:1-2-9913,n:15034,s:D05MN-HR-NNWBS1,c:1471371633*28\!SAVDM,1,1,9,A,15N0Q?PP00JR`p`E5j1K8gw428Ca,0*2D
\g:1-2-9915,n:15038,s:D05MN-HR-NNWBS1,c:1471371633*22\!SAVDM,1,1,1,A,H5N4rJPJuJ1@tqV1ALt00000000,2*7F
\g:1-2-4059,n:5145,s:D05MN-HR-MERBS1,c:1471371633*19\!SAVDM,1,1,0,B,B5NR?;00Bf`n2H5HsO;OwwhUoP06,0*01
\g:1-2-1769,n:16199,s:D13MN-PS-BAHBS1,c:1471371633*24\!SAVDM,1,1,6,A,35MOK`000go45IHK9sb=0bQ401;1,0*7F
\g:1-2-6383,n:15829,s:D13MN-CR-ELKBS1,c:1471371633*39\!SAVDM,1,1,1,A,15Mwq80002o8>rtJNPV6@mK22<22,0*79
\g:1-2-9298,n:13981,s:D08MN-MO-PSJBS1,c:1471371633*2A\!SAVDM,1,1,1,B,15MpUN0P0KIoRifAA>g4Rgw42<0I,0*20
\g:1-2-9490,n:13396,s:D08MN-MO-VCLBS1,c:1471371633*38\!SAVDM,1,1,2,A,15NNmV0P00Ibn9BAG?@8E?w20@CU,0*77
\g:1-2-2491,n:10412,s:D08MN-HG-CANBS1,c:1471371633*22\!SAVDM,1,1,7,B,15MsuO?P14I<;op@a88@Vgw400Sg,0*14
\g:1-3-2321,n:3738,s:D07MN-JA-JACBS1,c:1471371633*19\!SAVDM,2,1,4,A,553BKP01mkMtp@HR2220P599V0j0l59@Tr22220SEPV<D5q70EDi@H888888,0*53
\g:2-3-2321,n:3739*28\!SAVDM,2,2,4,A,88888888888,2*32
\g:1-2-4382,n:12414,s:D08MN-MO-SROBS1,c:1471371633*2A\!SAVDM,1,1,4,B,B5NUnHP00>LwoNTF@PP;3whUoP06,0*1C
\g:1-2-8145,n:5874,s:D07MN-CH-MCCBS1,c:1471371633*16\!SAVDM,1,1,7,B,18K4CR002MrCc6DBI1uja2;208C9,0*3D
```
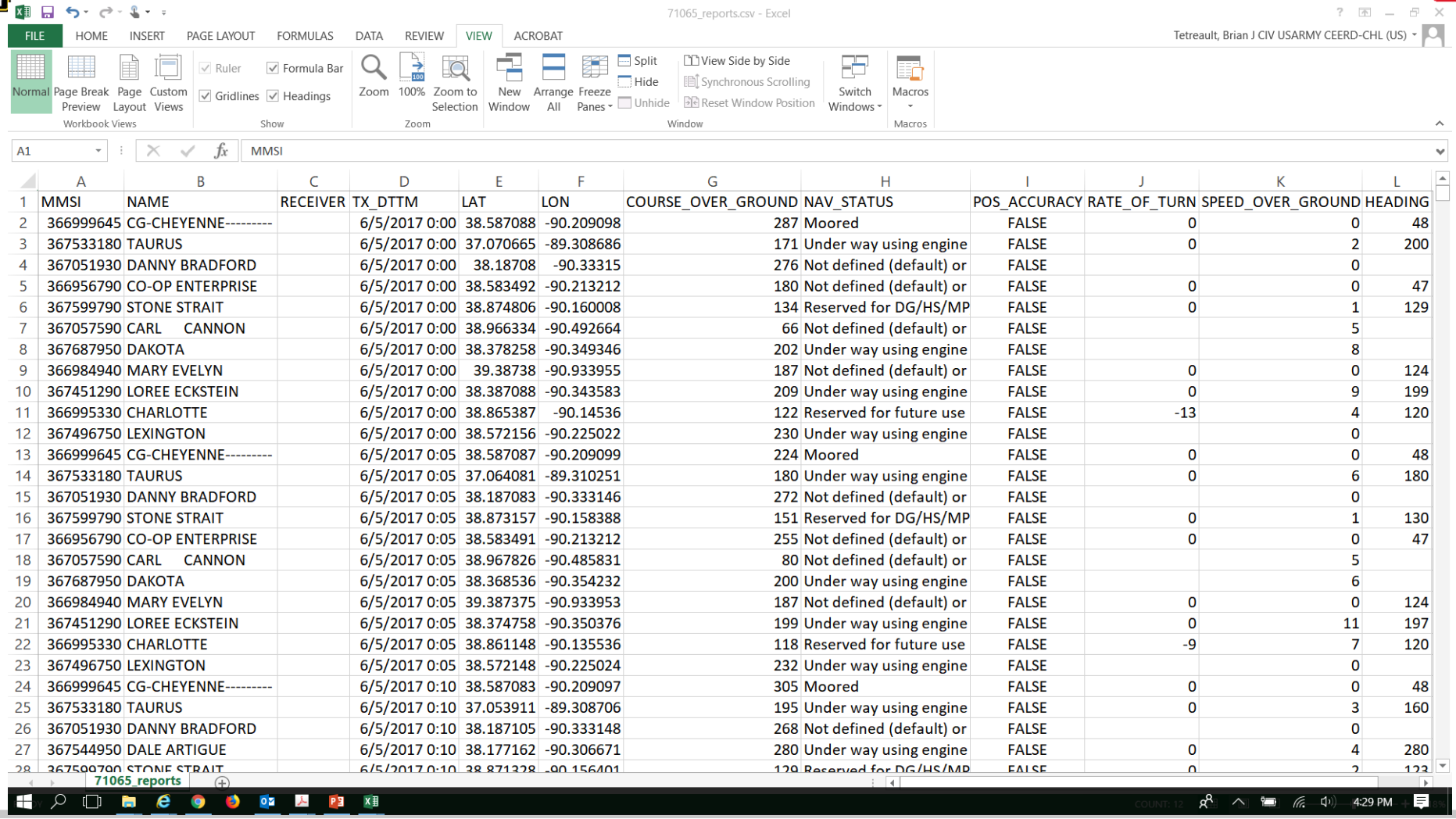
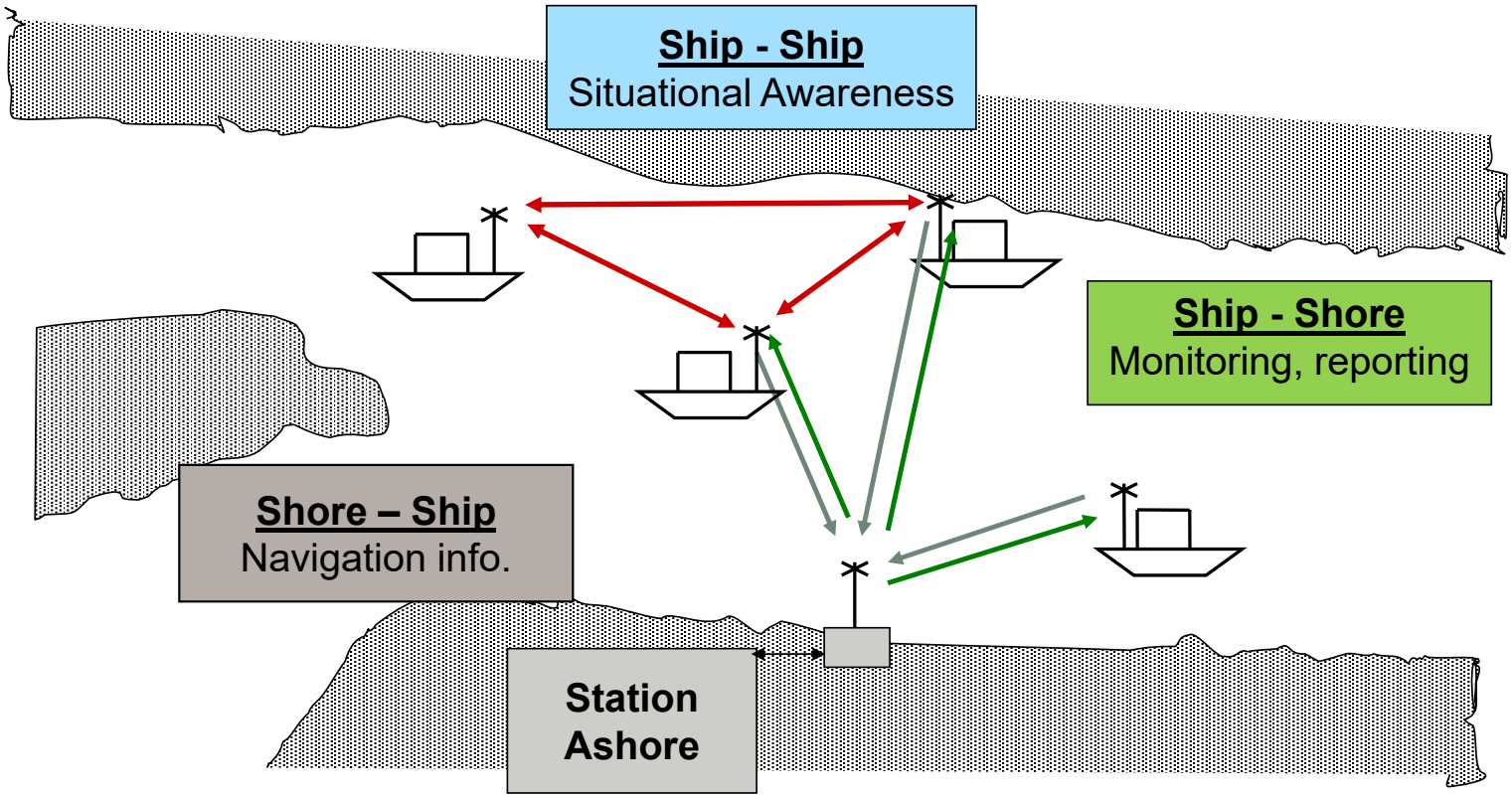

What does “AIS data” look like?



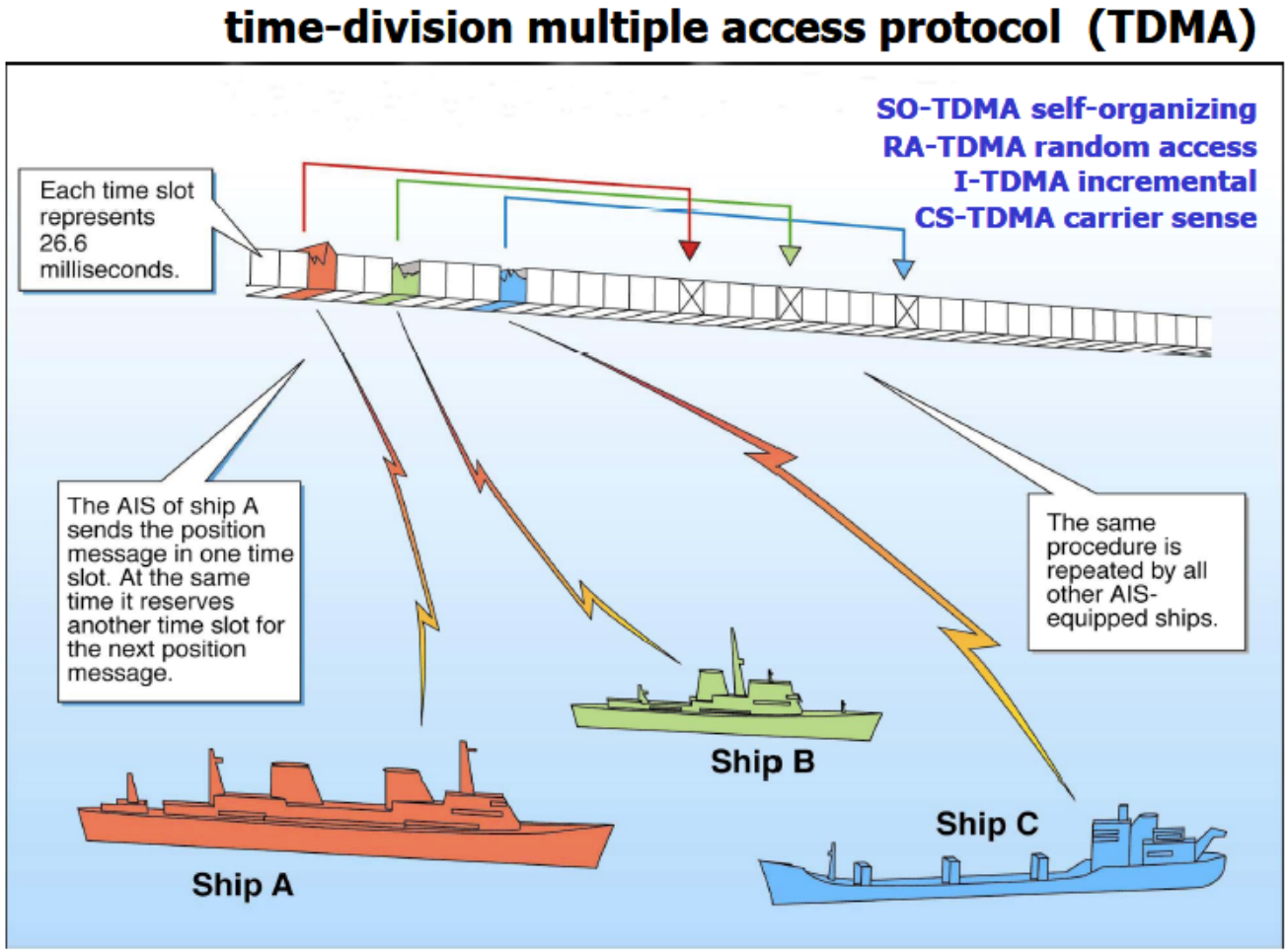
71065_reports.csv - Excel

	A	B	C	D	E	F	G	H	I	J	K	L
1	MMSI	NAME	RECEIVER	TX_DTTM	LAT	LON	COURSE_OVER_GROUND	NAV_STATUS	POS_ACCURACY	RATE_OF_TURN	SPEED_OVER_GROUND	HEADING
2	366999645	CG-CHEYENNE---------		6/5/2017 0:00	38.587088	-90.209098	287	Moored	FALSE	0	0	48
3	367533180	TAURUS		6/5/2017 0:00	37.070665	-89.308686	171	Under way using engine	FALSE	0	2	200
4	367051930	DANNY BRADFORD		6/5/2017 0:00	38.18708	-90.33315	276	Not defined (default) or	FALSE		0	
5	366956790	CO-OP ENTERPRISE		6/5/2017 0:00	38.583492	-90.213212	180	Not defined (default) or	FALSE	0	0	47
6	367599790	STONE STRAIT		6/5/2017 0:00	38.874806	-90.160008	134	Reserved for DG/HS/MP	FALSE	0	1	129
7	367057590	CARL CANNON		6/5/2017 0:00	38.966334	-90.492664	66	Not defined (default) or	FALSE		5	
8	367687950	DAKOTA		6/5/2017 0:00	38.378258	-90.349346	202	Under way using engine	FALSE		8	
9	366984940	MARY EVELYN		6/5/2017 0:00	39.38738	-90.933955	187	Not defined (default) or	FALSE	0	0	124
10	367451290	LOREE ECKSTEIN		6/5/2017 0:00	38.387088	-90.343583	209	Under way using engine	FALSE	0	9	199
11	366995330	CHARLOTTE		6/5/2017 0:00	38.865387	-90.14536	122	Reserved for future use	FALSE	-13	4	120
12	367496750	LEXINGTON		6/5/2017 0:00	38.572156	-90.225022	230	Under way using engine	FALSE		0	
13	366999645	CG-CHEYENNE---------		6/5/2017 0:05	38.587087	-90.209099	224	Moored	FALSE	0	0	48
14	367533180	TAURUS		6/5/2017 0:05	37.064081	-89.310251	180	Under way using engine	FALSE	0	6	180
15	367051930	DANNY BRADFORD		6/5/2017 0:05	38.187083	-90.333146	272	Not defined (default) or	FALSE		0	
16	367599790	STONE STRAIT		6/5/2017 0:05	38.873157	-90.158388	151	Reserved for DG/HS/MP	FALSE	0	1	130
17	366956790	CO-OP ENTERPRISE		6/5/2017 0:05	38.583491	-90.213212	255	Not defined (default) or	FALSE	0	0	47
18	367057590	CARL CANNON		6/5/2017 0:05	38.967826	-90.485831	80	Not defined (default) or	FALSE		5	
19	367687950	DAKOTA		6/5/2017 0:05	38.368536	-90.354232	200	Under way using engine	FALSE		6	
20	366984940	MARY EVELYN		6/5/2017 0:05	39.387375	-90.933953	187	Not defined (default) or	FALSE	0	0	124
21	367451290	LOREE ECKSTEIN		6/5/2017 0:05	38.374758	-90.350376	199	Under way using engine	FALSE	0	11	197
22	366995330	CHARLOTTE		6/5/2017 0:05	38.861148	-90.135536	118	Reserved for future use	FALSE	-9	7	120
23	367496750	LEXINGTON		6/5/2017 0:05	38.572148	-90.225024	232	Under way using engine	FALSE		0	
24	366999645	CG-CHEYENNE---------		6/5/2017 0:10	38.587083	-90.209097	305	Moored	FALSE	0	0	48
25	367533180	TAURUS		6/5/2017 0:10	37.053911	-89.308706	195	Under way using engine	FALSE	0	3	160
26	367051930	DANNY BRADFORD		6/5/2017 0:10	38.187105	-90.333148	268	Not defined (default) or	FALSE		0	
27	367544950	DALE ARTIGUE		6/5/2017 0:10	38.177162	-90.306671	280	Under way using engine	FALSE	0	4	280
28	367599790	STONE STRAIT		6/5/2017 0:10	38.871328	-90.156401	129	Reserved for DG/HS/MP	FALSE	0	2	123

How does AIS work?



How does AIS work? The magic of TDMA…



What vessels have AIS?

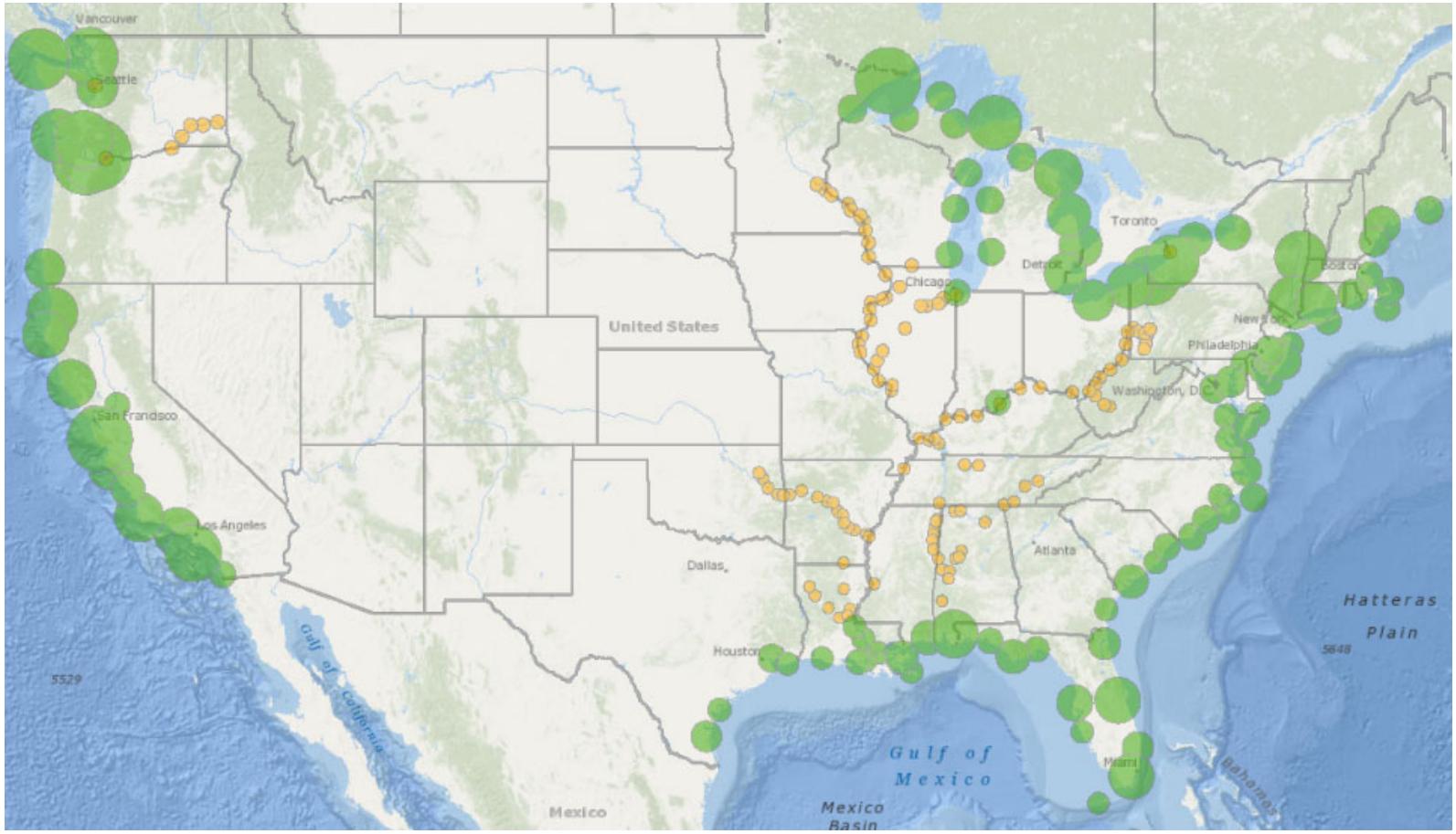
New AIS Carriage Requirements…

Effective March 2nd, 2015, these commercially self-propelled vessels, operating on U.S. navigable waters, must have a properly installed, operational Automatic Identification System (AIS) no later than March 1st, 2016

- vessels of ≥ 65 feet in length
- towing vessels of ≥26 feet in length & >600 hp
- vessels certificated to carry ≥150 passengers
- dredges and ~~floating plants~~ that operate in/near a commercial channel
- vessels engaged in the movement of certain dangerous cargo, flammable or combustible liquid cargo in bulk

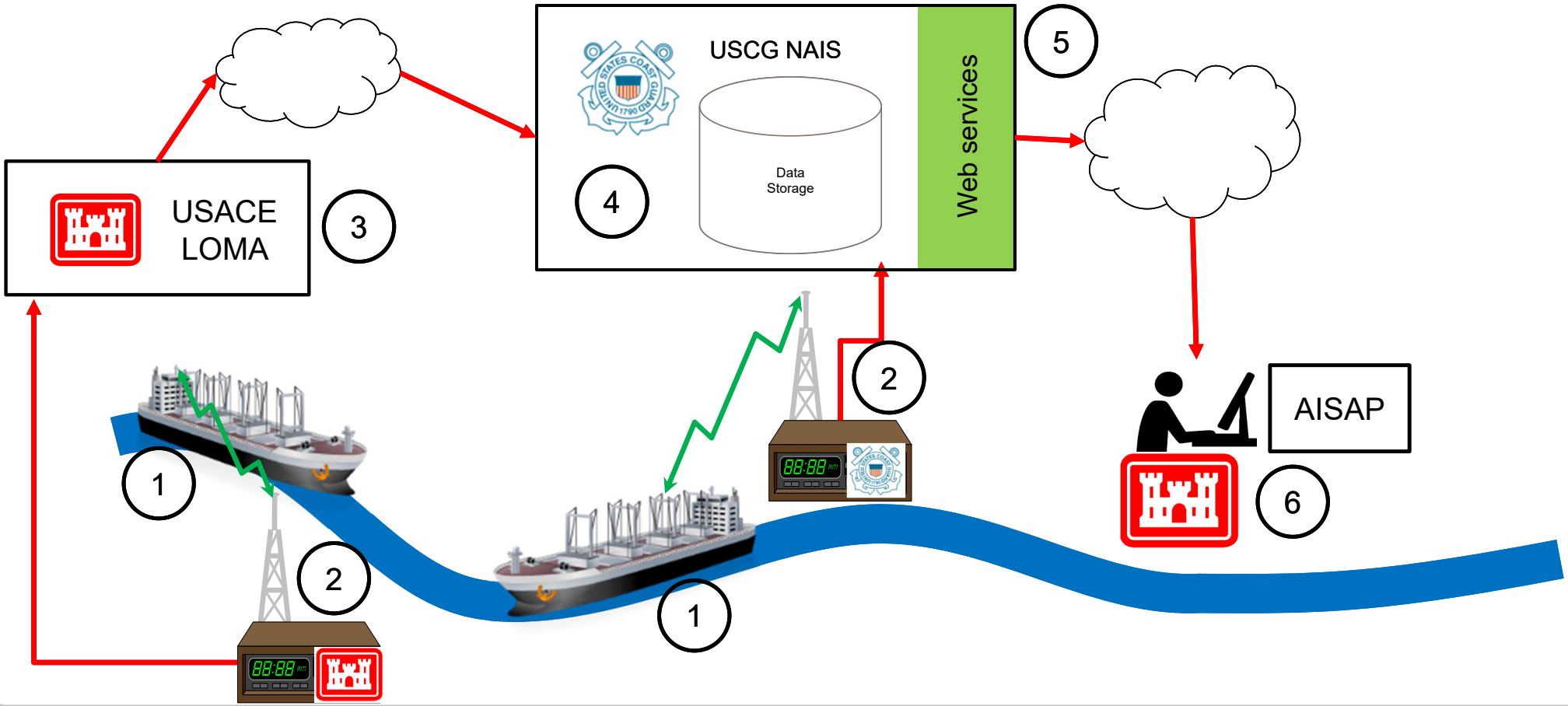
Effected Vessels by Type	2003		2015	Total Vessels
	SOLAS	Domestic		
Foreign ship >65'<300GT		1,119		1119
Fishing	1	-	2,906	2907
Towing	13	2,212	1,429	3654
Passenger	81	171	288	540
Cargo	154	77	247	478
OSV	55	432	151	638
MODU	1	-	31	32
Industrial	21	11	220	252
Research	10	11	54	75
School		5	10	15
Tank Ships	102	15	35	152
Unknown		16	134	150
Unclassified		13	326	339
Dredges		-	17	17
U.S. Total	**438**	**2,963**	**5,848**	**9,249**
Total	**4,520**		**5,848**	**10,368**

Where does AIS come from?



USACE and USCG AIS site locations

How does AIS data get to me?



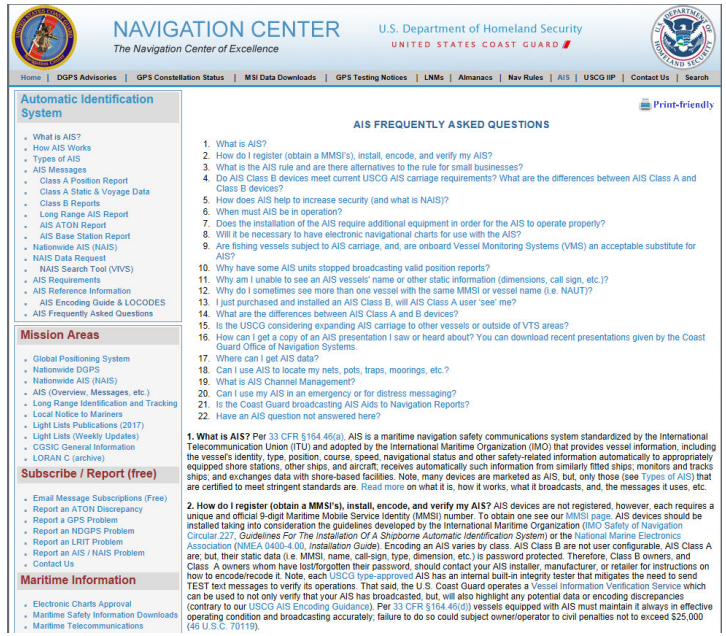
Do we now have answers?
Or just more questions…

- AIS is a digital communications system designed for navigation safety and ship monitoring.
- AIS was developed over many years by many players in the international community.
- What AIS looks like depends on who you are and what you want to do with it…
- AIS works through a sophisticated radio protocol that autonomously allows many AIS stations to transmit information in coordination
- Certain vessels are required to carry AIS but not all; some voluntarily carry AIS.
- USACE and USCG operate AIS networks to receive and transmit AIS data. USCG is the national AIS data clearing house.
- “Live” AIS data is available within USACE via the LOMA system. Historical AIS data is available via web services and historic data request from the USCG.
- Is there time to see what other cool things AIS can do?

Thank you

Brian Tetreault ERDC-CHL

brian.j.tetreault@usace.army.mil

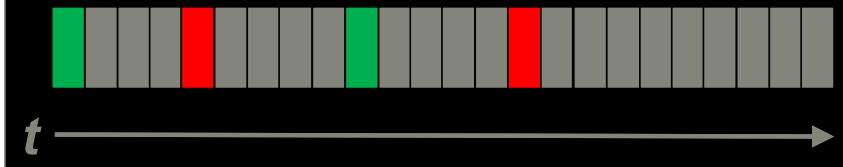


https://www.navcen.uscg.gov/?pageName=AISFAQ

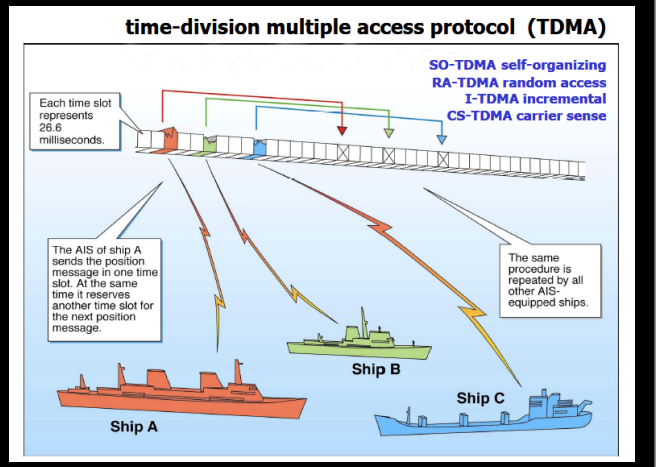
OTHER COOL AIS STUFF

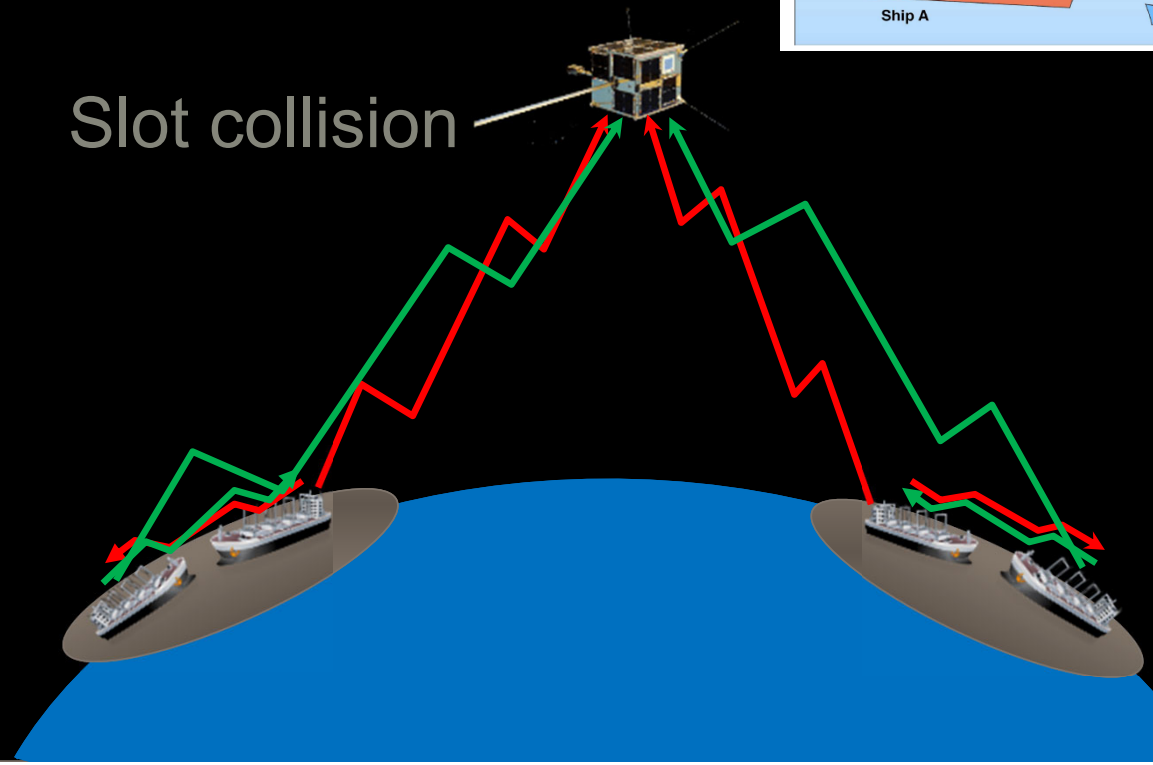
- Reception of AIS via Satellite
- Transmission of navigation safety information via AIS
- AIS AToNs
- Geographic Notices
- Other information
- Use of AIS to collect information from ships

AIS via Satellite



Slot collision



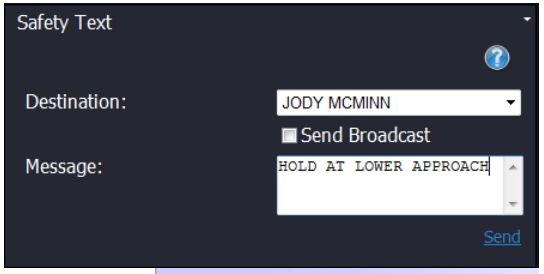


AIS TRANSMIT CAPABILITY

AIS well known as a “tracking” system
– Receive information from vessels

AIS is also a two-way communications system
– Send information to vessels
– Receive additional information from vessels
– Standard messages and new messages to address specific needs

Cooperative work with US Coast Guard
– Technology development
– Test beds



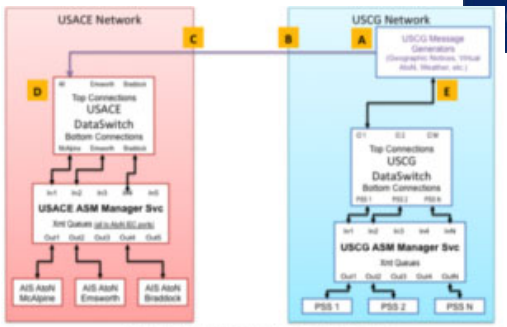
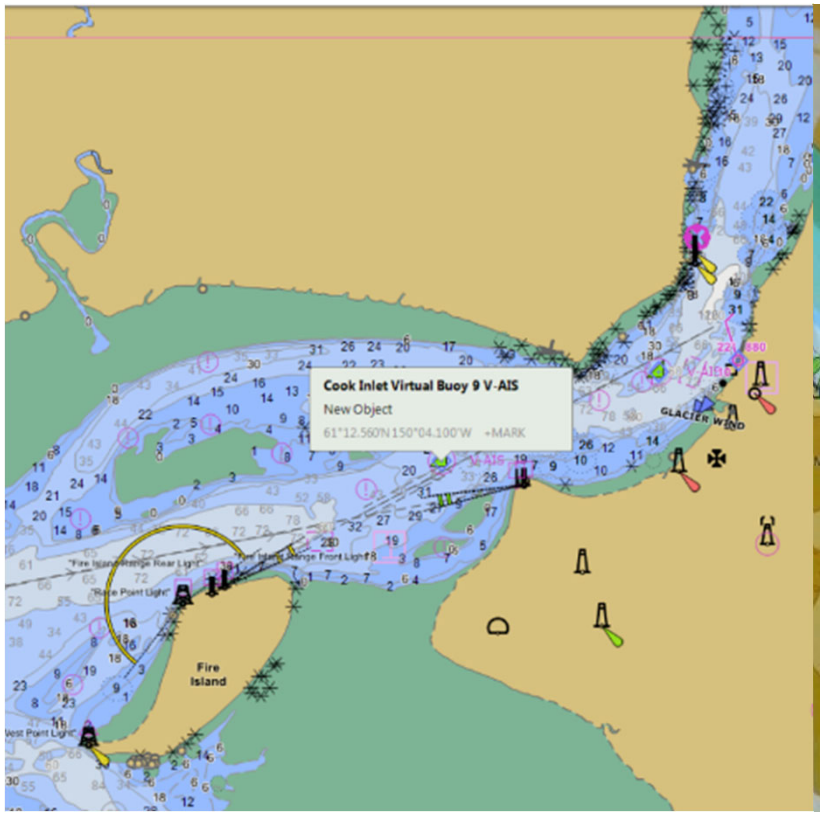
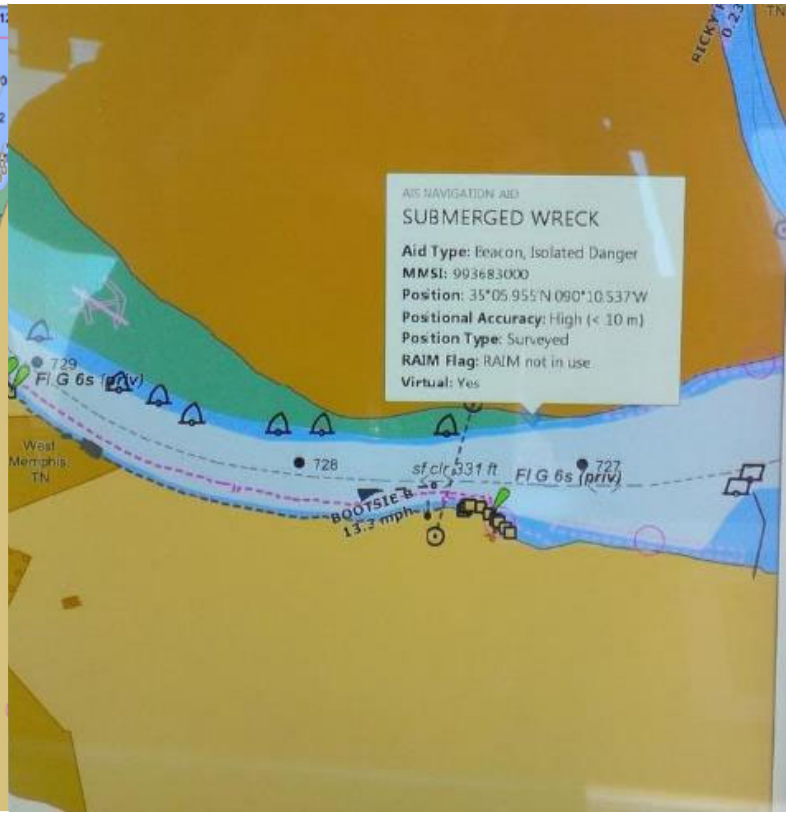


Figure 9. Initial USCG - USACE integration architecture

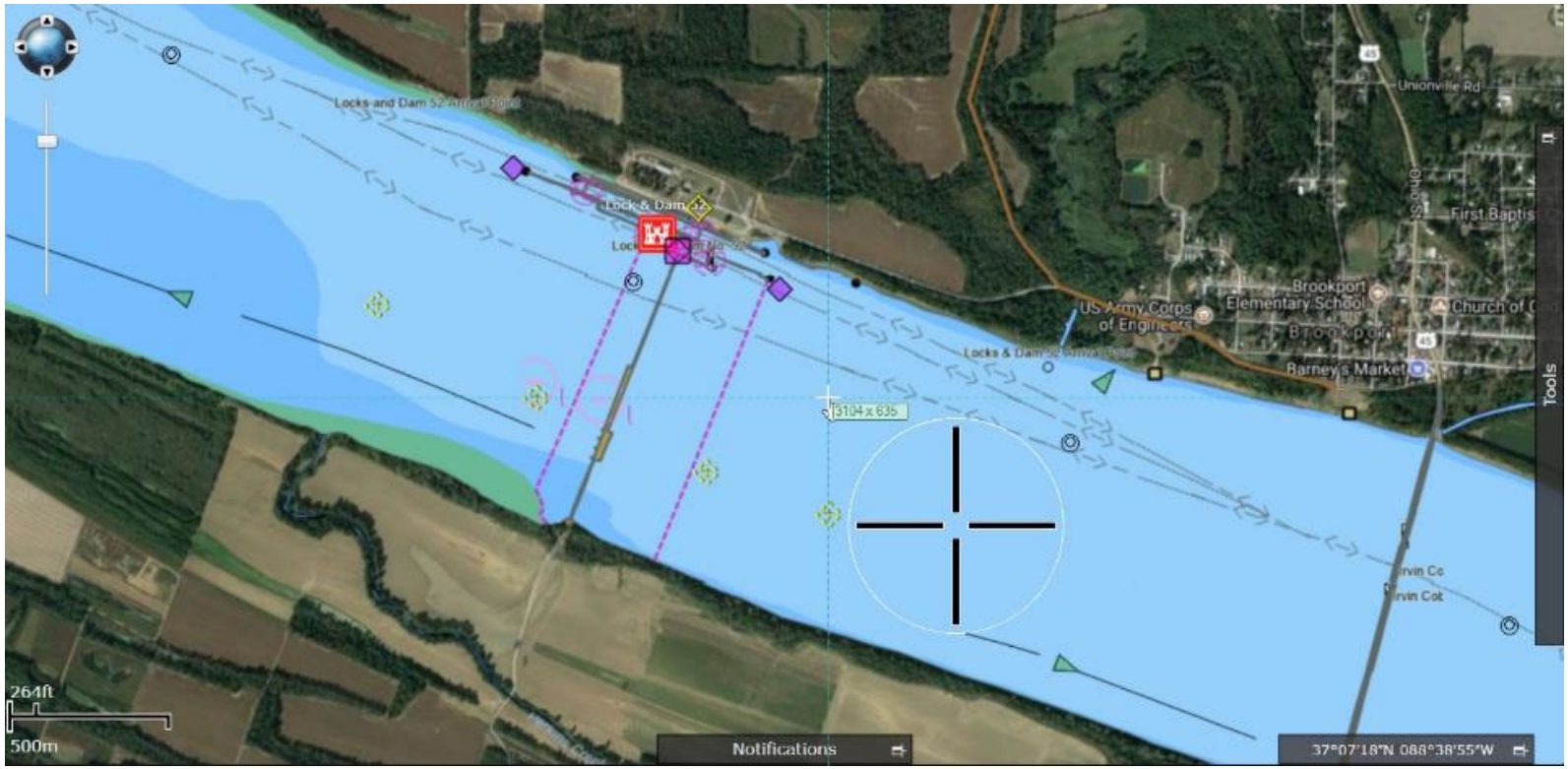
VIRTUAL ATON



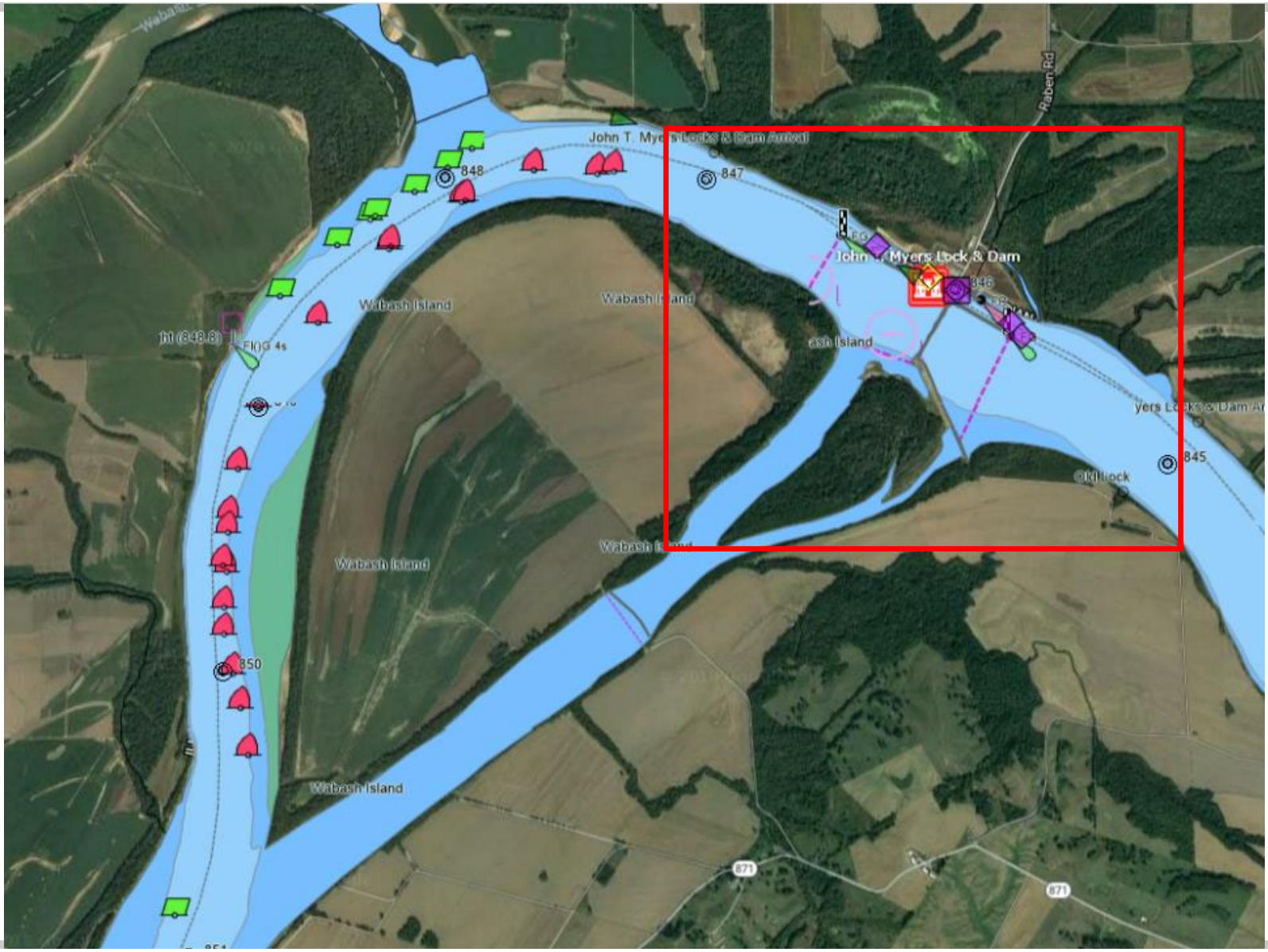
AIS V-AtoN in area where ice and tidal range prohibit physical AtoN

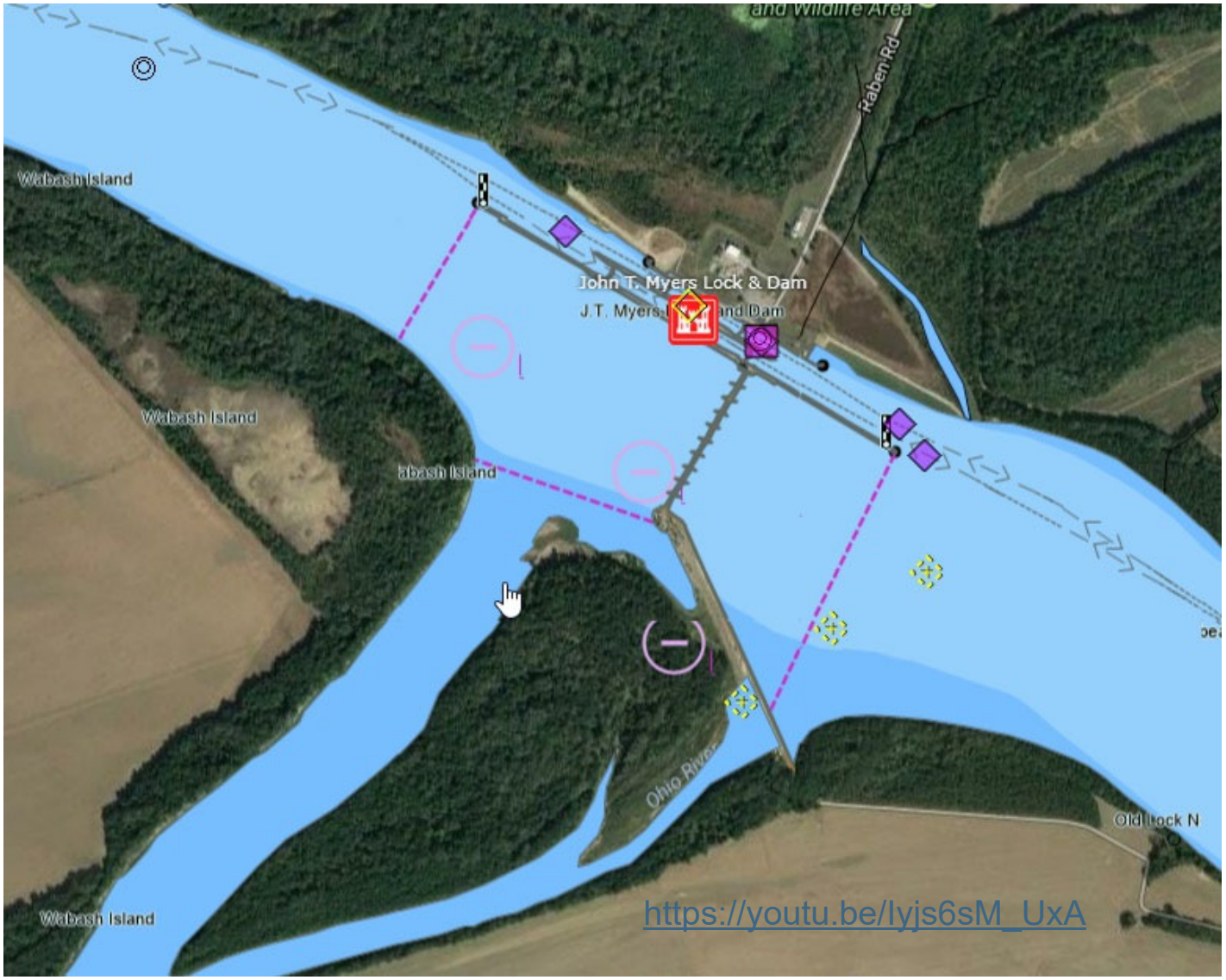


AIS V-AtoN marking submerged wreck in swift river waters


Locks and Dam 52
Lock & Dam 52
Unionville Rd
Ohio St
First Baptis
Brookport Elementary School
US Army Corps of Engineers
Barney's Market
Tools
264ft
500m
Notifications
37°07'18"N 088°38'55"W


Lord's Church of Prayer
Newburgh Locks & Dam River
Newburgh Lock & Dam
County Rdz200 S
Tools
264ft
500m
Notifications
37°55'51"N 087°22'38"W

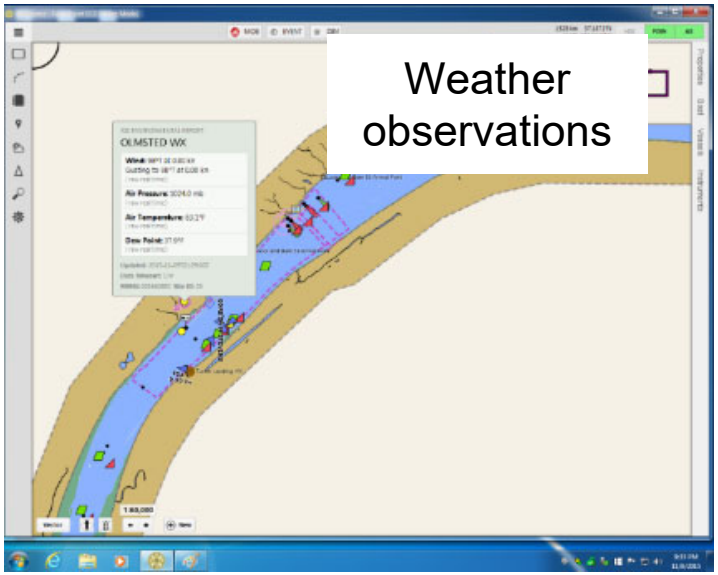

John T. Myers Locks & Dam Arrival
847
848
John T. Myers Lock & Dam
846
Wabash Island
Wabash Island
Wabash Island
Wabash Island
845
850
871
871
Raben Rd


Wabash Island
John T. Myers Lock & Dam
Raben Rd
Wabash Island
Wabash Island
Ohio River
Old lock N
Wabash Island
https://youtu.be/lyjs6sM_UxA

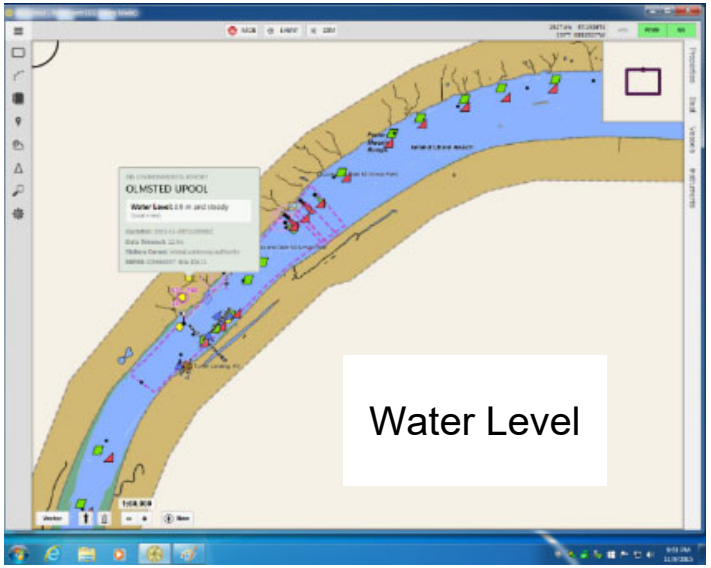
VIRTUAL/SYNTHETIC ATON ISSUES

Process
– Who decides when and where to establish?
– Who creates?
– Monitoring to ensure transmission/receipt?
Technical
– USCG-USACE connectivity
– USAIMS integration
IENC:
– What AIS AtoN are charted?

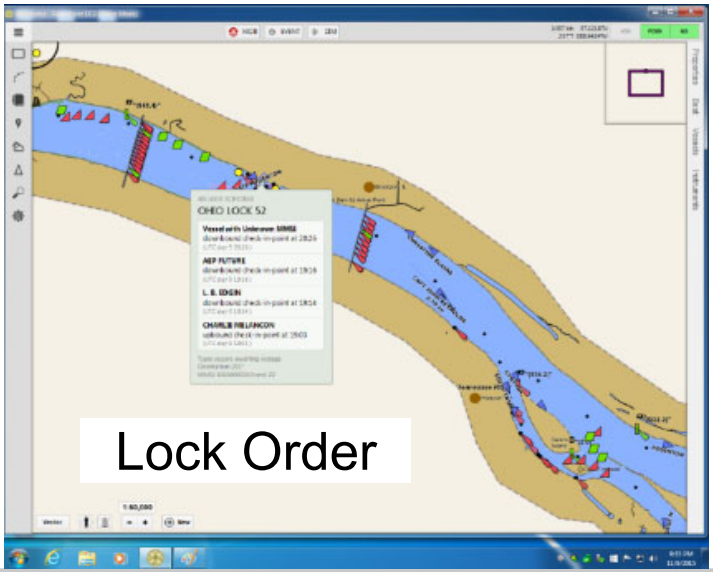
INFORMATION DELIVERED TO VESSELS VIA AIS



Weather observations

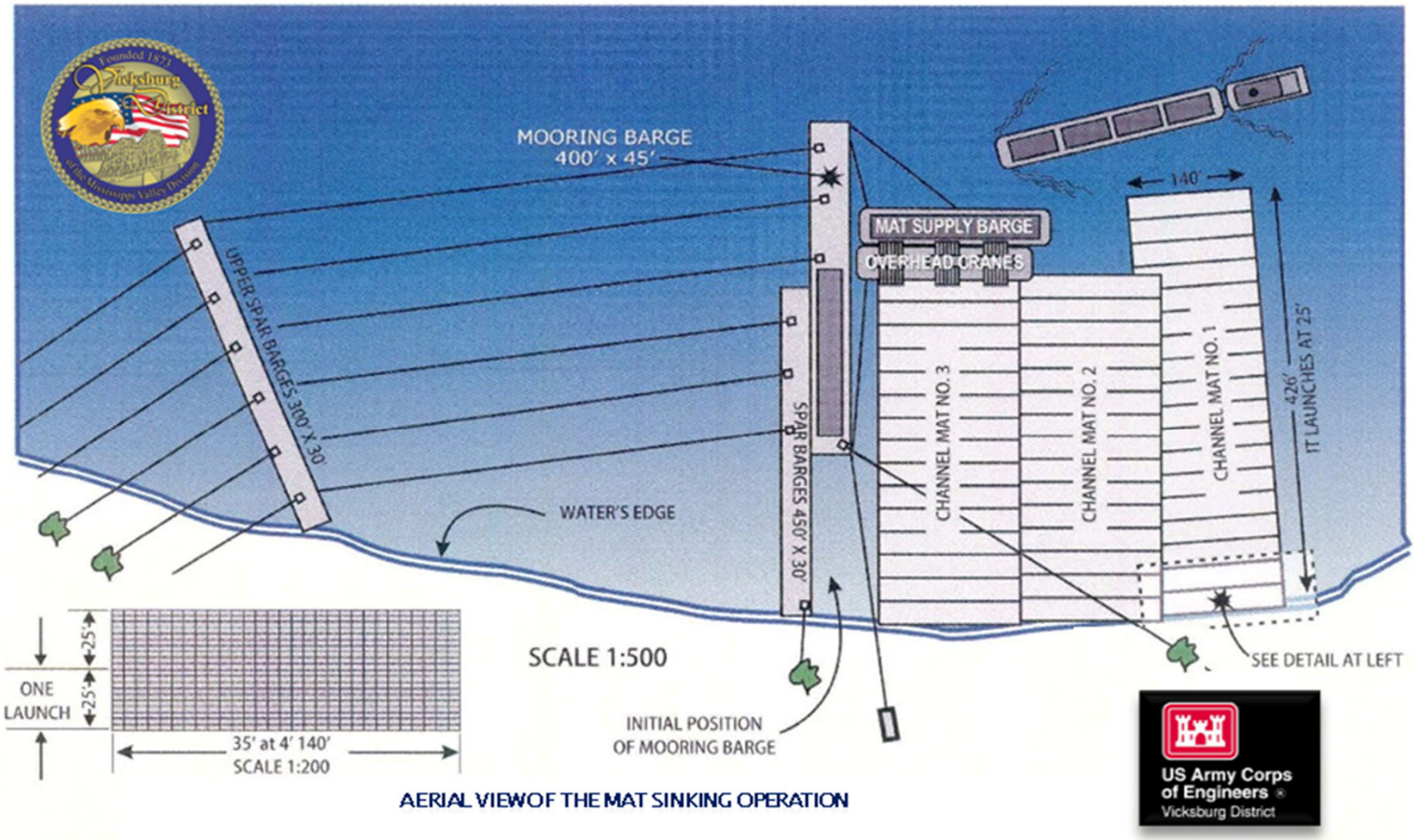


Water Level

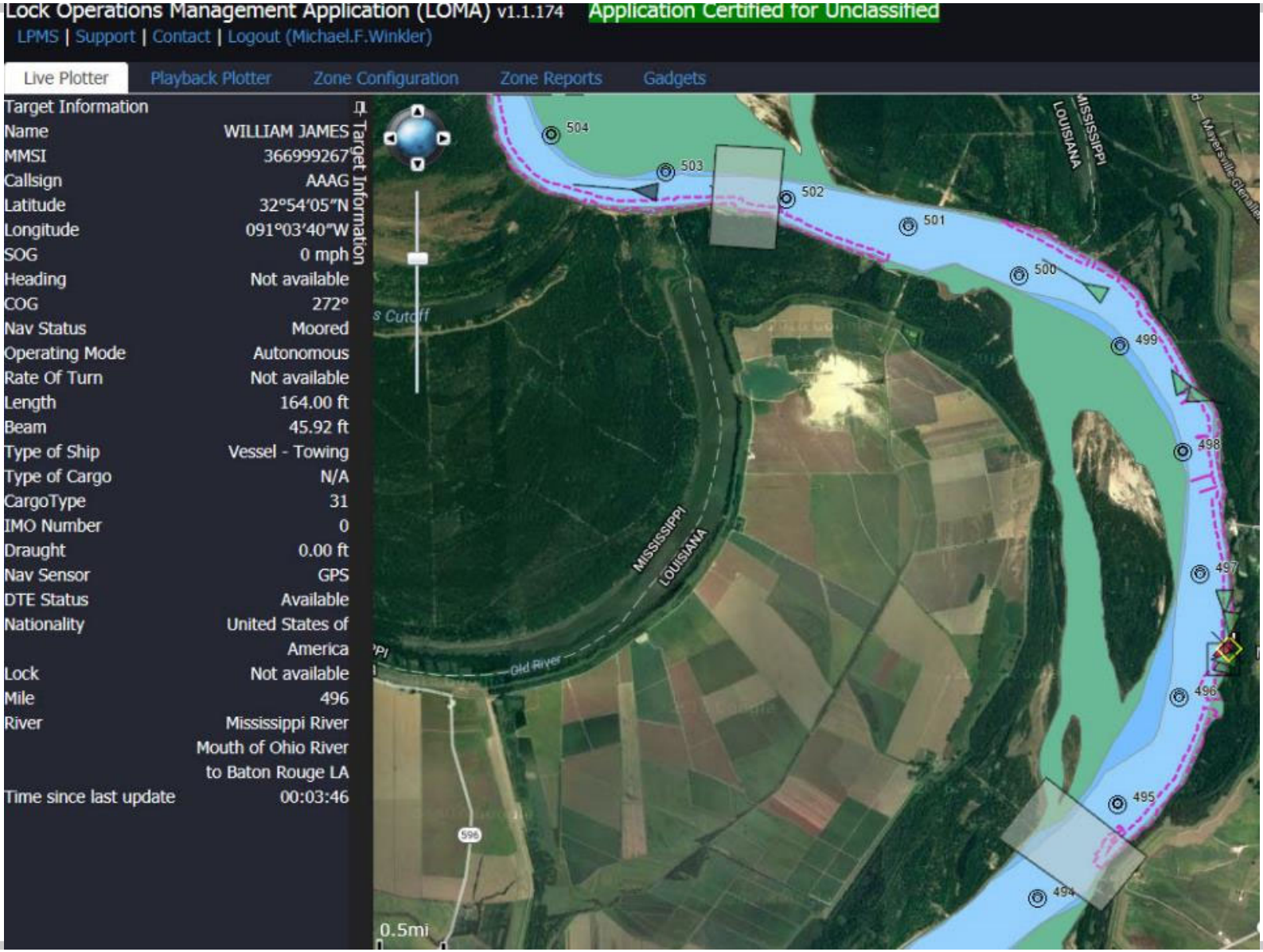


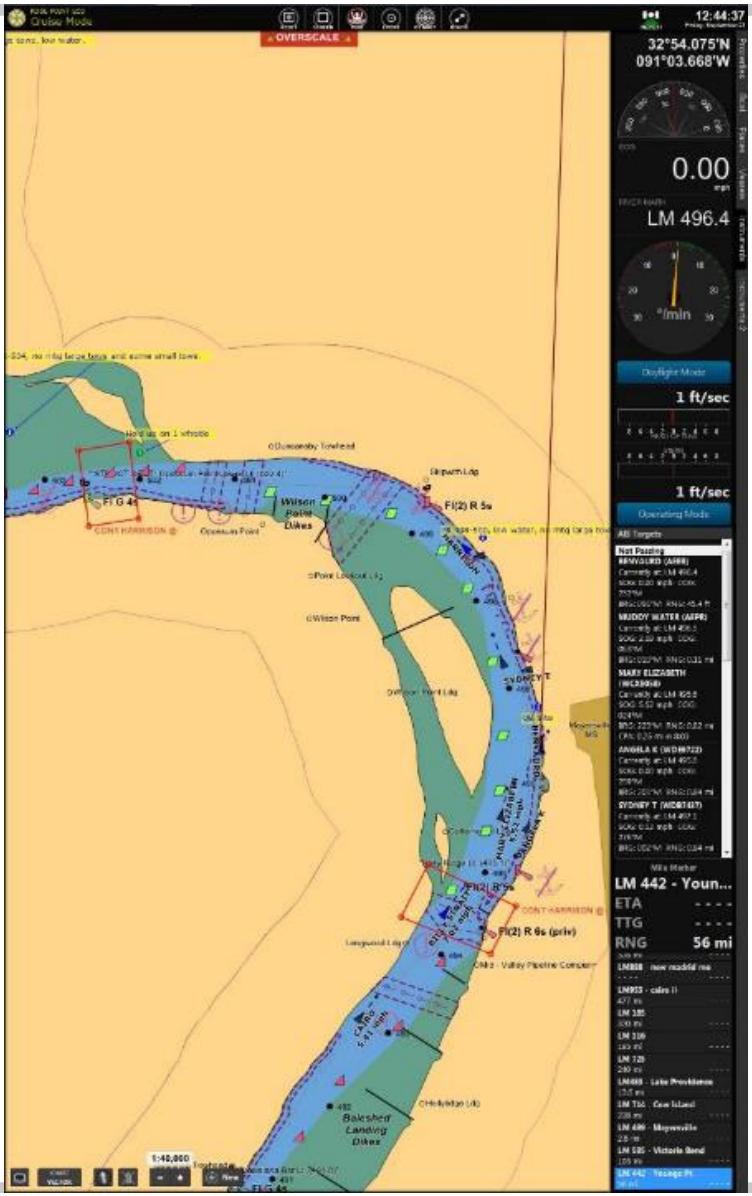
Lock Order

Mat Sinking Unit operations



AERIAL VIEW OF THE MAT SINKING OPERATION


Lock Operations Management Application (LOMA) v1.1.174
Application Certified for Unclassified
LPMS | Support | Contact | Logout (Michael.F.Winkler)
Live Plotter
Playback Plotter
Zone Configuration
Zone Reports
Gadgets
Target Information
Name WILLIAM JAMES
MMSI 366999267
Callsign AAAG
Latitude 32°54'05"N
Longitude 091°03'40"W
SOG 0 mph
Heading Not available
COG 272°
Nav Status Moored
Operating Mode Autonomous
Rate Of Turn Not available
Length 164.00 ft
Beam 45.92 ft
Type of Ship Vessel - Towing
Type of Cargo N/A
CargoType 31
IMO Number 0
Draught 0.00 ft
Nav Sensor GPS
DTE Status Available
Nationality United States of America
Lock Not available
Mile 496
River Mississippi River Mouth of Ohio River to Baton Rouge LA
Time since last update 00:03:46
Target Information
504
503
502
501
500
499
498
497
496
495
494
MISSISSIPPI
LOUISIANA
Old River
596
0.5mi


OVERSCALE
12:44:37
32°54.075'N
091°03.668'W
0.00
LM 496.4
1 ft/sec
1 ft/sec
Wilson Point Dikes
Fl(2) R 5s
Fl G 4s
Fl(2) R 6s (priv)
Baileshed Landing Dikes
LM 442 - Youn...
ETA
TTG
RNG
56 mi


12:49:16
32°54.074'N
091°03.669'W
0.00
LM 496.4
1 ft/sec
1 ft/sec
Fl(2) R 5s
Fl(2) R 6s (priv)
LM 442 - Youn...
ETA
TTG
RNG
56 mi

Collision between the *Riley Elizabeth* Tow and
US Army Corps of Engineers Barge Plant
Mississippi River near Waterproof, Louisiana
July 18, 2014

NTSB Marine Accident Report

4. Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following safety recommendations to the US Army Corps of Engineers:

Specify in the information you provide to the public how far US Army Corps of Engineers projects extend into the waterway. (M-15-13)

Use automatic identification system aids to navigation or application-specific messages to mark potential hazards to navigation. (M-15-14)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

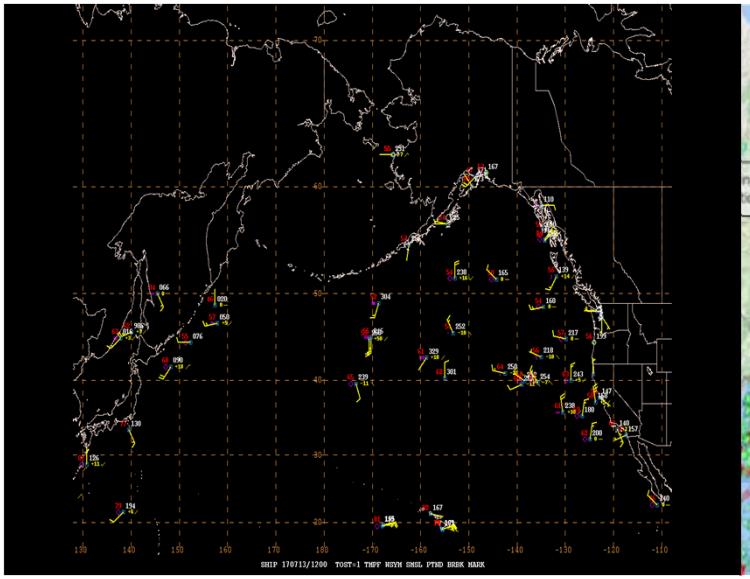
CHRISTOPHER A. HART
Chairman

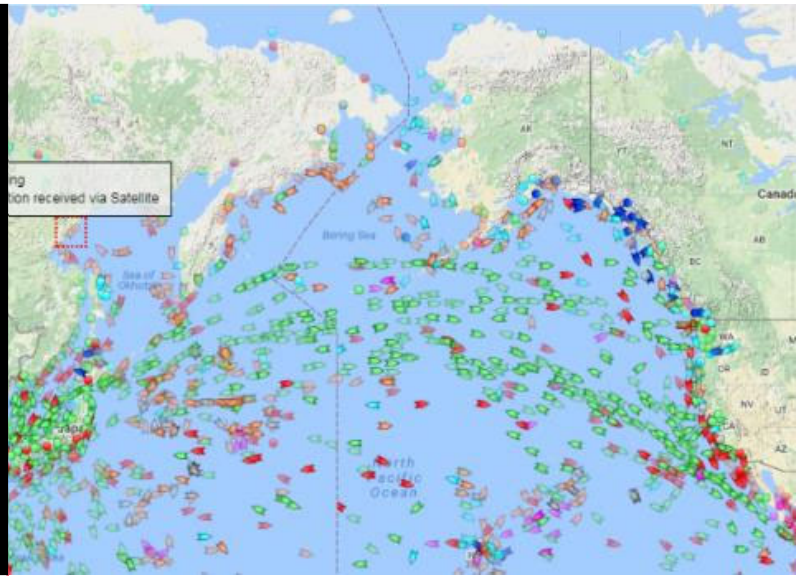
ROBERT L. SUMWALT
Member

Safety Board

WEATHER OBSERVATIONS VIA AIS

Weather forecasters need more observations
Small fraction of vessels provide voluntary observations
Observations are usually manually collected
Communication of observations from vessel to weather offices can be problematic





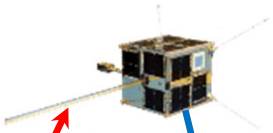
NMEA

Manual

Integration software

AIS

Other comms

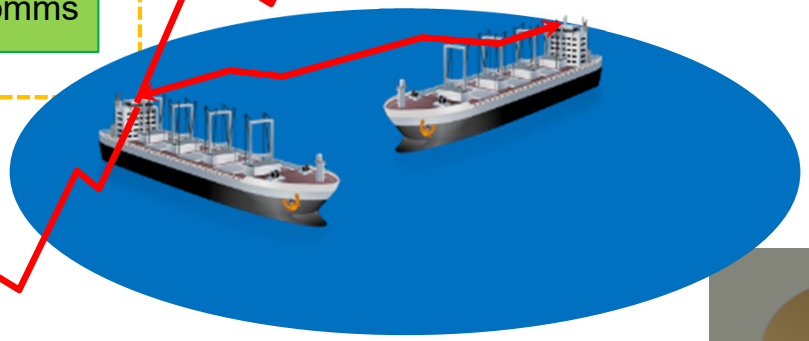


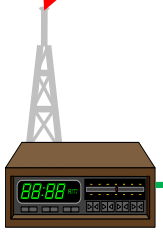
Forecaster

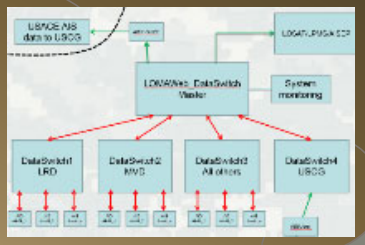
Obs. DB

Forecast models

Processing
- Decode
- QA/QC
- Routing







Shore AIS network

The laptop was placed on a ledge adjacent to the AIS pilot port; a cable from the pilot port was run to the laptop. A power strip plugged into the one available outlet was used to power the laptop and weather station.

Figure 7. Left: Laptop (orange arrow) on ledge to the right of the pilot port (green arrow). Right: close-up of pilot port.

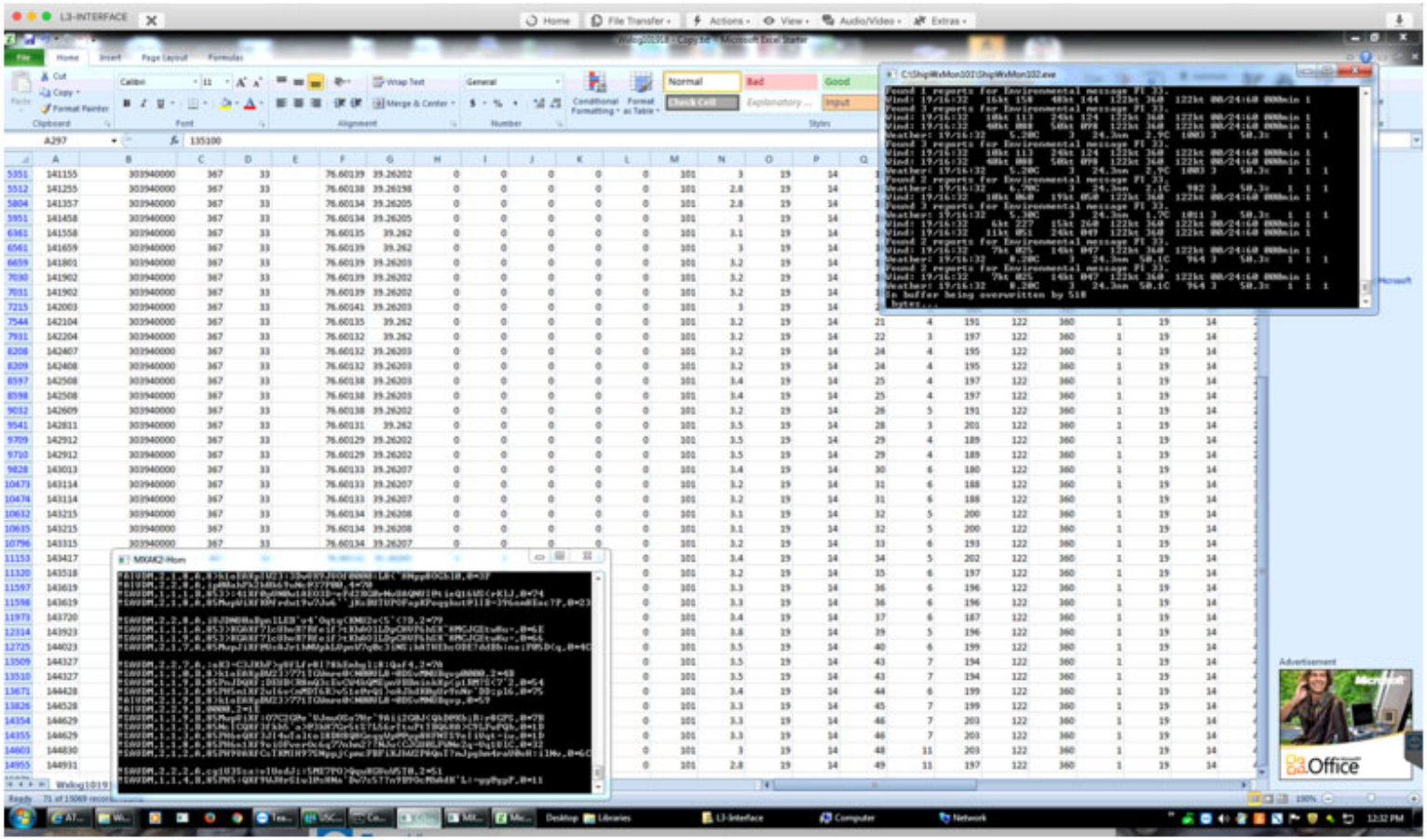
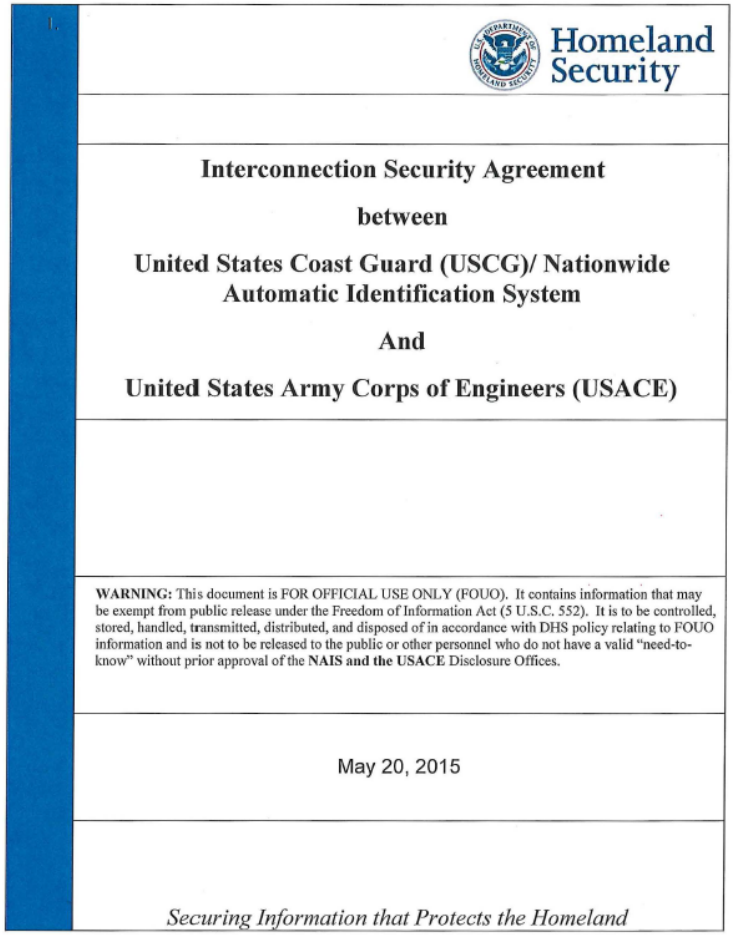


Figure 10. Shore side software (Ship Weather Monitor) is running in upper right window. The CSV file of logged data is shown in the background with reports from the CAPE WRATH (MMSI 303940000)

USACE-USCG ISA



Homeland Security

Interconnection Security Agreement

between

United States Coast Guard (USCG)/ Nationwide Automatic Identification System

And

United States Army Corps of Engineers (USACE)

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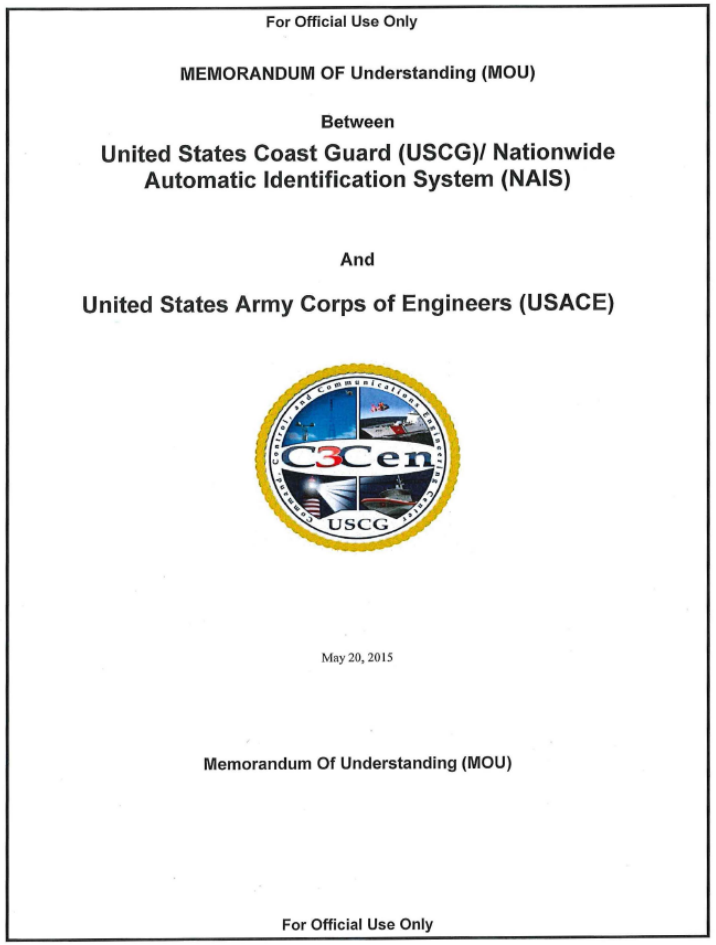
May 20, 2015

Securing Information that Protects the Homeland



For Official Use Only

MEMORANDUM OF Understanding (MOU)

Between

United States Coast Guard (USCG)/ Nationwide Automatic Identification System (NAIS)

And

United States Army Corps of Engineers (USACE)

C3Cen USCG

May 20, 2015

Memorandum Of Understanding (MOU)

For Official Use Only

SYSTEM MONITORING

LOMA Transceiver Status Report 11/27/2018 0830 CT (UNCLASSIFIED) - Message (Plain Text)

FILE MESSAGE McAfee E-mail Scan ADOBE PDF

Tue 11/27/2018 9:33 AM

Towne, Brady A CIV USARMY CEERD (US)

LOMA Transceiver Status Report 11/27/2018 0830 CT (UNCLASSIFIED)

To Aust, Kimberly J CIV USARMY CEIT (US); Brooks, Curtis J CIV CEMVR CEMVD (US); Chambers, Gary E CIV DFAS (US); Christopher.P.Padlo@uscg.mil; Dennis.R.Foster@uscg.mil; Dijoseph, Patricia K CIV USARMY CEERD-CHL (US); Eckhardt, W Cody CIV USARMY CEMVD (US); Elvin. G. Bruce2@uscg. mil (Elvin.G.Bruce2@uscg.mil); Heinold, Thomas D Jr CIV USARMY CEMVR (US); Jacob.E.Littley@uscg.mil; James Kilroy (DREN; 'Jennifer. M. Newman2@uscg. mil' (Jennifer.M.Newman2@uscg.mil); Johnson, Gregory W; Kilroy, James T Jr CIV USARMY CEERD-CHL (US); Lauth, Timothy John CIV USARMY CEMVS (US); Martin, Matthew O CIV USARMY CEMVR (USA); michael.j.newman@uscg.mil; Mitchell, Kenneth N CIV USARMY CEERD-CHL (USA); Ramon Villa ; Riley, Steven D CIV (US);

CLASSIFICATION: UNCLASSIFIED

LOMA Transceiver Status Report 11/27/2018 0830 CT All LOMA units are up and operational except:

COLUMBIA_OB_0X2D	ACE-IT INC # 6953207
SELDEN_BW_0JZW	ACE-IT INC # 6988495
MVM_BGU	ACE-IT INC # 7168243/7176106/7175895
MVM_HURLEY	
MVM_MISSISSIPPI	
USACEENSLEYYARD_0WMW	

IWR FEED UP

ACE-IT: Site	Incident Date	Incident Time	Ticket #	Notes
LRLJTM - John T Myers Lock & Dam - Vernon, Indiana	24-Nov-18	1045 CT	7233561	Degraded / UITOC
SAMSELr1-vpn - Seldon Lock & Dam - Sawyerville, Alabama	14-Aug-18	0945 CT	7129080	Down / UITOC / Awaiting p
SWLDAV-David D Terry Lock and Dam #6 - Scott, Arkansas	21-Nov-18	0934 CT	7232225	Down / Telco

ACE-IT Maintenance:
- ACE-IT Vicksburg (CPC) Scheduled Database Migration Maintenance, Friday, 30 November 2018, 1400-1900 Central Time
- ACE-IT Scheduled ESD Electrical Room Maintenance, Thursday, 29 November 2018, from 1200 to 1600 Central Time

LOMA Admin Console

Admin Panel | Bottom Connections | Top Connections | Map Analysis

DataSwitch Status		
Web DataSwitch	Online	11/26/2018 7:58:06 AM
DataSwitch 1	Online	9/25/2018 3:30:27 AM
DataSwitch 2	Online	11/20/2018 12:49:52 AM
DataSwitch 3	Online	11/20/2018 12:40:23 AM
DataSwitch 4	Online	11/26/2018 7:46:26 AM

DataStore Status		
DataStore	Up	281.6

Server Status		
Web Server	140.194.60.240	Online
DataSwitch 1 Server	140.194.60.242	Online
DataSwitch 2 Server	140.194.60.243	Online
DataSwitch 3 Server	140.194.60.244	Online
DataSwitch 4 Server	140.194.60.245	Online
Authentication/Tools Server	140.194.60.49	Online
Database Server	140.194.20.33	Online

SYSTEM MONITORING

USACE Performance Report
Production – OSC Feed
26 November 2018

1. **Analyst Report:**
   - See Analyst comments.
2. **Analyst Comments:**
   - C3CEN has not received USACE data via the OSC production feed since November 23, 2018 @ 0500 EST (0000 GMT).

VILLA.RAMON.FLORES.JR.1155962620 Digitally signed by VILLA.RAMON.FLORES.JR.1155962620 Date: 2018.11.27 07:58:16 -05'00'

NAIS Analyst

USACE Performance Report
Pre-Production - Direct Feed
26 November 2018

1. **Analyst Report:**
   - 138 – Total valid receivers.
   - 134 – Valid receivers online and reporting.
   - 4 – Valid receivers offline.
   - 0 – Valid receivers online, but not reporting.
   - 97.10% – Percent of total valid receivers online.
   - 0 – Unknown receivers.
   - 0 – Receivers with greater than 5% bad data.
   - 1691 – Unique MMSI(s).
2. **Analyst Comments:**
   - 0EK6, 0EL3, and 0JVF all report valid and compliant sentences, with 0 class A and B message types, and 1 MMSI.
   - There are 2 receivers reporting as non-operational on the LOMA TSR dated 11/26/2018 that did not report offline in pre-production: 0A9W and 0C31.
   - There are 2 receivers reporting offline in pre-production that did not appear on the LOMA TSR dated 11/26/2018: 096K and 0JZW.
3. **Total Data Report from Analysis Tool:**

Receiver Name	Compliant Sentences	Sentences	MMSI	Class A	Class B	% Bad Data	Own Base Station	Remarks
rACE01HW	260261	260261	118	224686	2972	0	1	
rACE01PN	36351	36351	4	7095	0	0	0	
rACE01SU	35247	35247	6	5970	0	0	0	
rACE01VK	34308	34308	6	3600	0	0	0	
rACE021Z	30083	30083	2	841	0	0	0	
rACE0230	31702	31702	5	2427	0	0	0	
rACE0239	30086	30086	3	1290	0	0	0	
rACE024S	34835	34835	5	5377	182	0	0	
rACE03H5	115275	115275	29	57891	0	0	2	