

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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ERDC-CHL

09 January 2019

ERDC
Engineer Research and
Development Center



US Army Corps
of Engineers®



What is AIS?

- Transponder?
- Tracking system?
- Collision avoidance system?
- Communications system?
- Everything to everyone?



The Players

- 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

AIS performance guidelines



MSC 69/22/Add.1
ANNEX 12
Page 13

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.

International Telecommunication Union

ITU-R
Radiocommunication Sector of ITU

Recommendation ITU-R M.1371-5
(02/2014)

**Technical characteristics for an automatic
identification system using time division
multiple access in the VHF maritime
mobile frequency band**

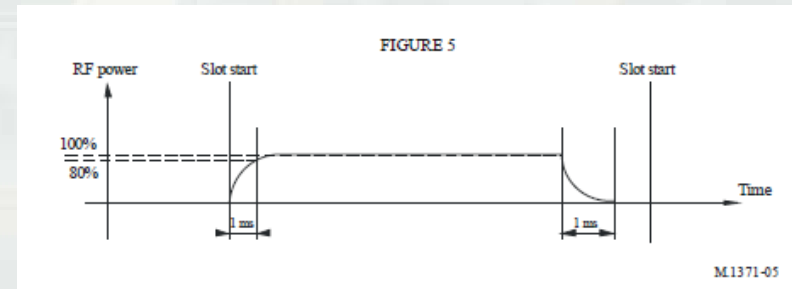
M Series
**Mobile, radiodetermination, amateur
and related satellite services**



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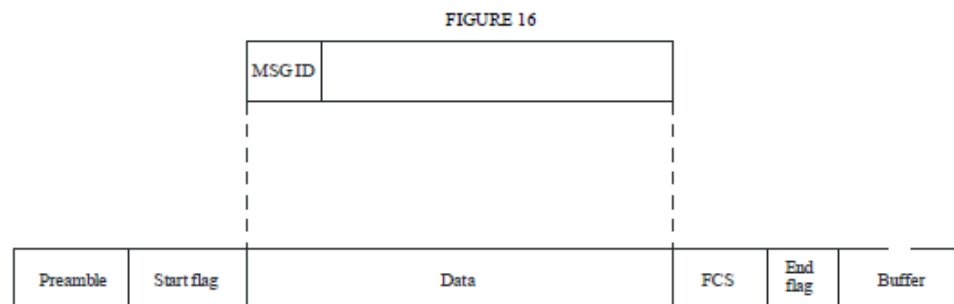
ITU-R.M1371-5

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



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:



M1371-16



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TABLE 46

Message ID	Name	Description	Priority	Access scheme	Communication 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 acknowledgement	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 acknowledgement	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	Communication 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 ⁽⁶⁾	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 Communications 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 48²³

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, wind-driven vessel towing astern (regional use), 12 = power-driven vessel pushing ahead or to starboard, 13 = reserved for future use, 14 = AIS-SART (active), MOB-AIS, EPIRB, 15 = undefined = default (also used by AIS under test)
Rate of turn ROT AIS	8	0 to +126 = turning right at up to 708° per min 0 to -126 = turning left at up to 708° per min Values between 0 and 708° per min coded $ROT_{AIS} = 4.733 \sqrt{ROT_{sensor}}$ where ROT_{sensor} is the Rate of Turn as input to the Rate of Turn Indicator (TI). ROT_{AIS} is rounded to the nearest integer. +127 = turning right at more than 5° per 30 seconds -127 = turning left at more than 5° per 30 seconds -128 (80 hex) indicates no turn information ROT data should not be derived from COG
SOG	10	Speed over ground in 1/10 knot steps (0-1023) 1 023 = not available, 1 022 = 102.2 knots
Position accuracy	1	The position accuracy (PA) flag should be as per Table 50 1 = high (≤ 10 m) 0 = low (> 10 m) 0 = default
Longitude	28	Longitude in 1/10 000 min ($\pm 180^\circ$, East = positive (as per 2's complement), West = negative (as per 2's complement). 181 = (6791AC _{0h}) = not available = default)
Latitude	27	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 _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	



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TABLE 52

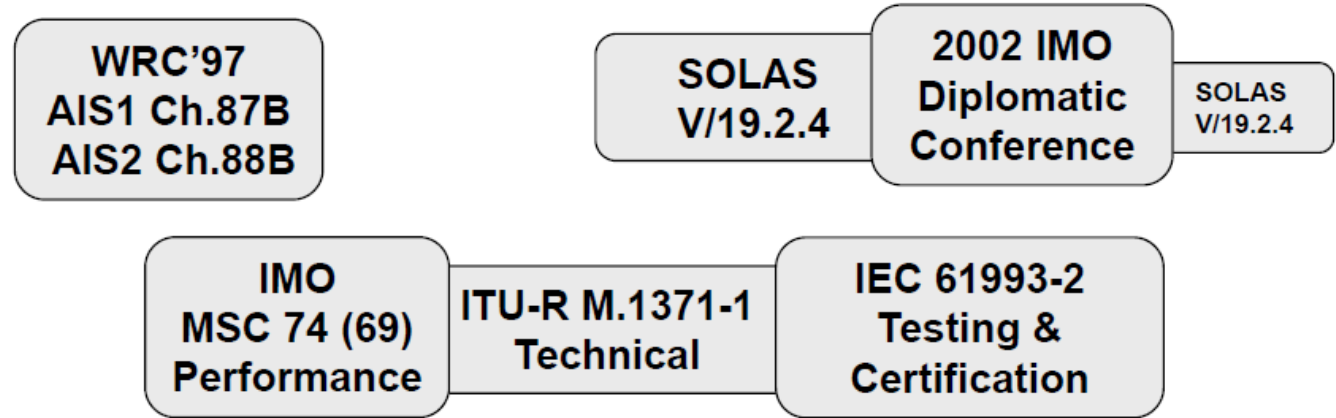
Parameter	Number of bits	Description
Message ID	6	Identifier for this Message 5
Repeat indicator	2	Used by the repeater to indicate how many times the message is repeated. Refer to § 4.6.1, Annex 2; 0 = not repeated, 1 = repeated
User ID	30	MMSI number
AIS version indicator	2	0 = station compliant with Recommendation 19.2.1 1 = station compliant with Recommendation 19.2.2 2 = station compliant with Recommendation 19.2.3 3 = station compliant with future editions
IMO number	30	0 = not available = default – Not applicable to SAR aircraft 0000000001-0000999999 not used 0001000000-0009999999 = valid IMC number 0010000000-1073741823 = official flag number
Call sign	42	7 x 6 bit ASCII characters, @@@@ Craft associated with a parent vessel, 6 digits of the MMSI of the parent vessel, towed vessels, rescue boats, tenders, life rafts
Name	120	Maximum 20 characters 6 bit ASCII, @@@@ The Name should be as shown on the aircraft registration document. If not available, it should be set to "SAR AIRCRAFT". For SAR aircraft, the registration number 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

AIS Timeline

International



1990-----1994-----1997----1998----1999----2000----2001----2002---2003--2004

OPA
'90



ADSSE
ITU-R
M.825-3

National
Dialog
Group

Marine Board
Ports &
Waterways
Study

FCC
Notice
DA-02-1362

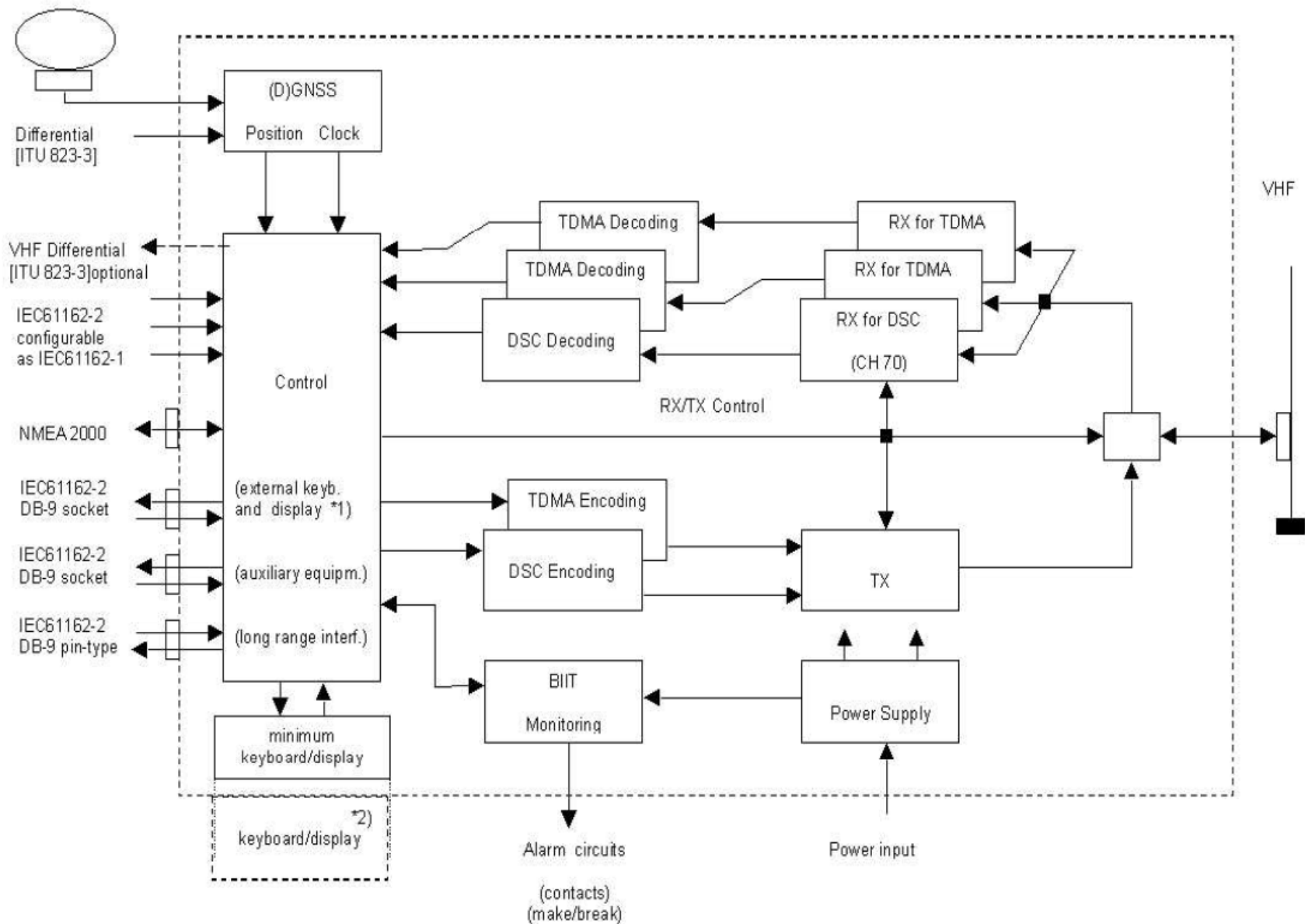
National

105th
Congress

VTS LMR
Public
Meeting

MTSA - 11/02
Interim - 7/03
Final - 10/03
Deadline - 1/04

What does AIS look like?



What does AIS look like?

Current AIS Prices



Furuno FA150 AIS Transponder
 Product ID: FA150-15 MFG ID: FA150

Furuno FA150 is a shipborne Universal AIS (Automatic Identification System) Transponder capable of exchanging navigation and ship data between own ship and other ships or coastal stations.

Availability: Usually ships within 24 hours

List Price ~~\$4,499.00~~ **Our Price \$3,999.95**

Qty: 1 [+](#) [ADD TO CART](#)

Class B: \$499 – \$1,700
Class A: 2,900 – \$3,990

Milltech Marine Online Store



ACR Nauticast2 Class A AIS Transponder

The ACR Nauticast2 AIS Transponder is a class A unit that is specifically designed to fulfill non-SOLAS carriage requirements. This product is packaged in an All-in-One kit that includes the AIS transponder, VHF & GPS antenna kit. An ECDIS port adapter is included with your ECDIS display or map can be ordered for use with 12

ACR-2609 \$2,999.00 [Add to Cart](#)



ComNav Voyager X3 Class A AIS Transceiver

SKU: 2141802 WGT: 9.30 LBS

RETAIL: \$2,499.00
Our Price: \$2,074.45

[ADD TO CART](#)

Free UPS Ground Shipping
 No Sales Tax (outside of FL)
 Easy 30 Day Returns



WEST MARINE NEW!
AIS-1000 Class B "Send and Receive" AIS Transponder

\$699.99 USD

[Add To Cart >>](#)

[+ Add AIS-1000 Class B "Send and Receive" AIS Transponder To Project List](#)



FURUNO FA30 BLACK BOX AIS

List Price: ~~\$1,162.50~~
Our Price: \$805.00
 You Save: \$297.50 (27%)

SKU: FURFA30

In Stock



Humminbird TX AIS Class B Receiver

RRP: \$550.00
Your Price: \$448.82
 (You save \$111.17)

SKU: 409310-1
 Brand: **Humminbird**
 Condition: New
 Weight: 5.00 LBS

*** Extended Warranty:**
 No Extended Warranty
 2 Year Warranty 39.99
 3 Year Warranty 59.99



Simrad AIS50 AIS Identification

Product ID: SIM159-00

Simrad AIS50 AIS Automatic Identification System (AIS) transmits a digital signal that contains the vessel's identity, speed, and location in your area. In the US.

Availability: Usually ships within 24 hours

List Price ~~\$669.00~~ **Our Price: \$1,249.95**

Qty: 1 [+](#) [ADD TO CART](#)

Total AIS Costs	2003	2015	
	Class A	Class A	Class B
Unit	\$7,000	\$3,230	\$700
Installation	\$2,000	\$969	\$210
Operation & Maintenance	\$250	\$250	\$250
Training	\$110	\$110	\$110
Individual Cost	\$9,250	\$ 4,449	\$1,160
Total Costs	\$49.2 M	\$20.5 M	

What does AIS look like?



162.000.000



AIS1

AIS2

-100

161.90

161.95

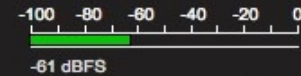
162.00

162.05

162.10

162.15

161.975.000



CH 84 ship rcv

AIS1

AIS2

NOAA WX 1

NOAA WX 2

-100

161.8

161.9

162.0

162.1

162.2

162.3

162.4

162.5



What does AIS look like?

```
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\n:793047,s:b003669953,c:1471371636*18\!SAVDM,1,1,,A,15NTfUPP01IS5hv@bED:fOw400Rv,0*76
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\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>1=;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-NNWSBS1,c:1471371633*28\!SAVDM,1,1,9,A,15N0Q?PP00JR`p`E5j1K8gw428Ca,0*2D
\g:1-2-9915,n:15038,s:D05MN-HR-NNWSBS1,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
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\g:1-2-8099,n:15834,s:D09MN-LM-WILBS1,c:1471371633*38\!SAVDM,1,1,6,A,15Nai?g000qdttrGmfW<TWA40D0>,0*6C
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\g:1-2-0101,n:14293,s:D11MN-LA-LAGBS1,c:1471371633*2B\!SAVDM,1,1,6,A,H5NRUoU3653hhhiG47om1l000000,0*40
\n:164432,s:b2003669980,c:1471371637*2D\!SAVDM,1,1,,B,15NGht?P12IARL2A4R9GR?w42@Ch,0*68
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\n:342293,s:b003669978,c:1471371636*12\!SAVDM,1,1,,B,15NW@MP000I<RcTA14w:c0?400SA,0*1C
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What does AIS look like?

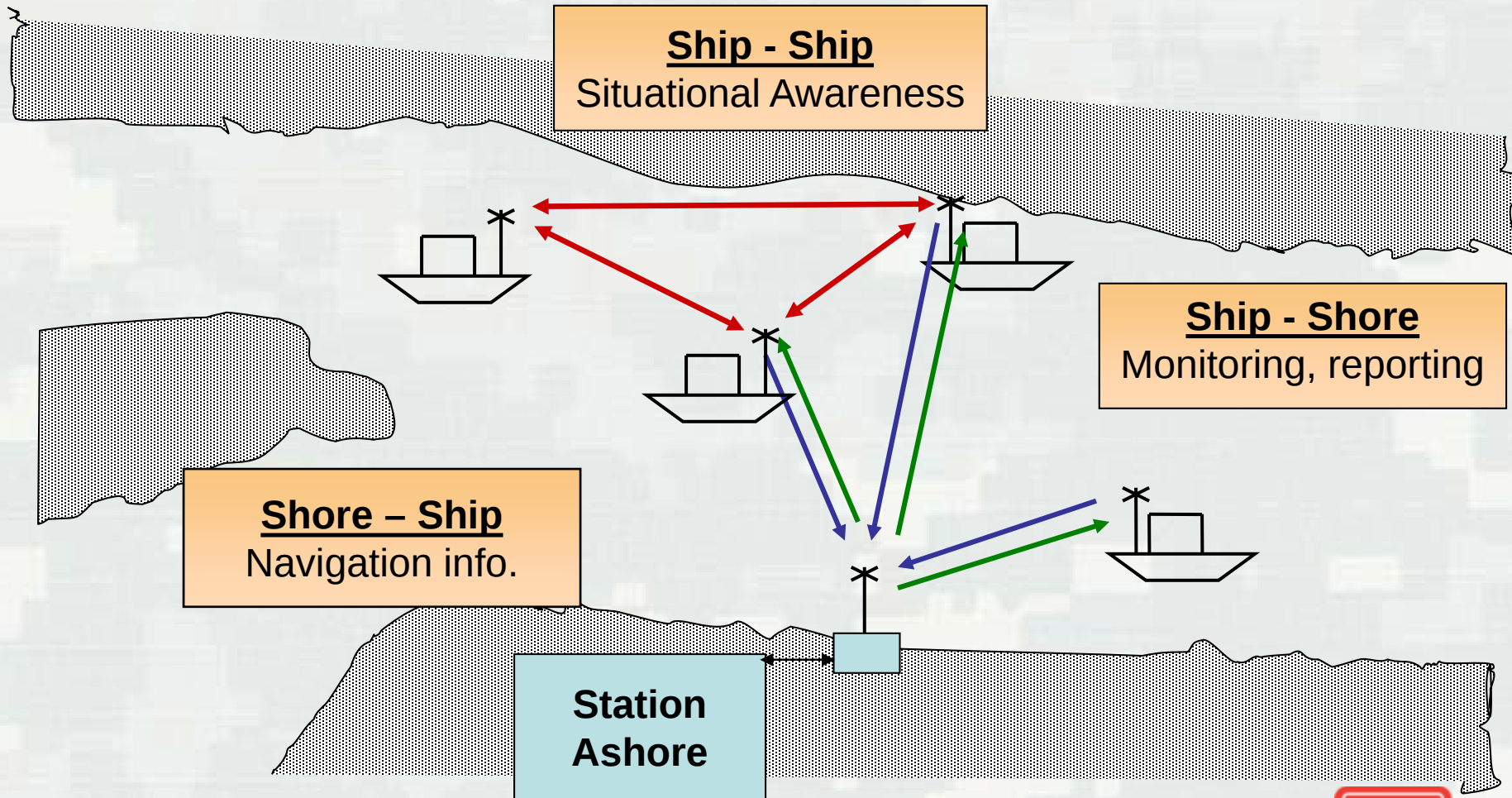
71065_reports.csv - Excel

Tetreault, Brian J CIV USARMY CEERD-CHL (US)

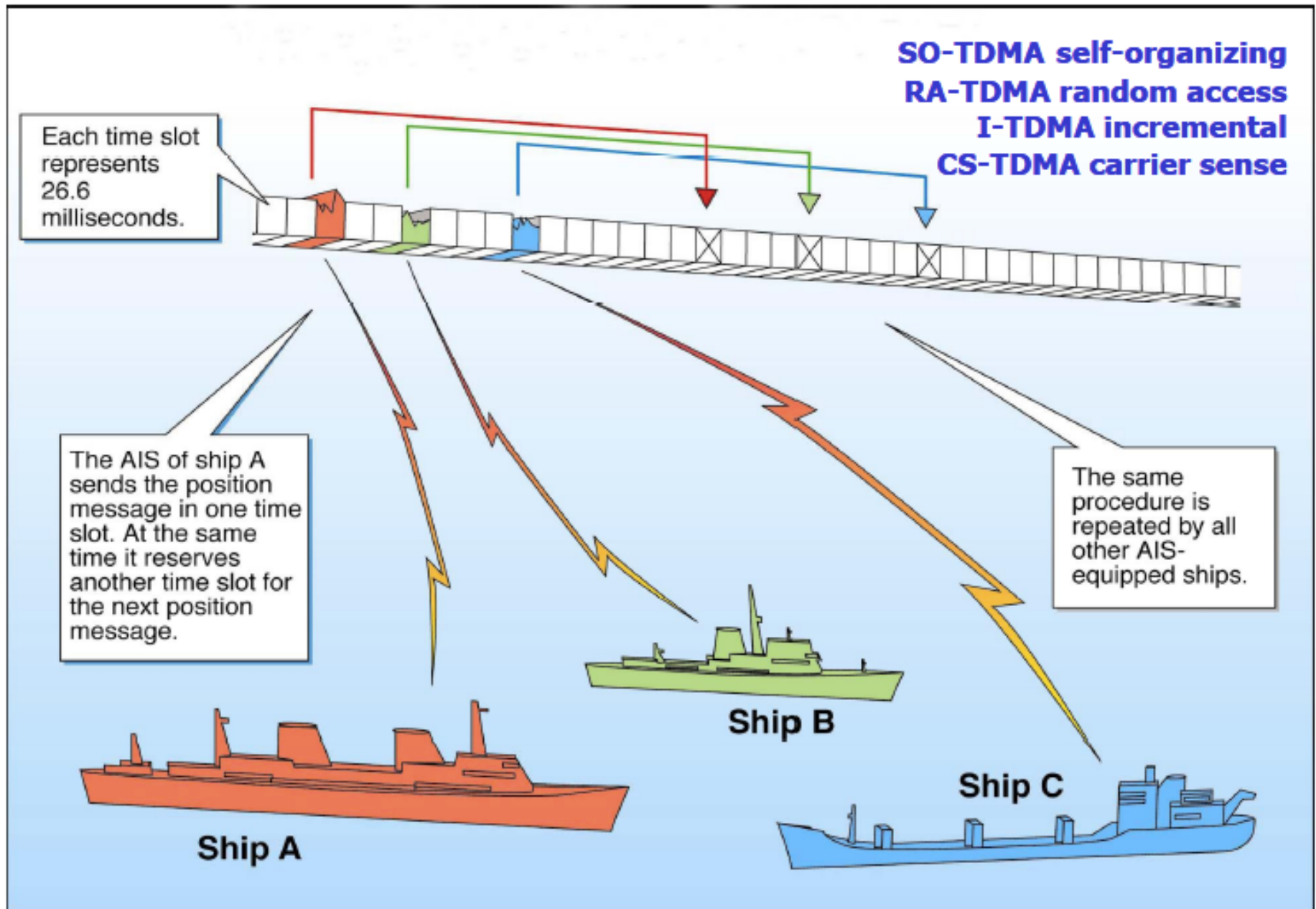
	A	B	C	D	E	F	G	H	I	J	K	L
	MMSI	NAME	RECEIVER	TX_DTTM	LAT	LON	COURSE_OVER_GROUND	NAV_STATUS	POS_ACCURACY	RATE_OF_TURN	SPEED_OVER_GROUND	HEADING
2	366999645	CG-CHEYENNE-----		6/5/2017 0:00	38.587088	-90.209098	287	Moored	FALSE	0	0	48
3	367533180	TAURUS		6/5/2017 0:00	37.070665	-89.308686	171	Under way using engine	FALSE	0		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	367500700	STONE STRAIT		6/5/2017 0:10	38.871328	-90.156401	129	Reserved for DG/HS/MP	FALSE	0	2	122

71065_reports

Automatic Identification System (AIS)



time-division multiple access protocol (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





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

Print-friendly

System

- What is AIS?
- How AIS Works
- Types of AIS
- AIS Messages
 - Class A Position Report
 - Class A Static & Voyage Data
 - Class B Reports
 - Long Range AIS Report
 - AIS ATON Report
 - AIS Base Station Report
- Nationwide AIS (NAIS)
 - NAIS Data Request
 - NAIS Search Tool (VIVS)
- AIS Requirements
- AIS Reference Information
 - AIS Encoding Guide & LOCOCODES
- AIS Frequently Asked Questions

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 (2017)
- Light Lists (Weekly Updates)
- CGSIC General Information
- LORAN C (archive)

Subscribe / Report (free)

- Email Message Subscriptions (Free)
- Report an ATON Discrepancy
- Report a GPS Problem
- Report an NDGPS Problem
- Report an LRIT Problem
- Report an AIS / NAIS Problem
- Contact Us

Maritime Information

- Electronic Charts Approval
- Maritime Safety Information Downloads
- Maritime Telecommunications

AIS FREQUENTLY ASKED QUESTIONS

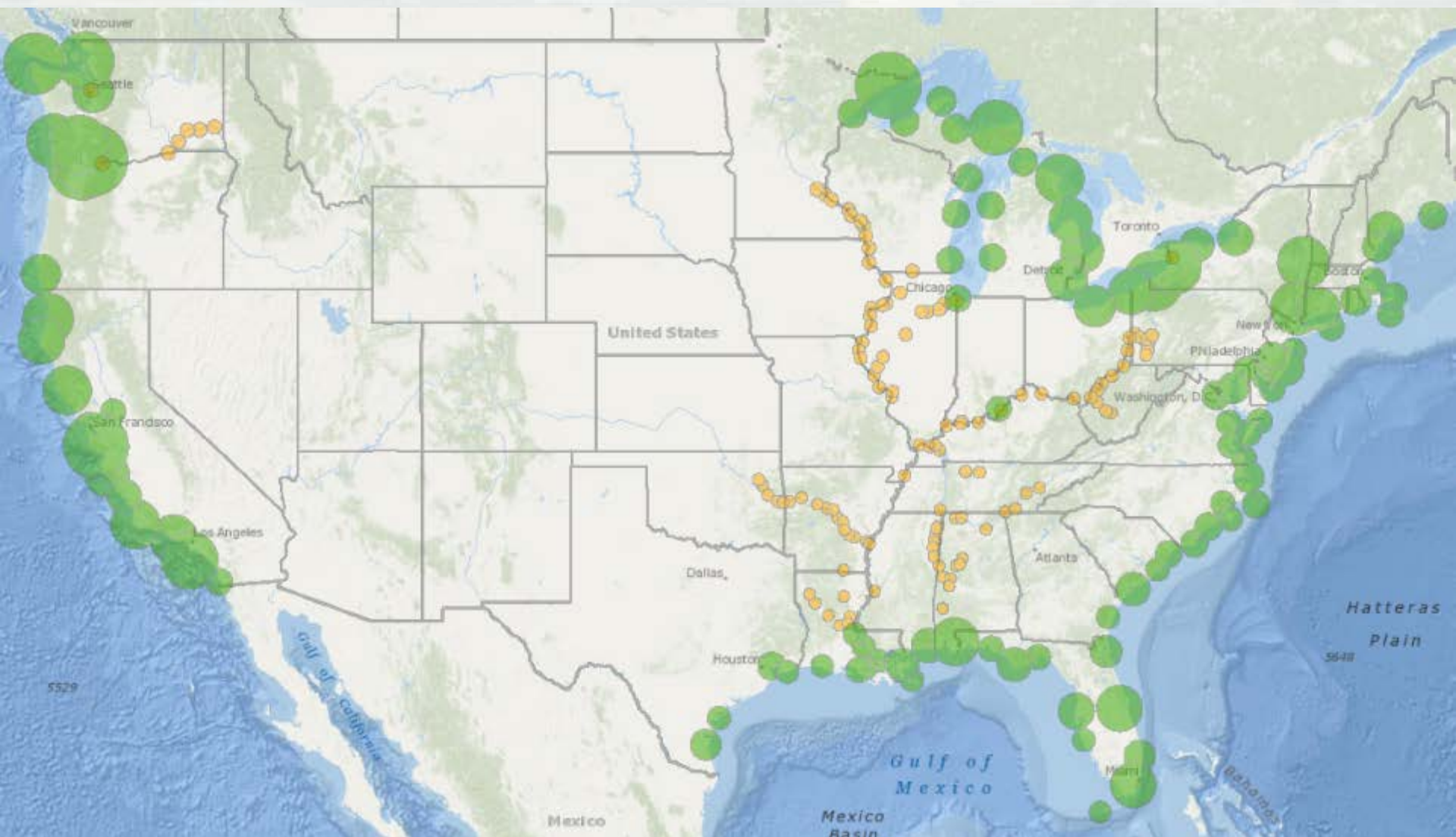
- What is AIS?
- How do I register (obtain a MMSI's), install, encode, and verify my AIS?
- What is the AIS rule and are there alternatives to the rule for small businesses?
- Do AIS Class B devices meet current USCG AIS carriage requirements? What are the differences between AIS Class A and Class B devices?
- How does AIS help to increase security (and what is NAIS)?
- When must AIS be in operation?
- Does the installation of the AIS require additional equipment in order for the AIS to operate properly?
- Will it be necessary to have electronic navigational charts for use with the AIS?
- Are fishing vessels subject to AIS carriage, and, are onboard Vessel Monitoring Systems (VMS) an acceptable substitute for AIS?
- Why have some AIS units stopped broadcasting valid position reports?
- Why am I unable to see an AIS vessels' name or other static information (dimensions, call sign, etc.)?
- Why do I sometimes see more than one vessel with the same MMSI or vessel name (i.e. NAUT)?
- I just purchased and installed an AIS Class B, will AIS Class A user 'see' me?
- What are the differences between AIS Class A and B devices?
- Is the USCG considering expanding AIS carriage to other vessels or outside of VTS areas?
- How can I get a copy of an AIS presentation I saw or heard about? You can download recent presentations given by the Coast Guard Office of Navigation Systems.
- Where can I get AIS data?
- Can I use AIS to locate my nets, pots, traps, moorings, etc.?
- What is AIS Channel Management?
- Can I use my AIS in an emergency or for distress messaging?
- Is the Coast Guard broadcasting AIS Aids to Navigation Reports?
- Have an AIS question not answered here?

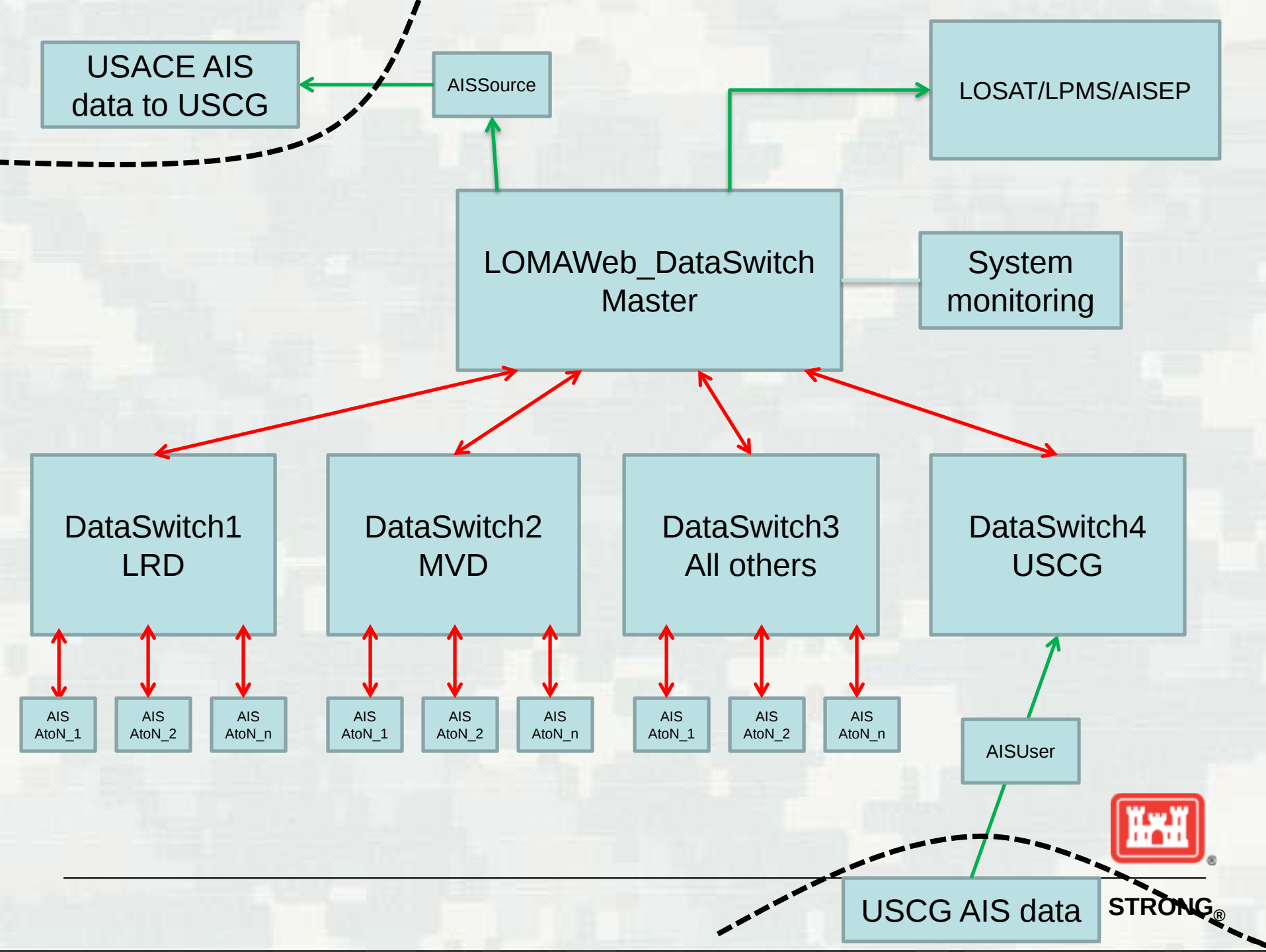
1. What is AIS? Per 33 CFR §164.46(a), AIS is a maritime navigation safety communications system standardized by the International Telecommunication Union (ITU) and adopted by the International Maritime Organization (IMO) that provides vessel information, including the vessel's identity, type, position, course, speed, navigational status and other safety-related information automatically to appropriately equipped shore stations, other ships, and aircraft; receives automatically such information from similarly fitted ships; monitors and tracks ships; and exchanges data with shore-based facilities. Note, many devices are marketed as AIS, but, only those (see [Types of AIS](#)) that are certified to meet stringent standards are. [Read more](#) on what it is, how it works, what it broadcasts, and, the messages it uses, etc.

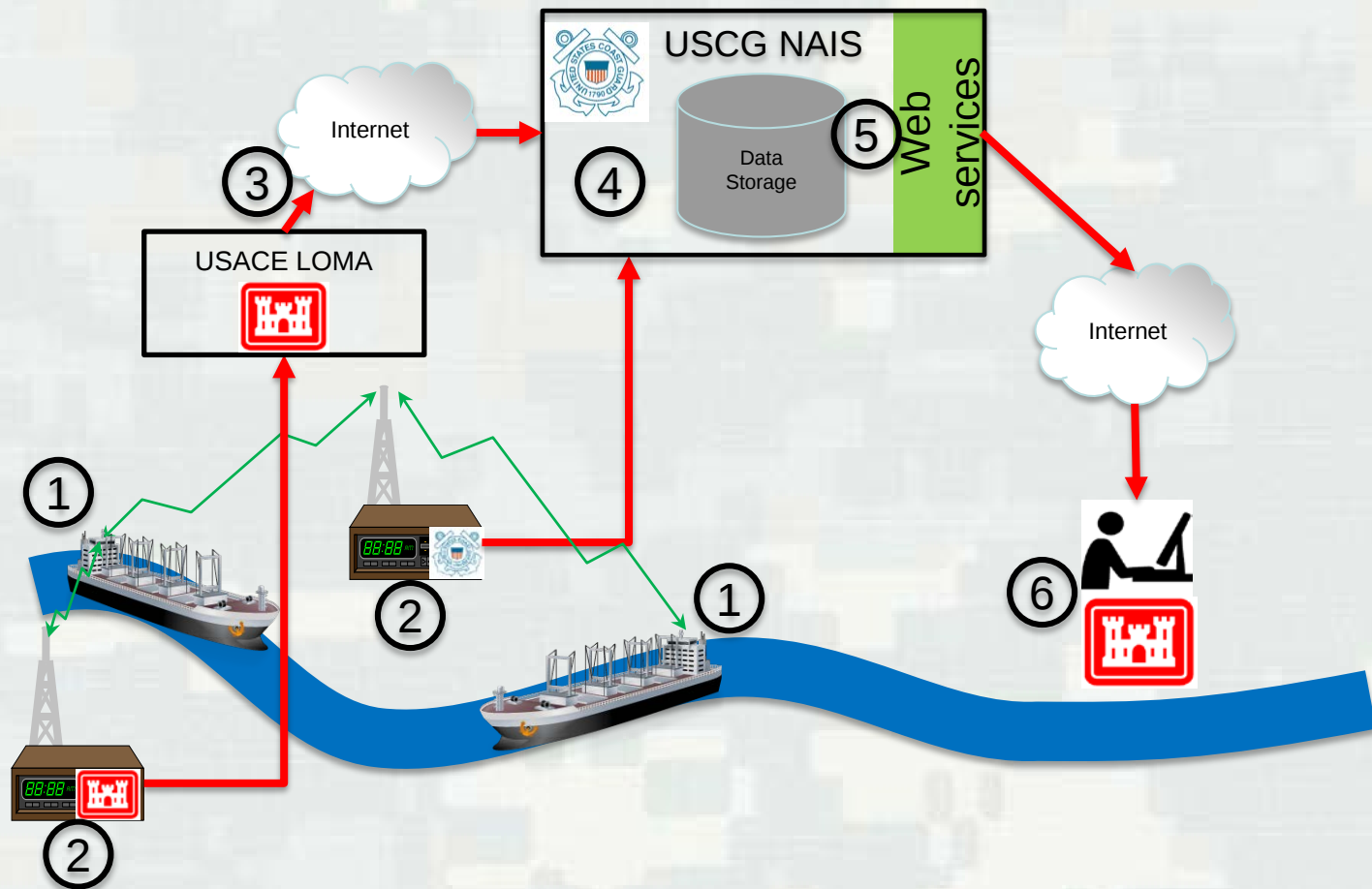
2. How do I register (obtain a MMSI's), install, encode, and verify my AIS? AIS devices are not registered, however, each requires a unique and official 9-digit Maritime Mobile Service Identity (MMSI) number. To obtain one see our [MMSI page](#). AIS devices should be installed taking into consideration the guidelines developed by the International Maritime Organization (IMO [Safety of Navigation Circular 227, Guidelines For The Installation Of A Shipborne Automatic Identification System](#)) or the [National Marine Electronics Association \(NMEA 0400-4.00, Installation Guide\)](#). Encoding an AIS varies by class. AIS Class B are not user configurable, AIS Class A are; but, their static data (i.e. MMSI, name, call-sign, type, dimension, etc.) is password protected. Therefore, Class B owners, and Class A owners whom have lost/forgotten their password, should contact your AIS installer, manufacturer, or retailer for instructions on how to encode/recode it. Note, each USCG type-approved AIS has an internal built-in integrity tester that mitigates the need to send TEST text messages to verify its operations. That said, the U.S. Coast Guard operates a [Vessel Information Verification Service](#) which can be used to not only verify that your AIS has broadcasted, but, will also highlight any potential data or encoding discrepancies (contrary to our [USCG AIS Encoding Guidance](#)). Per 33 CFR §164.46(d) vessels equipped with AIS must maintain it always in effective operating condition and broadcasting accurately; failure to do so could subject owner/operator to civil penalties not to exceed \$25,000 (46 U.S.C. 70119).



USACE and USCG AIS coverage







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)



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
SELDEN_BW_0JZW
MVM_BGU
MVM_HURLEY
MVM_MISSISSIPPI
USACEENSLEYARD_OWMW

ACE-IT INC # 6953207
ACE-IT INC # 6988495
ACE-IT INC # 7168243/7176106/7175895

IWR FEED UP

ACE-IT: Site	Incident Date	Incident Time	Ticket #	Notes
LRUTM - 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.F
LORES.JR.11559
62620

Digitally signed by
VILLA.RAMON.FLORES.JR.11
55962620
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	20	57801	0	0	2	

Summary

- What is AIS?
- Players
 - ▶ 1371 overview
 - ▶ IMO performance guidelines
- Technology
- Limitations
- Data flow to USCG
 - ▶ opportunity for ready access to real-time and archival data



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

Safety Text

Destination: JODY MCMINN

☐ Send Broadcast

Message: HOLD AT LOWER APPROACH

[Send](#)



Acquisition Directorate
Research & Development Center

USACE AIS Transmit Technical Support Summary Report

Distribution Statement A: Approved for public release; distribution is unlimited.
September 2014

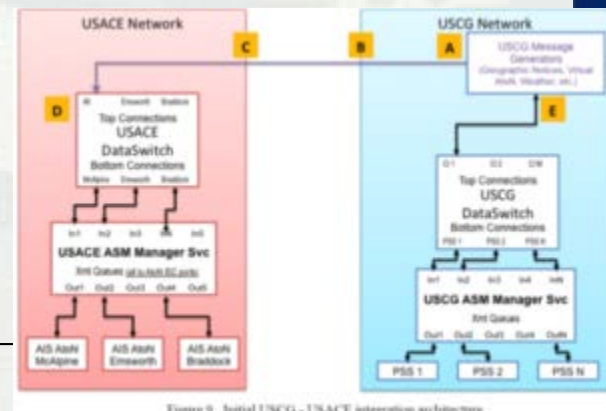


Figure 9. Initial USCG - USACE integration architecture.

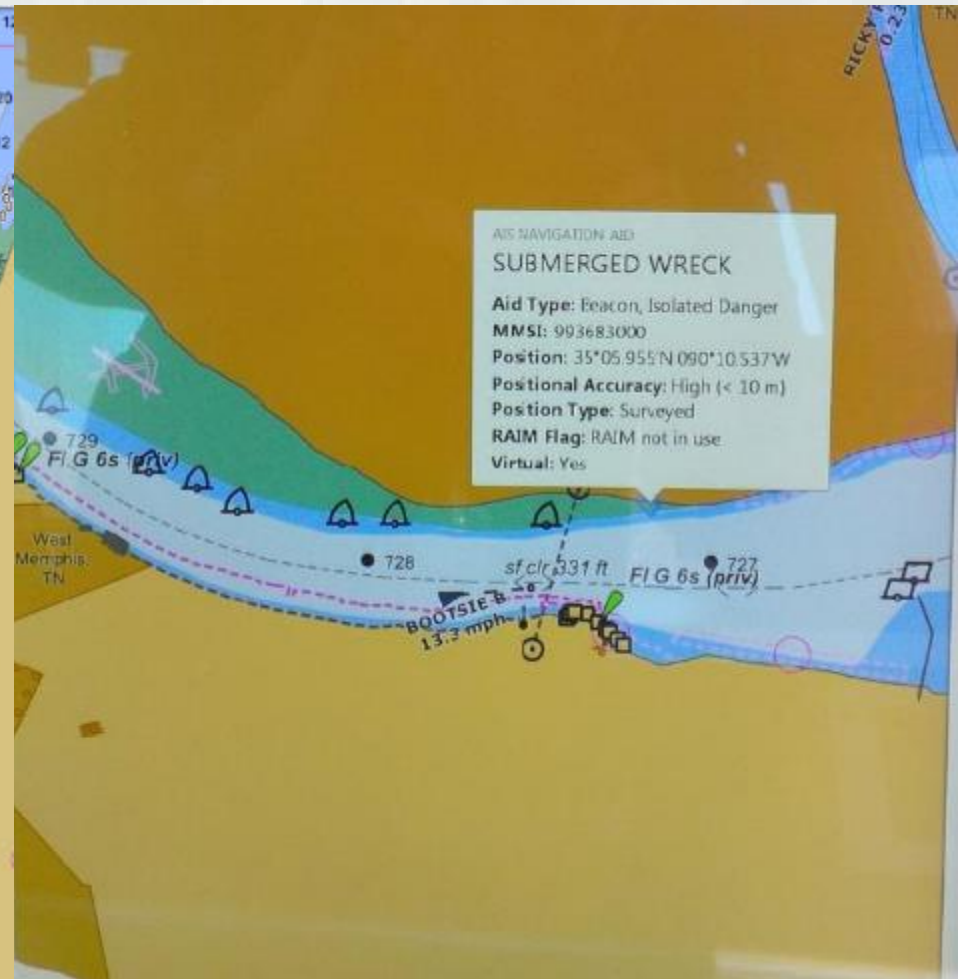


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Virtual AtoN

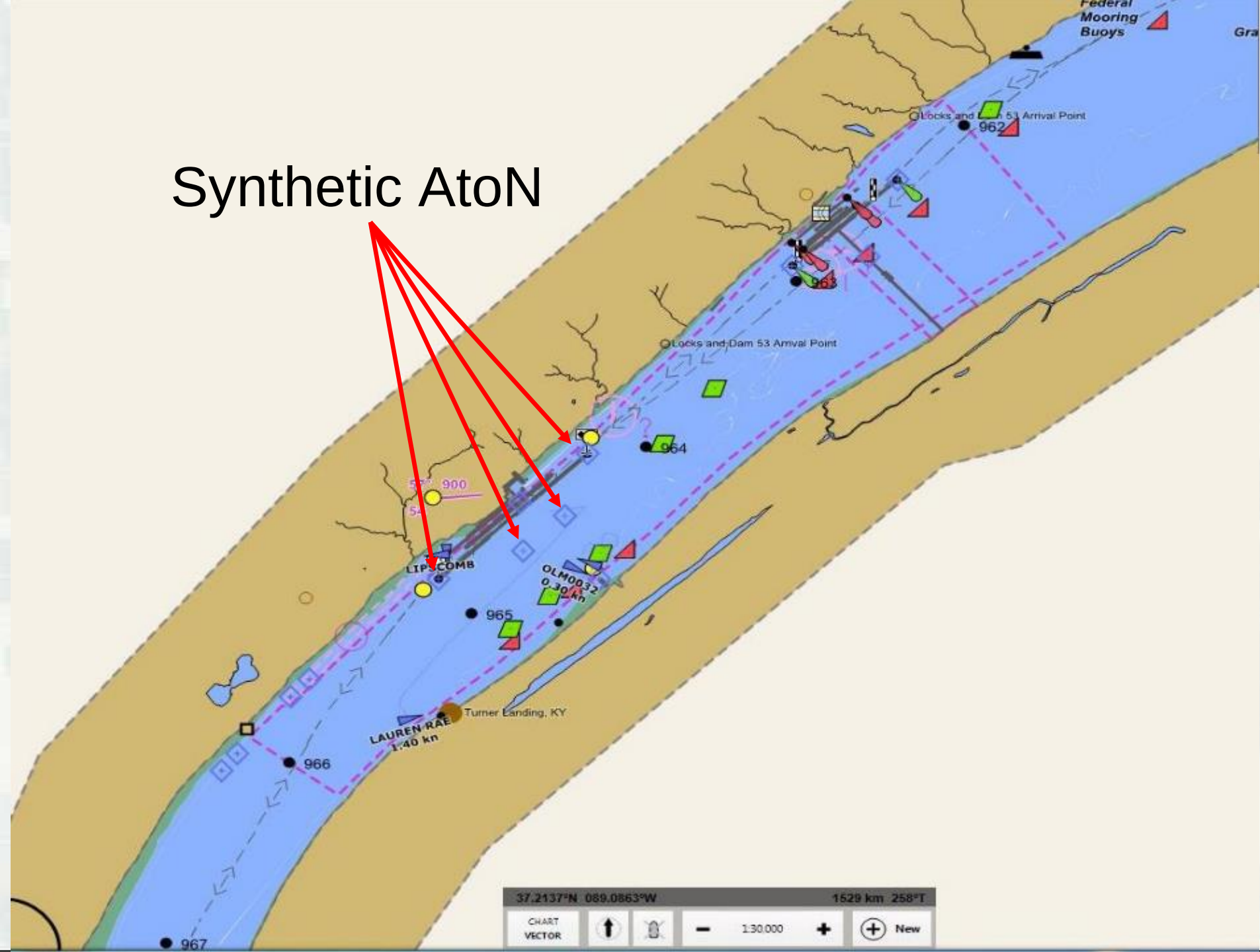


AIS V-AtoN in area where ice and tidal range prohibit physical AtoN

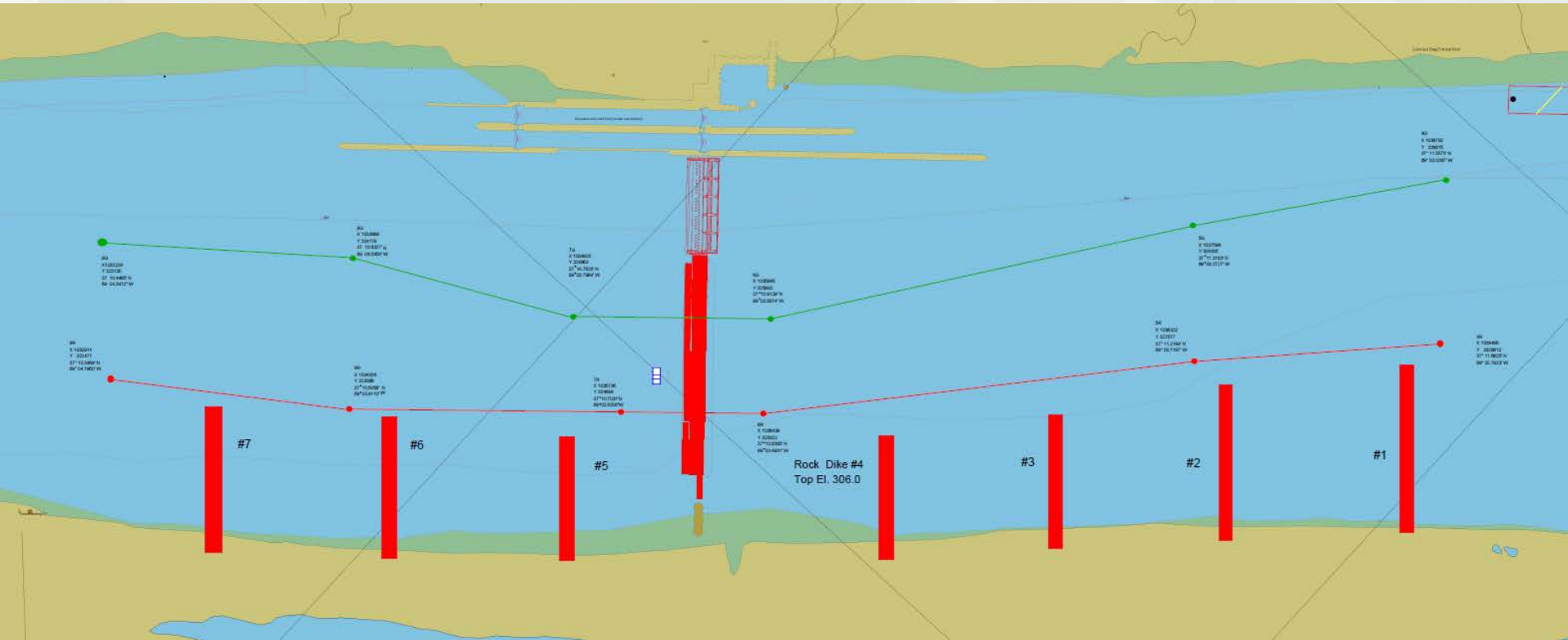


AIS V-AtoN marking submerged wreck in swift river waters

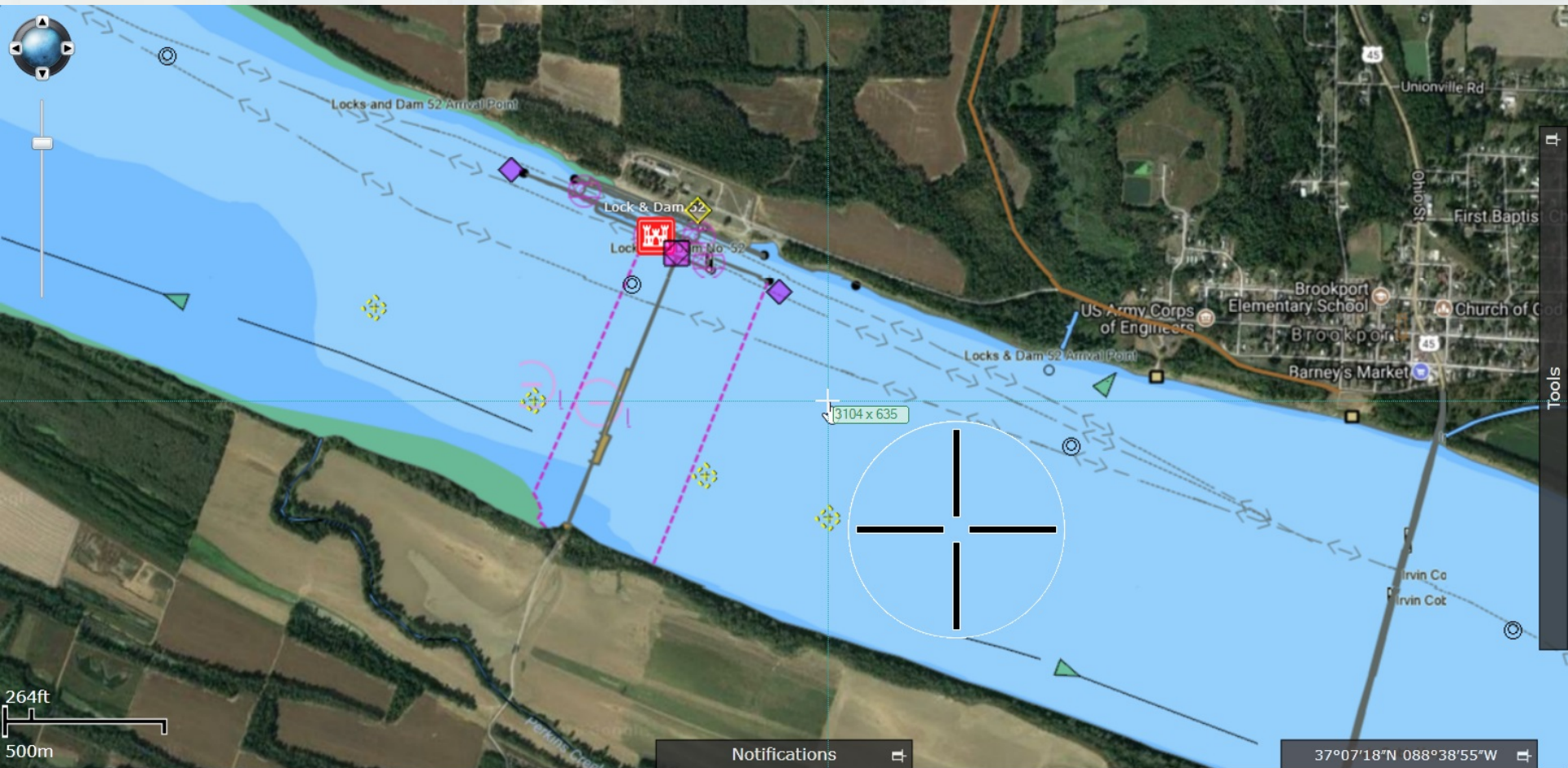
Synthetic AtoN



AIS AtoN marking navigation pass



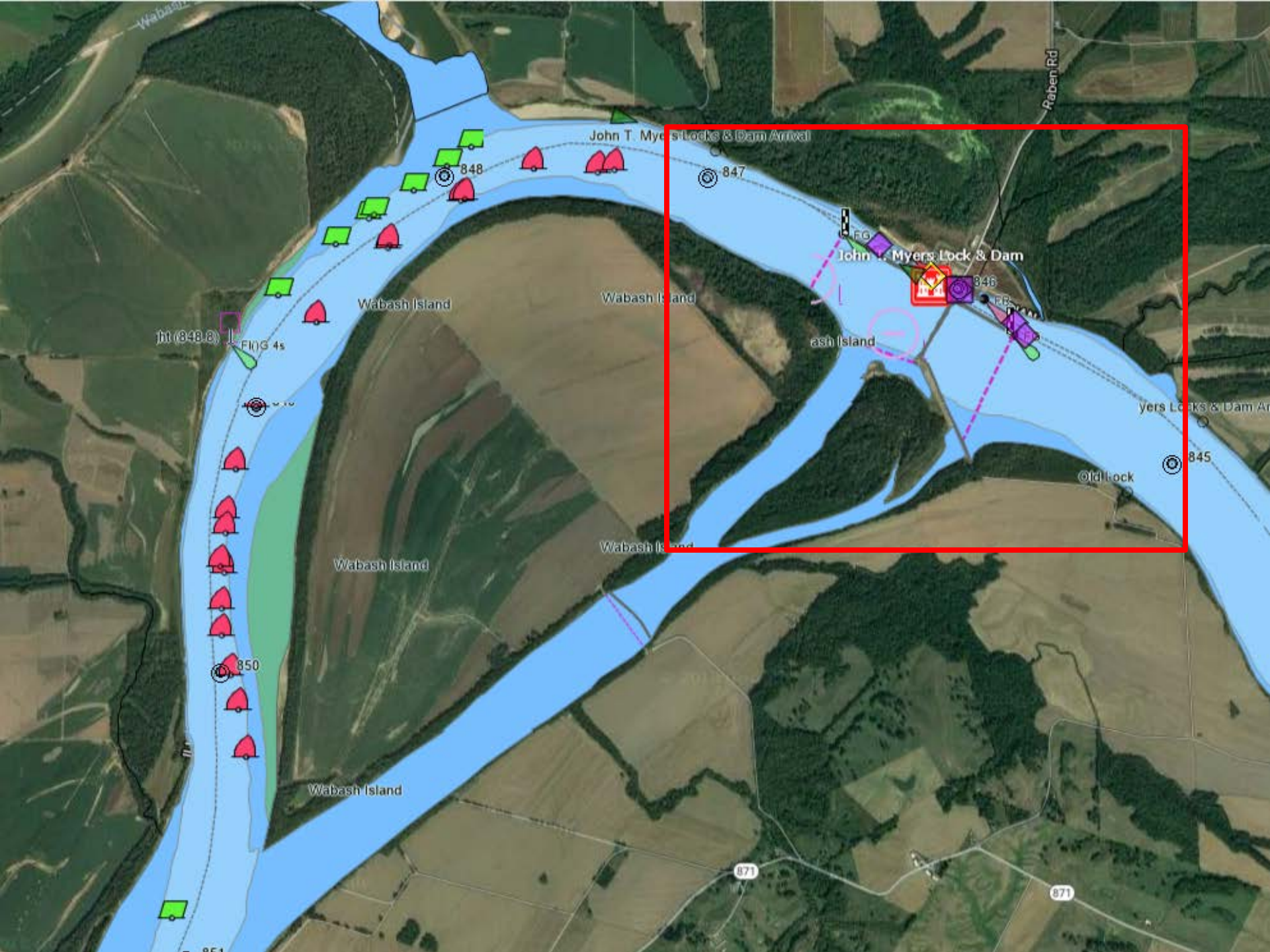
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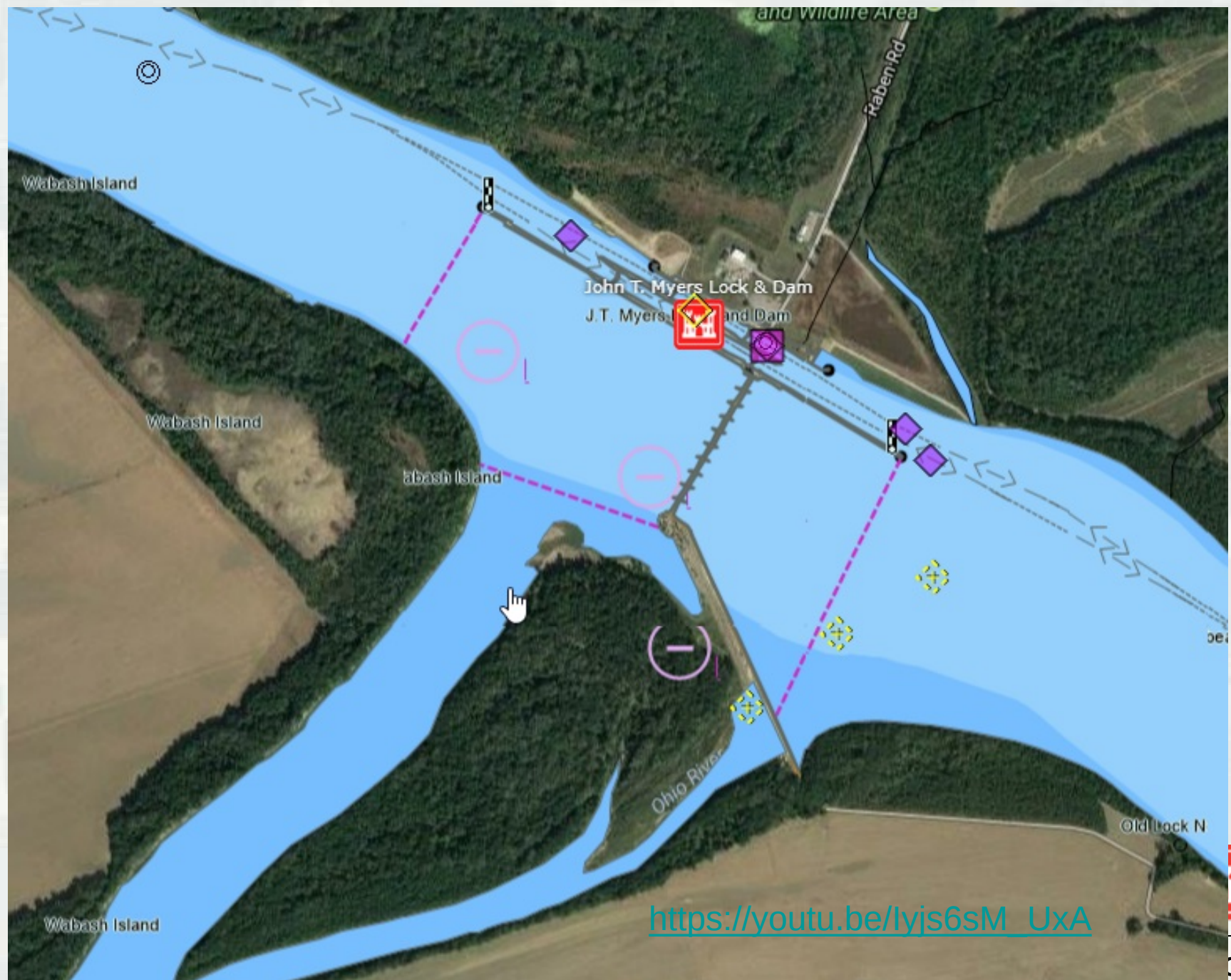


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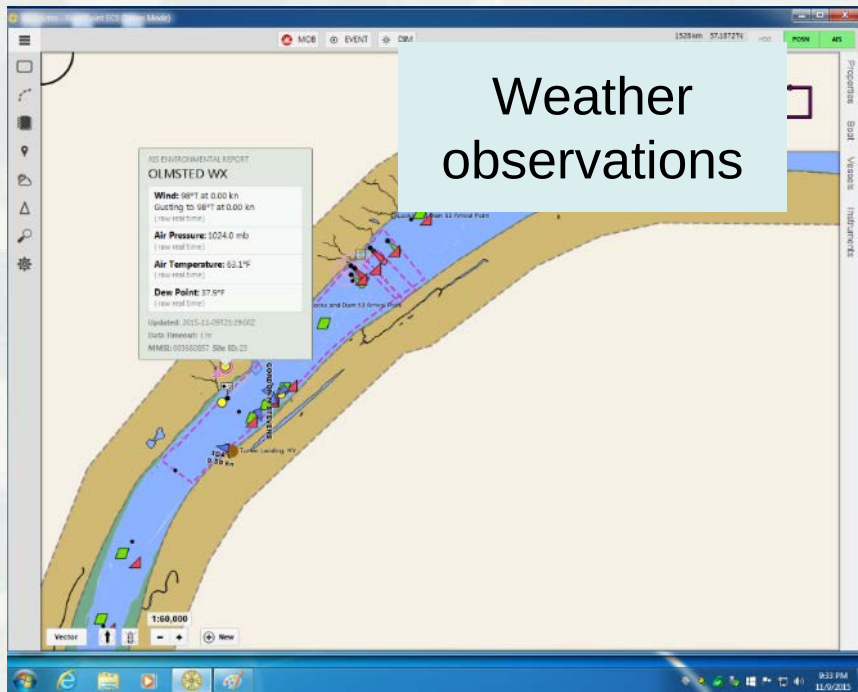
https://youtu.be/lyjs6sM_UxA

Virtual/Synthetic AtoN issues

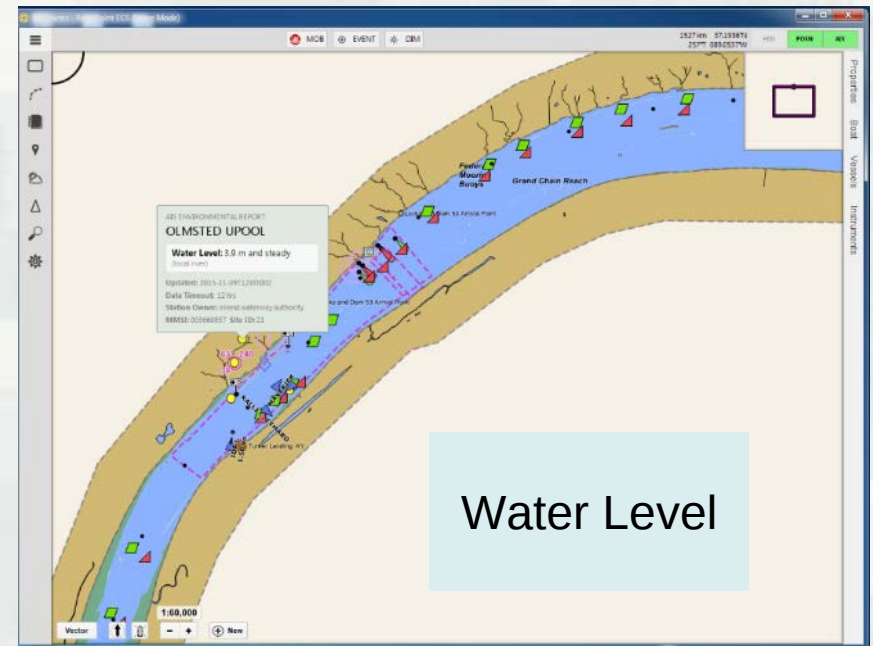
- Process
 - ▶ Who decides when and where to establish?
 - ▶ Who creates?
 - ▶ Monitoring to ensure transmission/receipt?
- Technical
 - ▶ USCG-USACE connectivity
 - ▶ USAIMS integration
- IENC:
 - ▶ What AIS AtoN are charted?



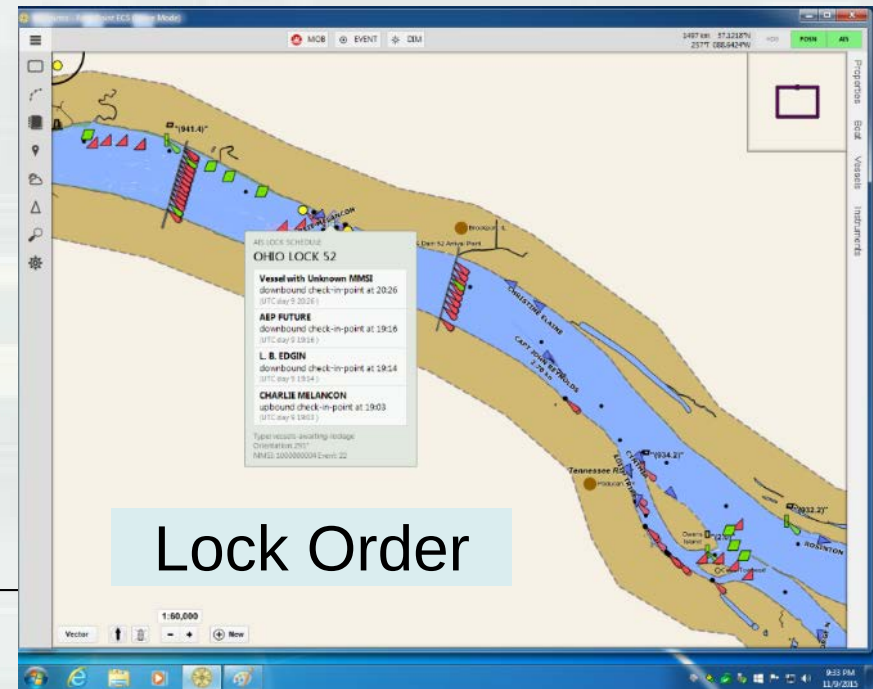
Information delivered to vessels via AIS



Weather observations

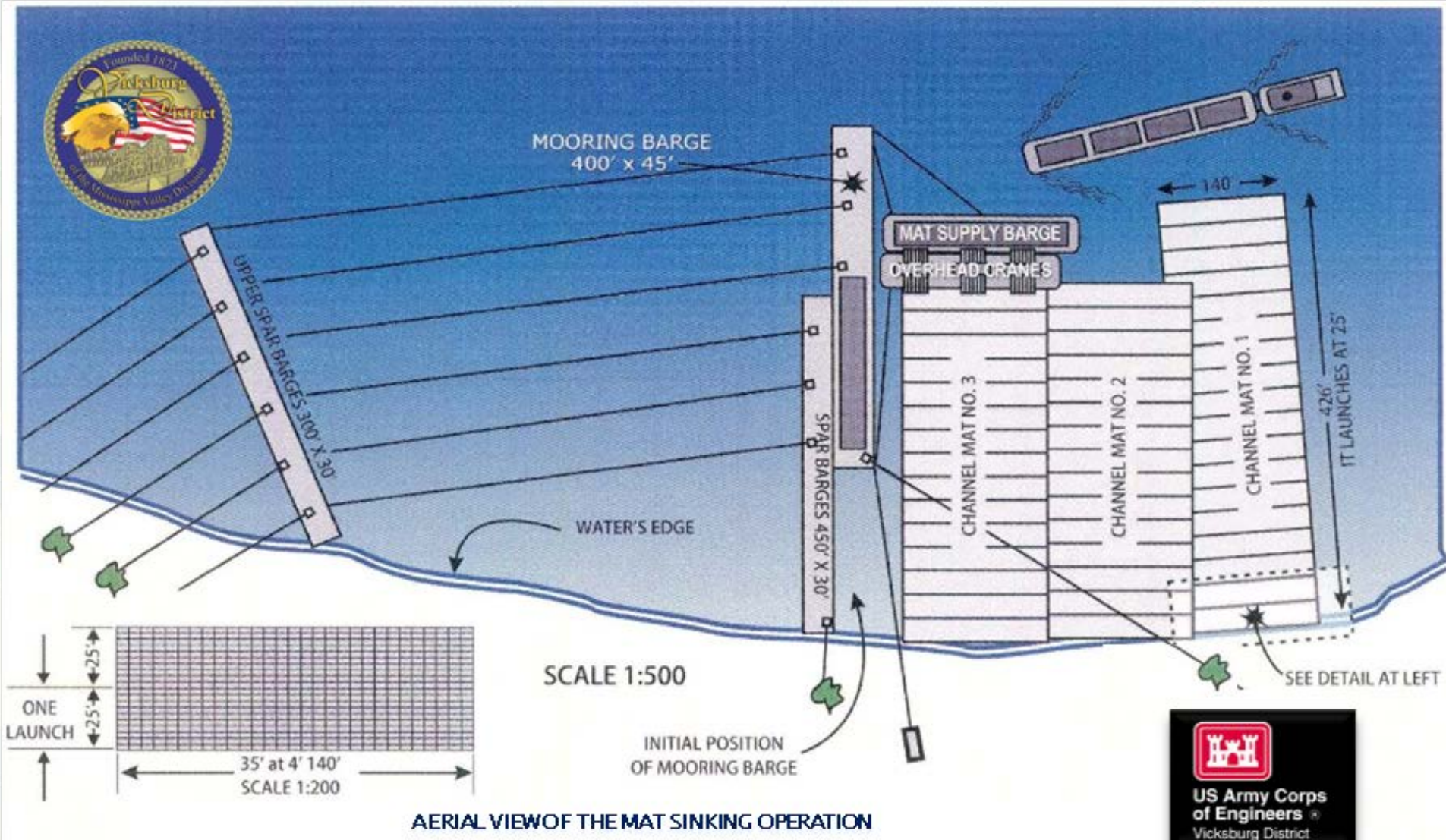


Water Level



Lock Order

Mat Sinking Unit operations



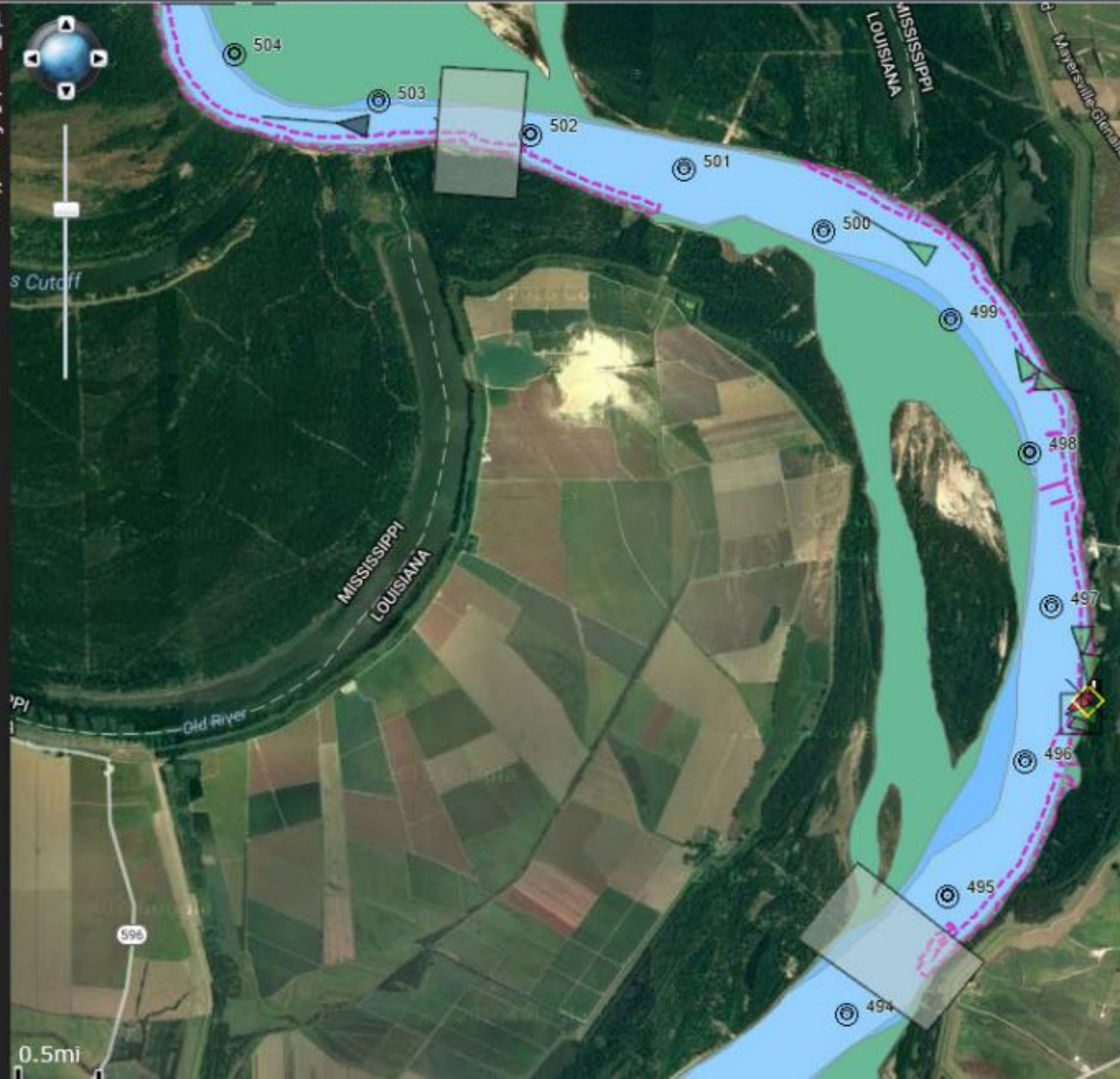
**US Army Corps
of Engineers**
Vicksburg District

[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





③



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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

Safety Board



LDING STRONG®

River Information Services

Working definition:

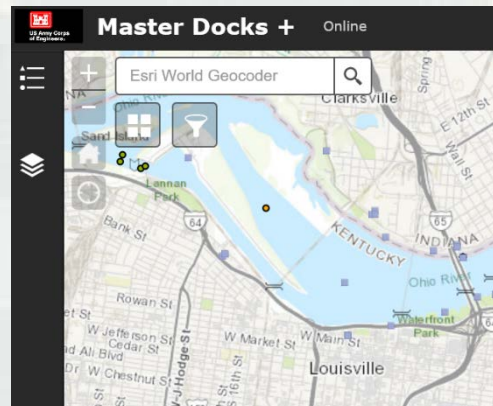
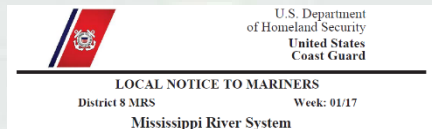
River Information Services (RIS) makes navigation data more accessible and usable in support of USACE Navigation operations and maintenance.

Technical Services

- Inland Navigation Charts (IENC)
- Vessel tracking (AIS)
- Notices to Mariners
- Electronic Reporting
- Reference Data

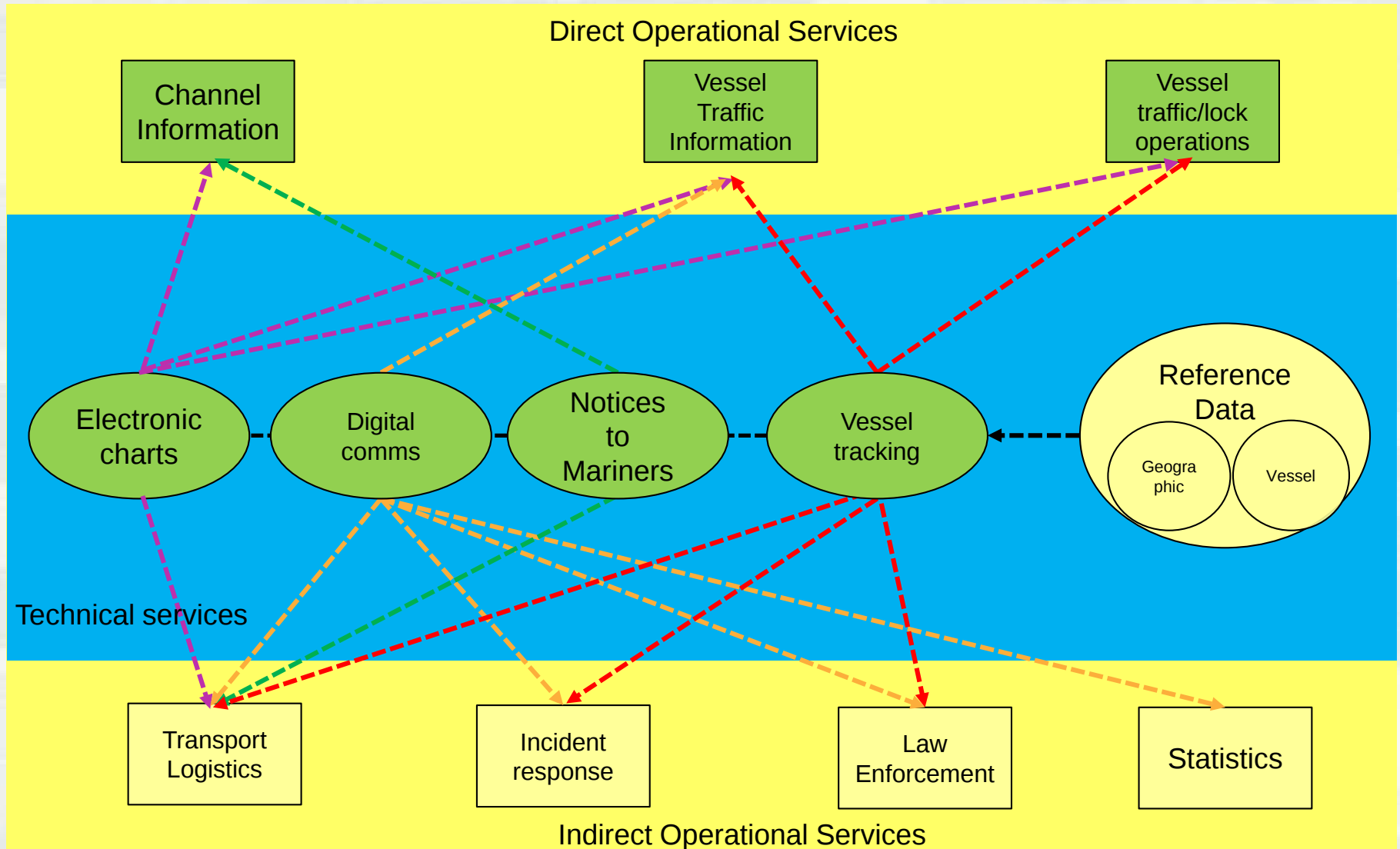
Operational Services

- Navigation channel information
- Vessel traffic information
- Traffic/lock operations
- Incident response support
- Law enforcement support
- Transport logistics support
- Statistics support



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RIS Technical and Operational Services

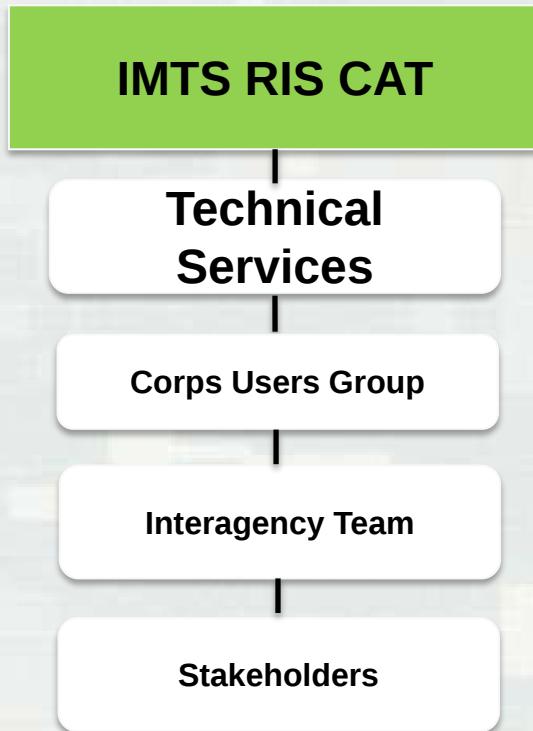


Way ahead for US RIS implementation

- Build on existing capabilities
- Establish governance
 - ▶ USACE RIS team
- External engagement:
 - ▶ Interagency
 - ▶ Industry
- Implementation project



RIS Collaborative Action Team



Provide oversight and strategic guidance to RIS implementation efforts

Focus on integration and enhancement of existing capabilities, development of new capabilities where needed

Provide input from field-level users of RIS capabilities and services

Coordinate the development and provision of services across agency lines

Insure RIS services meet external user needs, support waterway operations



National RIS Implementation Project

- Phase 1: short term - Define and achieve interoperability of systems
 - ▶ LOMA timings to LPMS – automate as much as possible
 - ▶ LPMS feed LOMA gate settings (etc.) for input to model outdrafts
 - ▶ Delays for system performance
- Phase 2: mid term - Vessel tracking and electronic reporting
 - ▶ eHydro integration/implementation
 - ▶ Electronic reporting of industry information
 - ▶ NTNI/NTM harmonization
- Phase 3: long term – Navigation Planning Tools
 - ▶ Congestion prediction
 - ▶ Dynamic trip support (ETA service)
 - ▶ Enhanced weather/water information



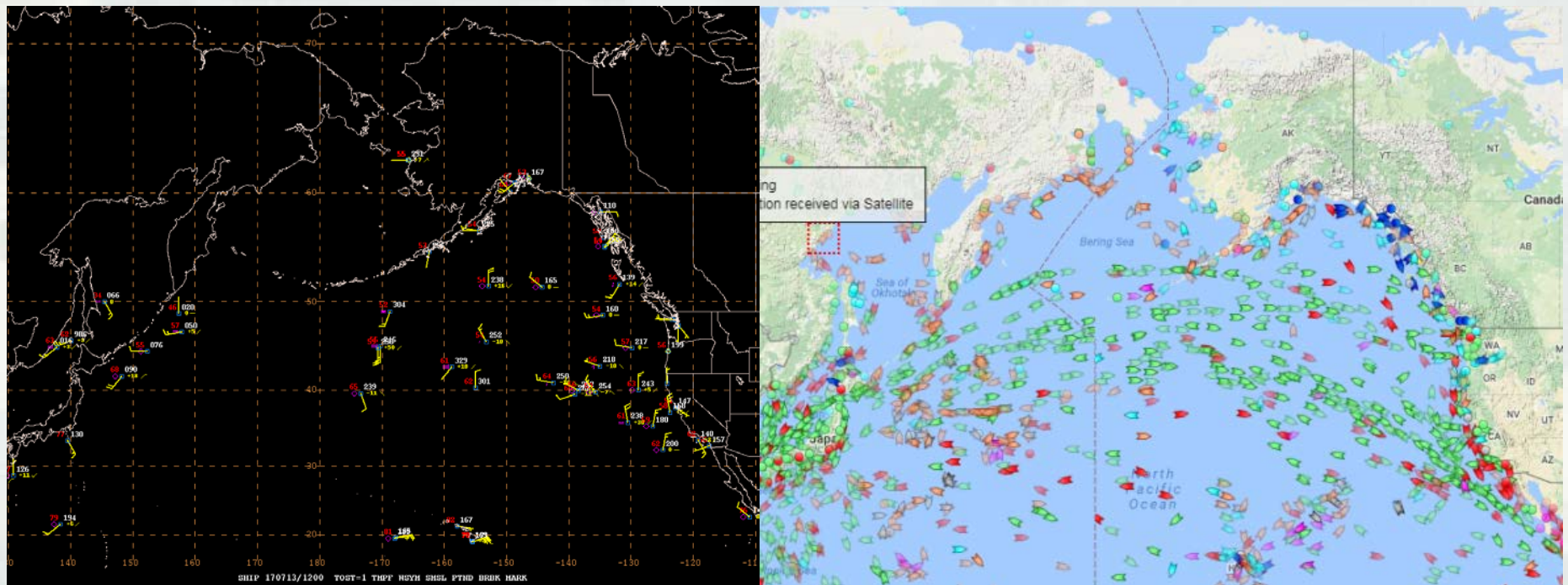
Strategic Communication

- Internal events:
 - ▶ Lock Operations workshop 16-18 October 2018
 - ▶ MSC Ops Chiefs TBD
 - ▶ Lock Maintenance workshop Jan/Feb 2019
- Industry outreach
 - ▶ MVD-LRD-stakeholders meeting 24 October 2018
 - ▶ Inland Waterways Conference March 2019
- Workshop(s) - TBD
- Interagency Outreach
 - ▶ Committee on the Marine Transportation System (CMTS)



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

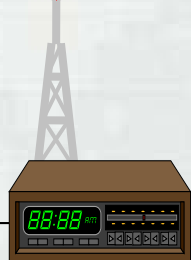
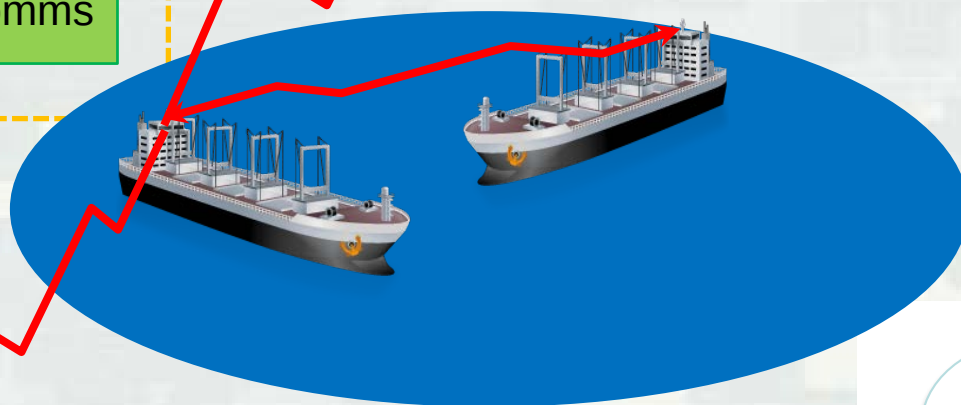
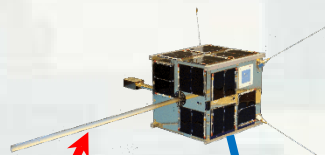
Manual

Integration
software

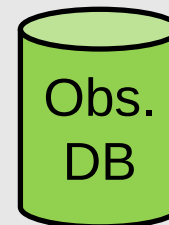
AIS

?

Other
comms



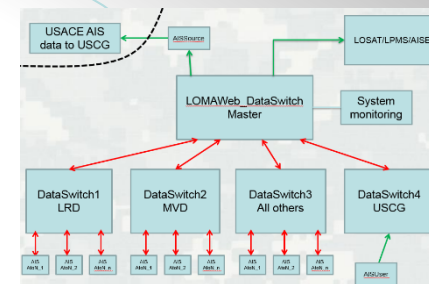

Forecaster



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.



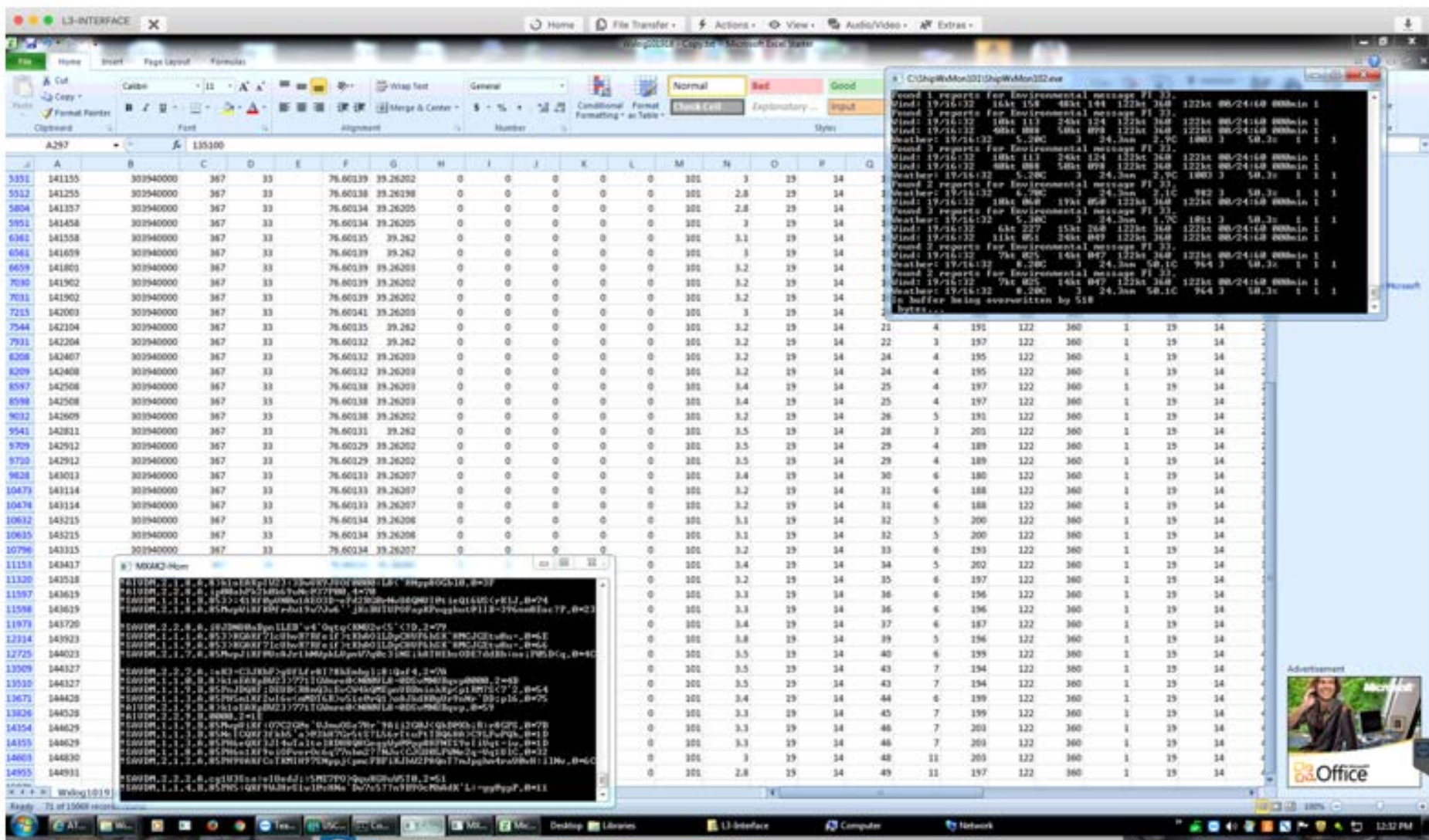
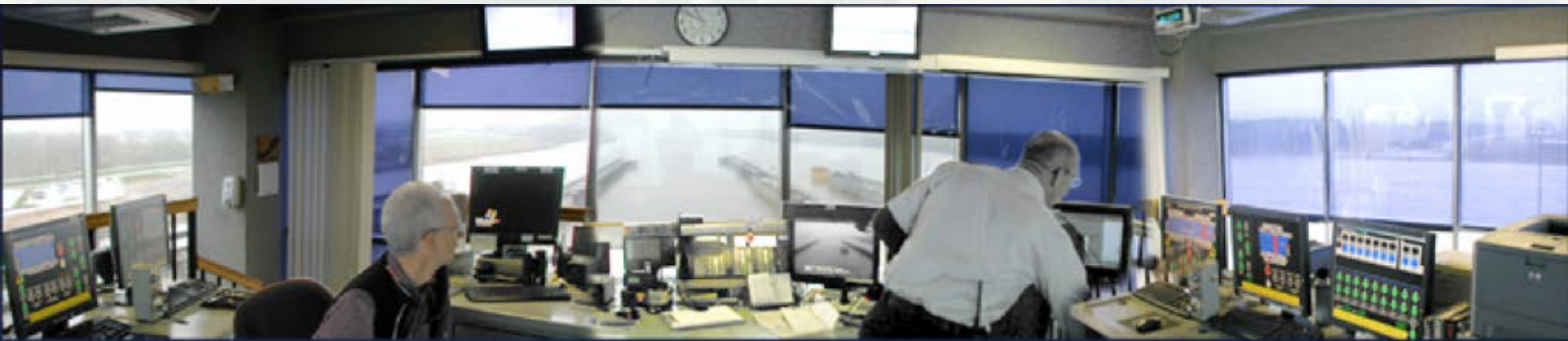


Figure 10. Shore side software (Ship Weather Monitor) is running in upper right window. The CSV file of logged data is shown in the background with reports from the CAPE WRATH (MMSI 303940000)

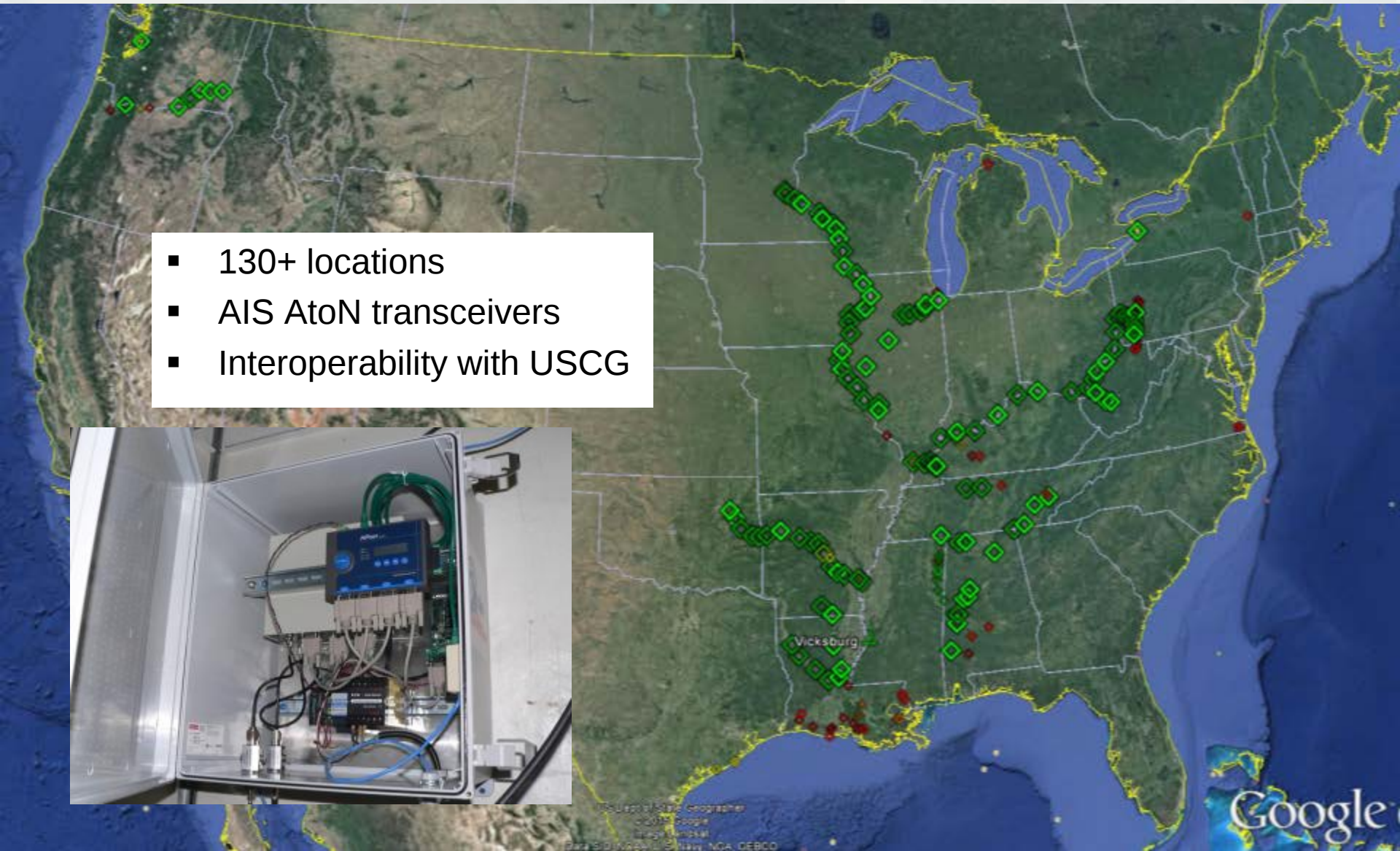
Lock Operations Management Application (LOMA)

- Purpose:
 - ▶ Provide end users information needed for decision support
- Goals:
 - ▶ Increase lock operator situational awareness
 - ▶ Provide vessel operators better information
 - ▶ Provide better information to Corps management
 - ▶ Exchange information with external users
- The Automatic Identification System (AIS) is the central LOMA technology



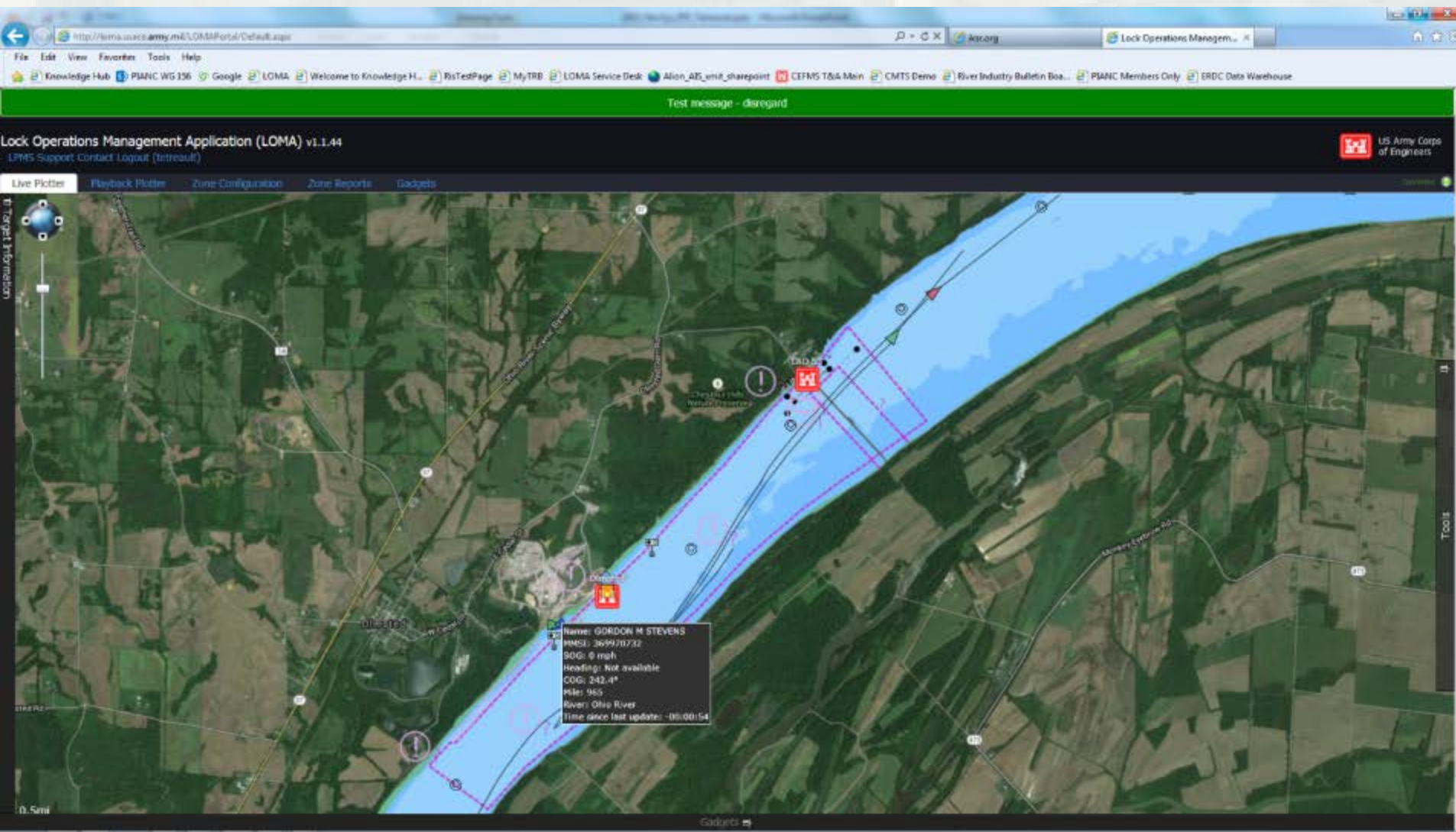
LOMA AIS equipment deployment

- 130+ locations
- AIS AtoN transceivers
- Interoperability with USCG



LOMA Capabilities

- Lock operator situational display
- AIS vessel information
- Zone Management
- Playback capability



LOMA - Zones

Lock Operations Management Application (LOMA) v1.1.44
LPMS Support Contact Logout (mfwink)

Live Plotter Playback Plotter Zone Configuration Zone Reports Gadgets

Target Information

Name	JOHN D NUGENT
MMSI	367057860
Callsign	WDC6557
Latitude	037°13'42"N
Longitude	088°57'32"W
SOG	8.2 kts
Heading	Not available
COG	268.6°
Nav Status	Under Way Engine
Operating Mode	Autonomous
Rate Of Turn	Not available
Destination	CAIRO
Length	134.48 ft
Beam	45.92 ft
Type of Ship	Vessel - Towing
Type of Cargo	N/A
CargoType	31
IMO Number	0
Draught	9.51 ft
Nav Sensor	GPS
DTE Status	Available
Nationality	United States of

Target Information



Gadgets

Targets in Olmsted

- MAVERICK
- LIPSCOMB
- KALLI C. EYMARD
- OLM0032

Zone Report

Lock Operations Management Application (LOMA) v1.1.44
LPMS Support Contact Logout (mfwink)

US Army Corps of Engineers

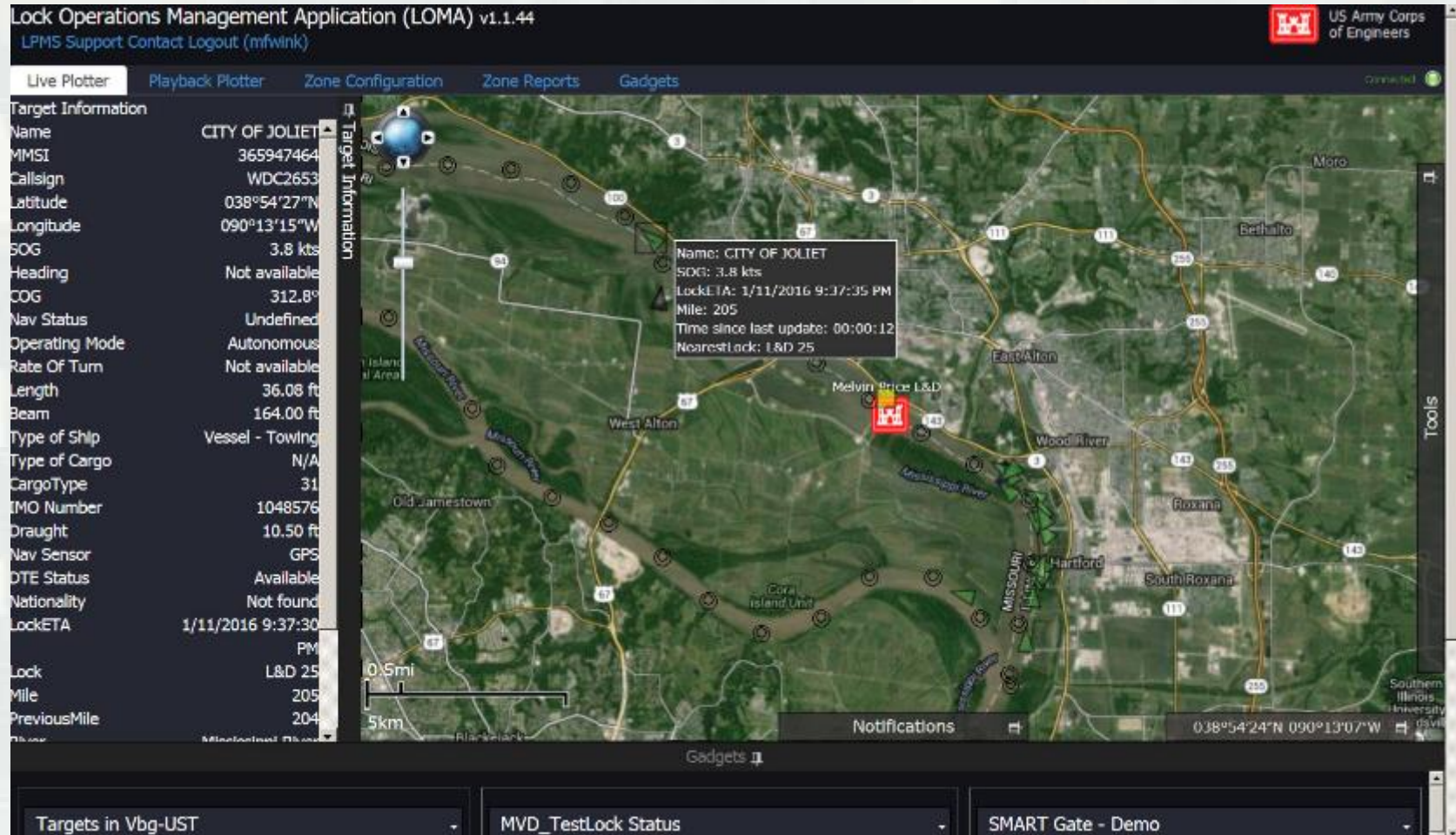
Live Plotter Playback Plotter Zone Configuration **Zone Reports** Gadgets

Show 10 entries Search:

Zone Name	MMSI	Vessel Name	Cargo Type	Ship Type	Entry Time	Exit Time	Time in Zone	SOG	COG	Callsign	Mile Mark	River	Nationality	Lat/Lon	Zone Owner
Vbg-UST	367434080	DON BOLING	N/A	Towing	1/11/2016 2:06:14 PM	1/11/2016 2:16:33 PM	0:10:19	11 kts	96.8	WDF2979	440	Mississippi River Mouth of Ohio River to Baton Rouge LA	United States of America	032°20' 46"N 090° 56'21"W	mfwink
Vbg_DST	366862710	WALTER BLESSEY JR	N/A	Towing and length of the tow exceeds 200 m or breadth exceeds 25 m	1/11/2016 1:45:40 PM	1/11/2016 1:52:31 PM	0:06:51	12.3 kts	232.6	WDA9212	433	Mississippi River Mouth of Ohio River to Baton Rouge LA	United States of America	032°17' 19"N 090° 56'09"W	mfwink
Vbg-UST	366862710	WALTER BLESSEY JR	N/A	Towing and length of the tow exceeds 200 m or breadth exceeds 25 m	1/11/2016 1:15:51 PM	1/11/2016 1:25:11 PM	0:09:20	12.6 kts	96	WDA9212	440	Mississippi River Mouth of Ohio River to Baton Rouge LA	United States of America	032°20' 43"N 090° 56'21"W	mfwink
Vbg_DST	366996740	LYDIA BRENT	N/A	Fishing	1/11/2016 1:13:51 PM	N/A	1:14:02	3.8 kts	45.9	WDC2716	433	Mississippi River Mouth of Ohio River to Baton Rouge LA	United States of America	032°17' 29"N 090° 56'16"W	mfwink
Vbg_DST	367402880	BIG VALLEY 499	All ships of this type	Passenger ships	1/11/2016 12:20:41 PM	1/11/2016 12:35:31 PM	0:14:50	12.2 kts	35.7	WC27096	435	Mississippi River Mouth of Ohio River to Baton Rouge LA	United States of America	032°18' 28"N 090° 54'59"W	mfwink



Lock ETA



Additional LOMA capabilities

Filter Selection

MMSI:

Vessel Size:

From:

To:

SOG:

From:

To:

Target Type:

Class A
Class B
Base Station
AtoN

Vessel Type:

Pilot
Search and rescue Vessels
...
WIG - No Sub Type
WIG - Hazard Category X
...
Vessel - Fishing

Nav Status

Underway Using Engine
At Anchor
Not Under Command
...

Playback query

Target Type:

Class A
Class B
AToN
Base Station
Met/Hydro

Vessel Type:

Reserved for future use - No Sub Type (1)
WIG - No Sub Type (2)
Vessel - No Sub Type (3)
HSC - No Sub Type (4)
Special Craft - No Sub Type (5)

Navigation Status:

Under way using engine (0)
At anchor (1)
Not under command (2)
Restricted manoeuvrability (3)
Constrained by her draught (4)

Vessel Length:

From: Disabled

To: Disabled

Vessel Speed:

From: Disabled

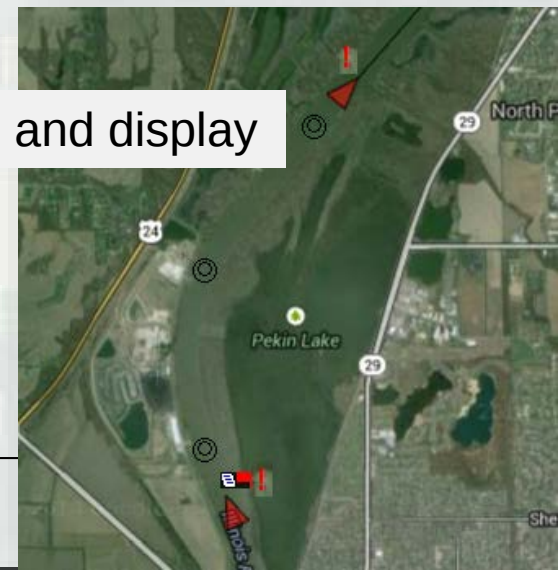
To: Disabled

Live target display filter

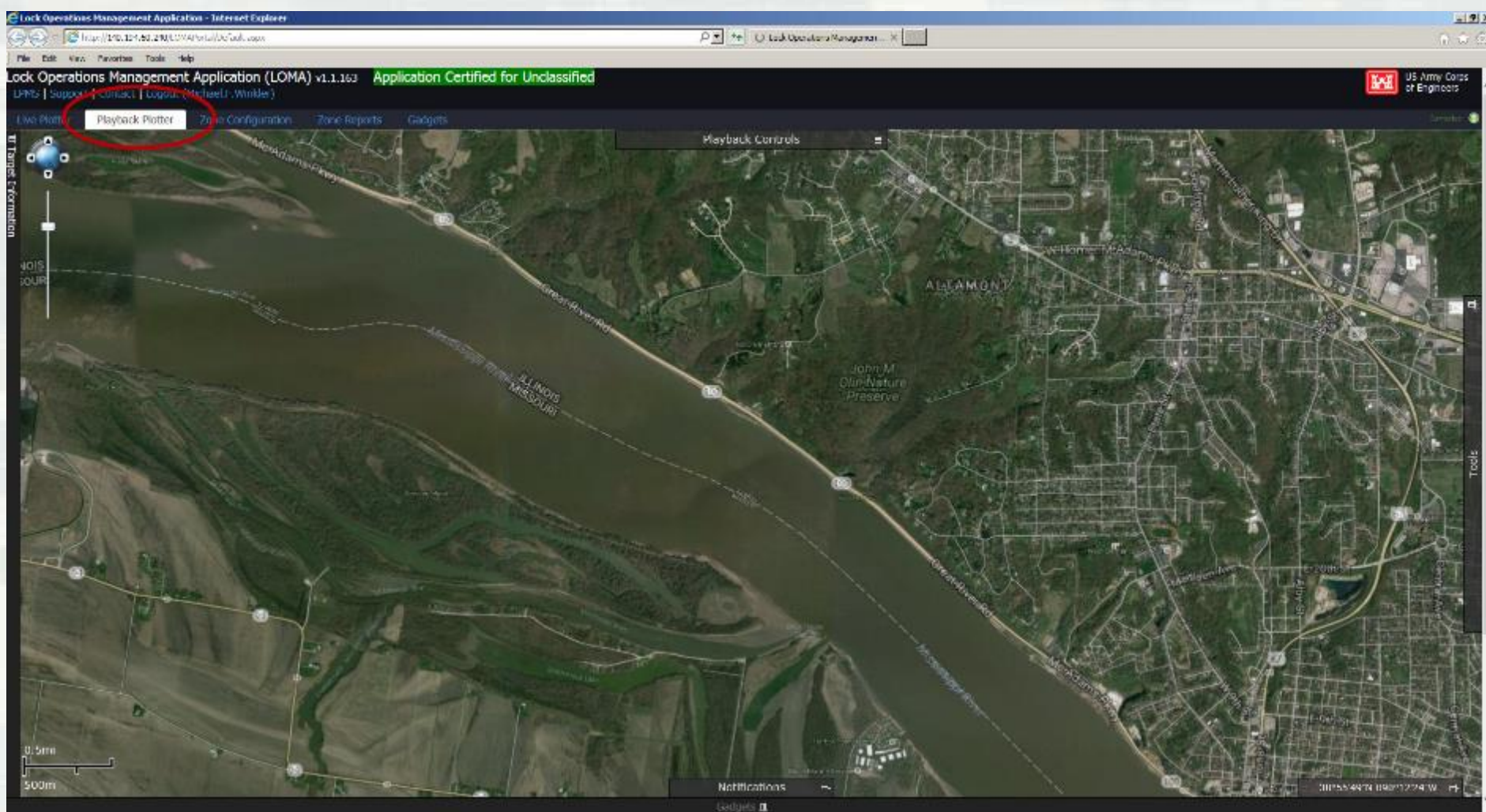


Vessels of interest selection and display

Vessels of Interest		Minimize Close Delete
Vessels	River/Mile	
• TY DOLESE	Yazoo River MS Mile 4	
• VIRGINIA RENEE	Ohio River Mile 9	
• SYNERGY	Cumberland River Mouth to Nashville TN Mile 21	
Update		

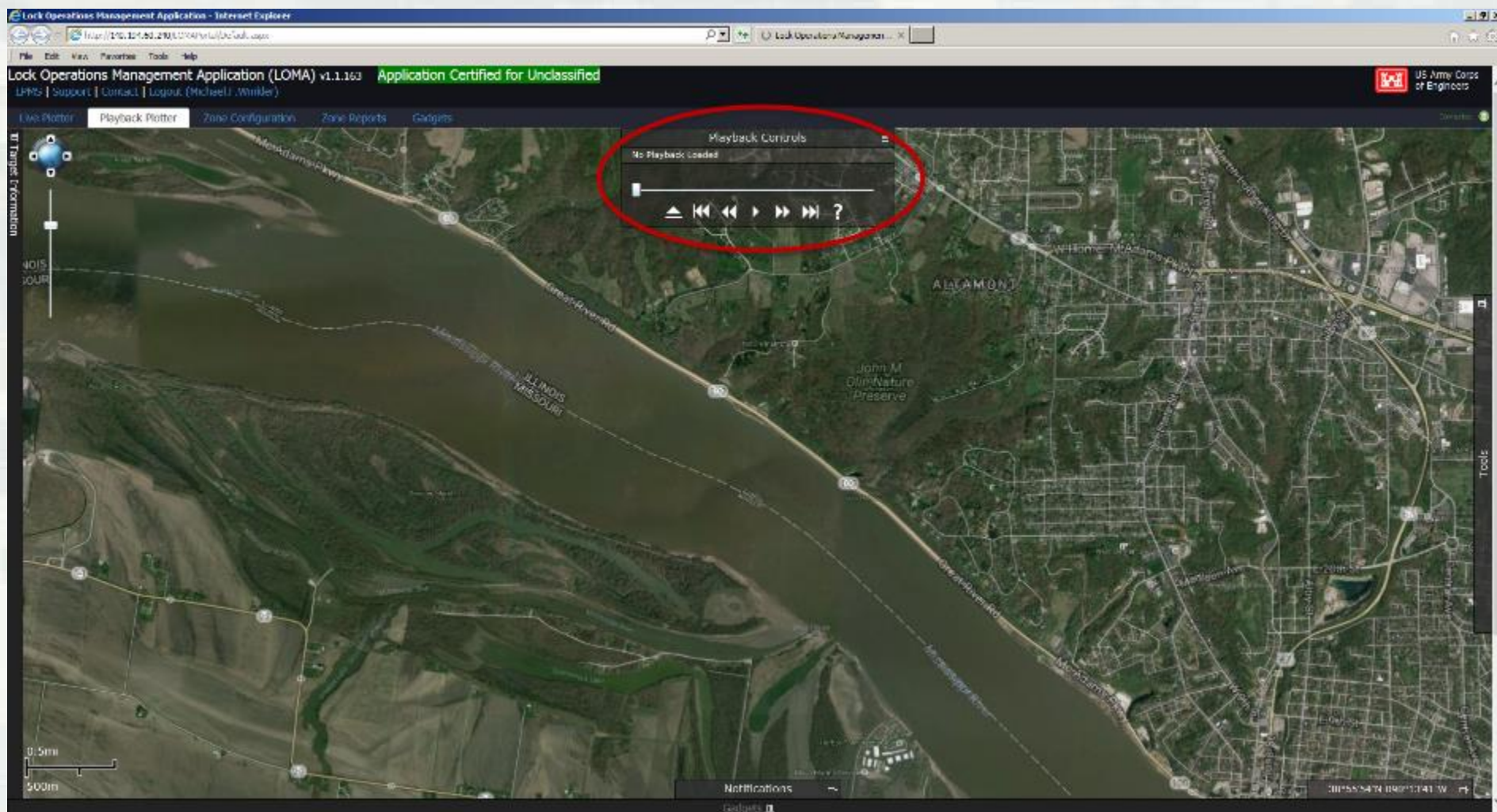


LOMA Playback Plotter

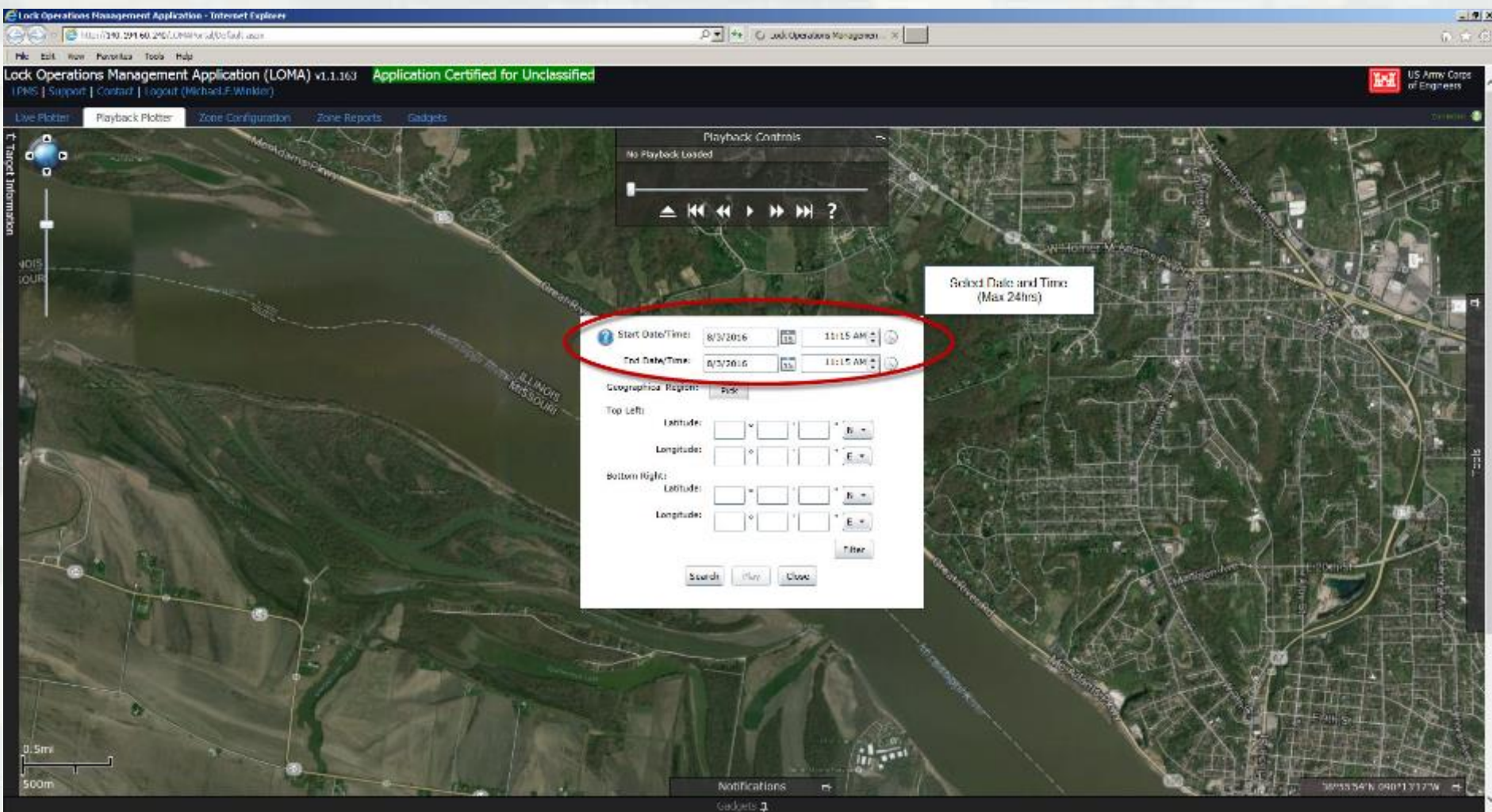


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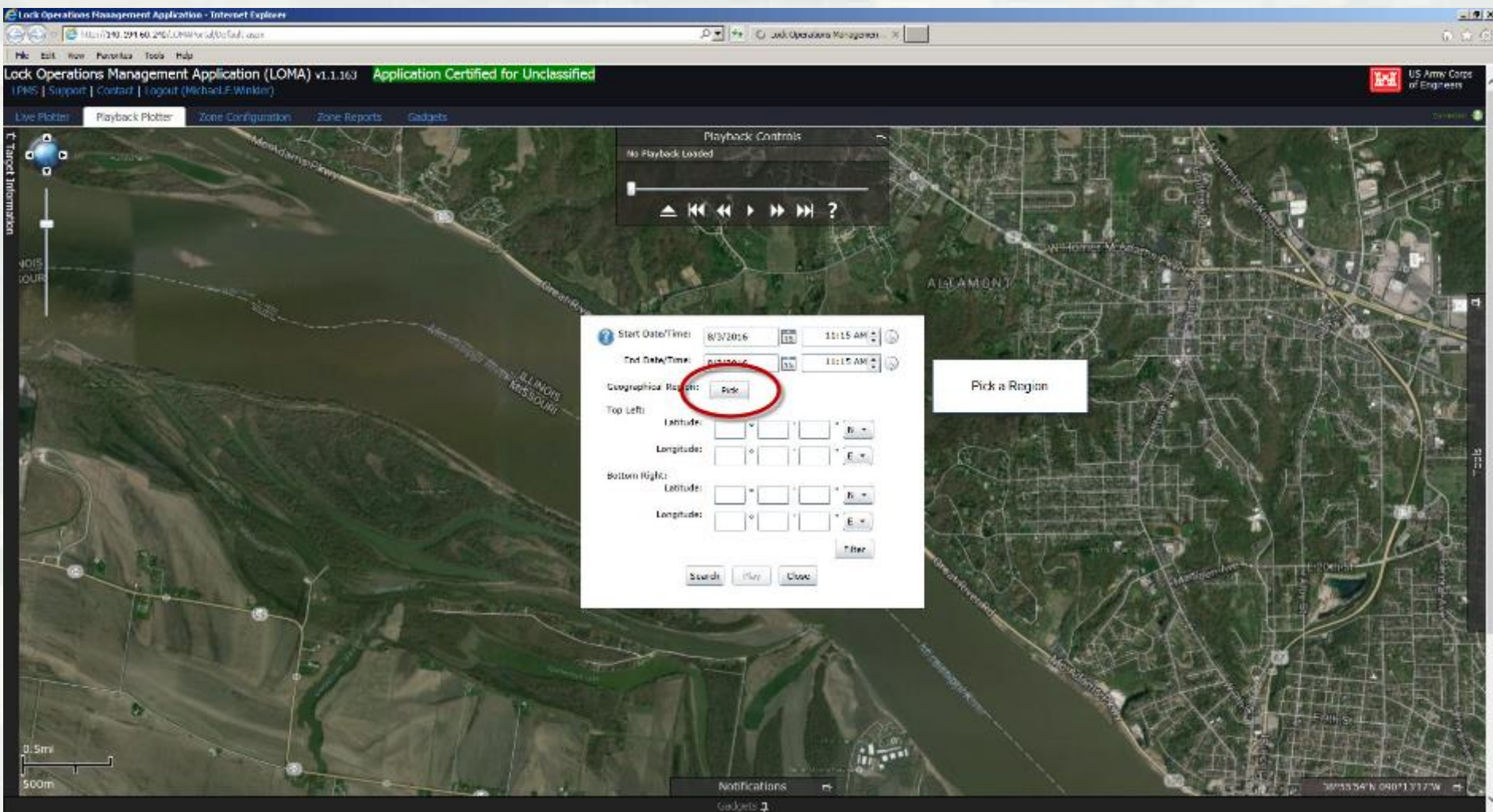
LOMA Playback Controls



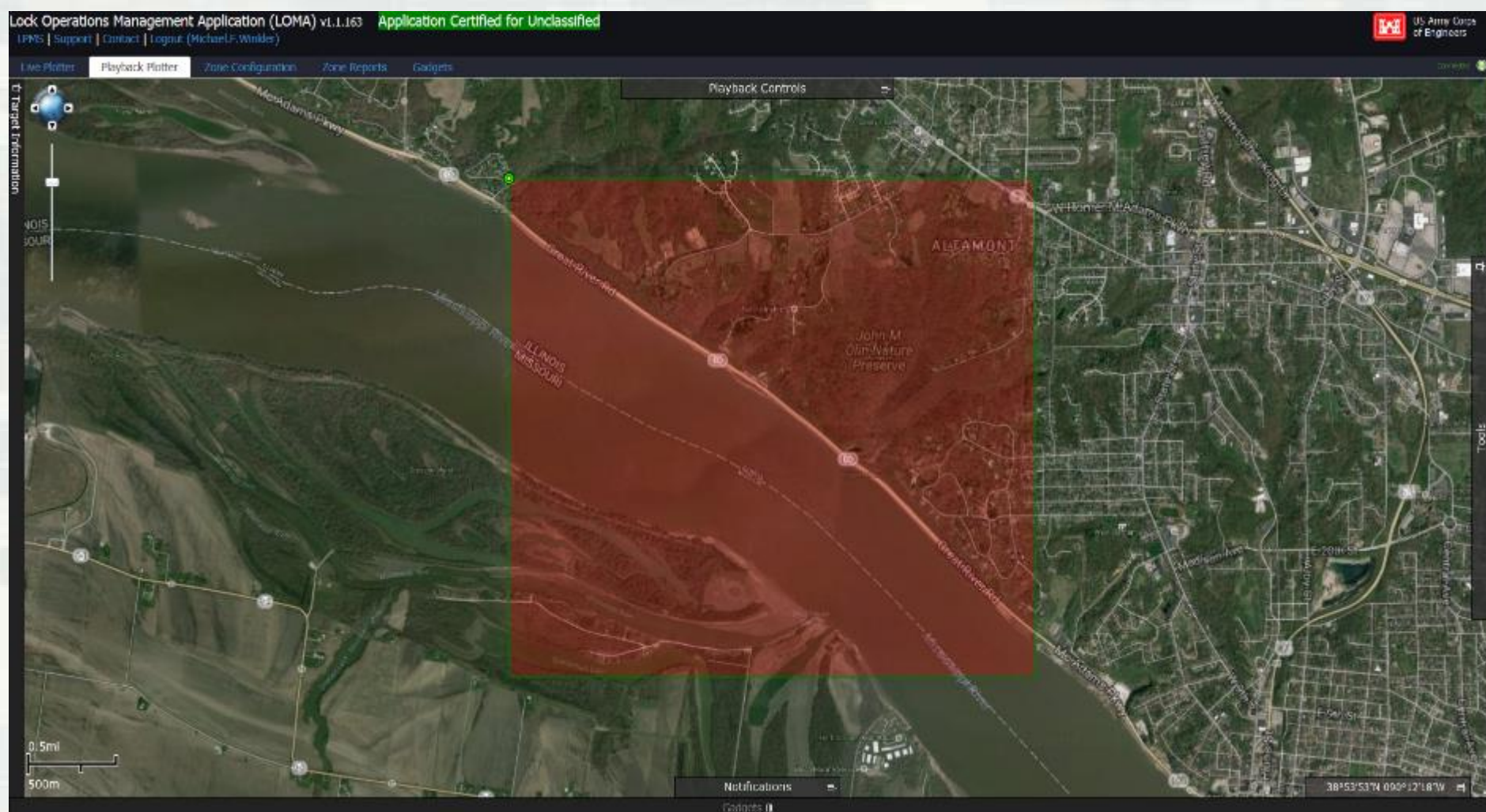
LOMA Playback Query



LOMA Playback Query



LOMA Playback Query



Grounding – Upper Mississippi River



Accident - Lock 18





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