USACE INLAND ELECTRONIC NAVIGATIONAL CHARTS (IENC) & OTHER CHARTING PRODUCTS

NOAA Open House on Nautical Cartography

07 July 2017

Denise LaDue

US Army Geospatial Center

US Army Corps of Engineers®

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BACKGROUND
A TRAGIC BEGINNING

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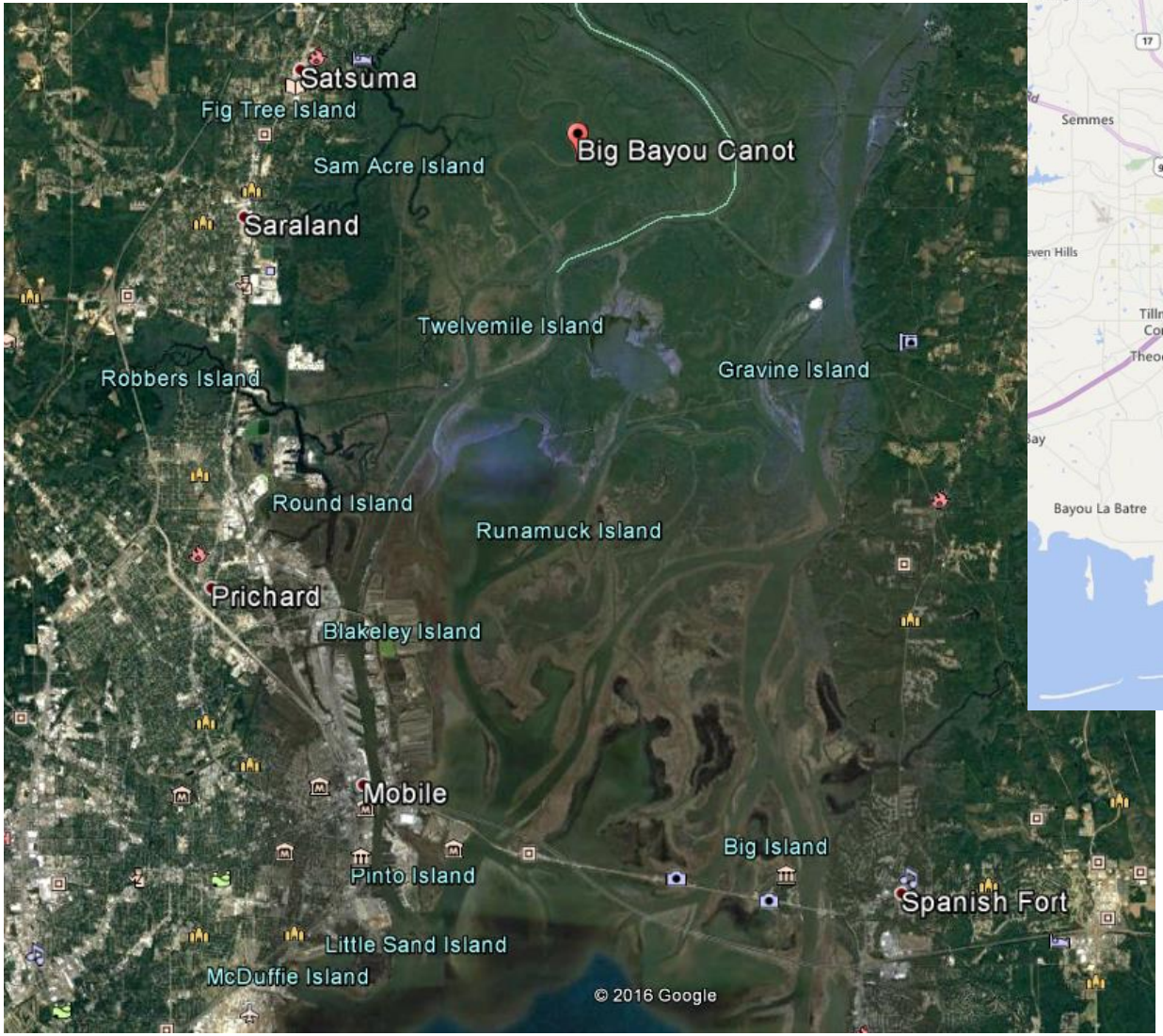
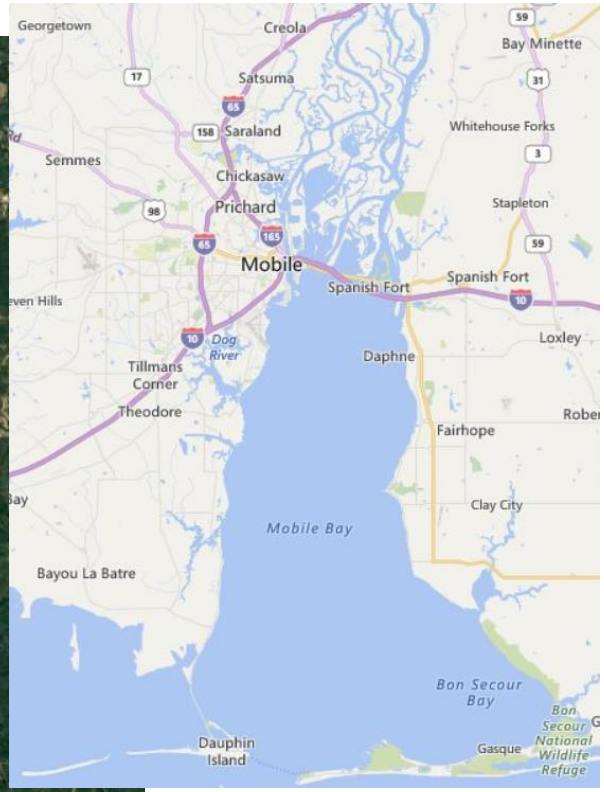
BIG BAYOU CANOT





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ELECTRONIC CHART DATA FOR SAFE AND EFFICIENT NAVIGATION

September 22, 1993

- A towboat pushing six barges, lost in the fog, struck the Big Bayou Canot bridge near Mobile, AL causing the track to misalign by approximately 3 feet.
- Eight minutes later, AMTRAK *Sunset Limited* derailed on the railroad bridge and plunged into the waterway, killing 47 and injuring 103.

An electronic chart system on the towboat may have prevented the accident.

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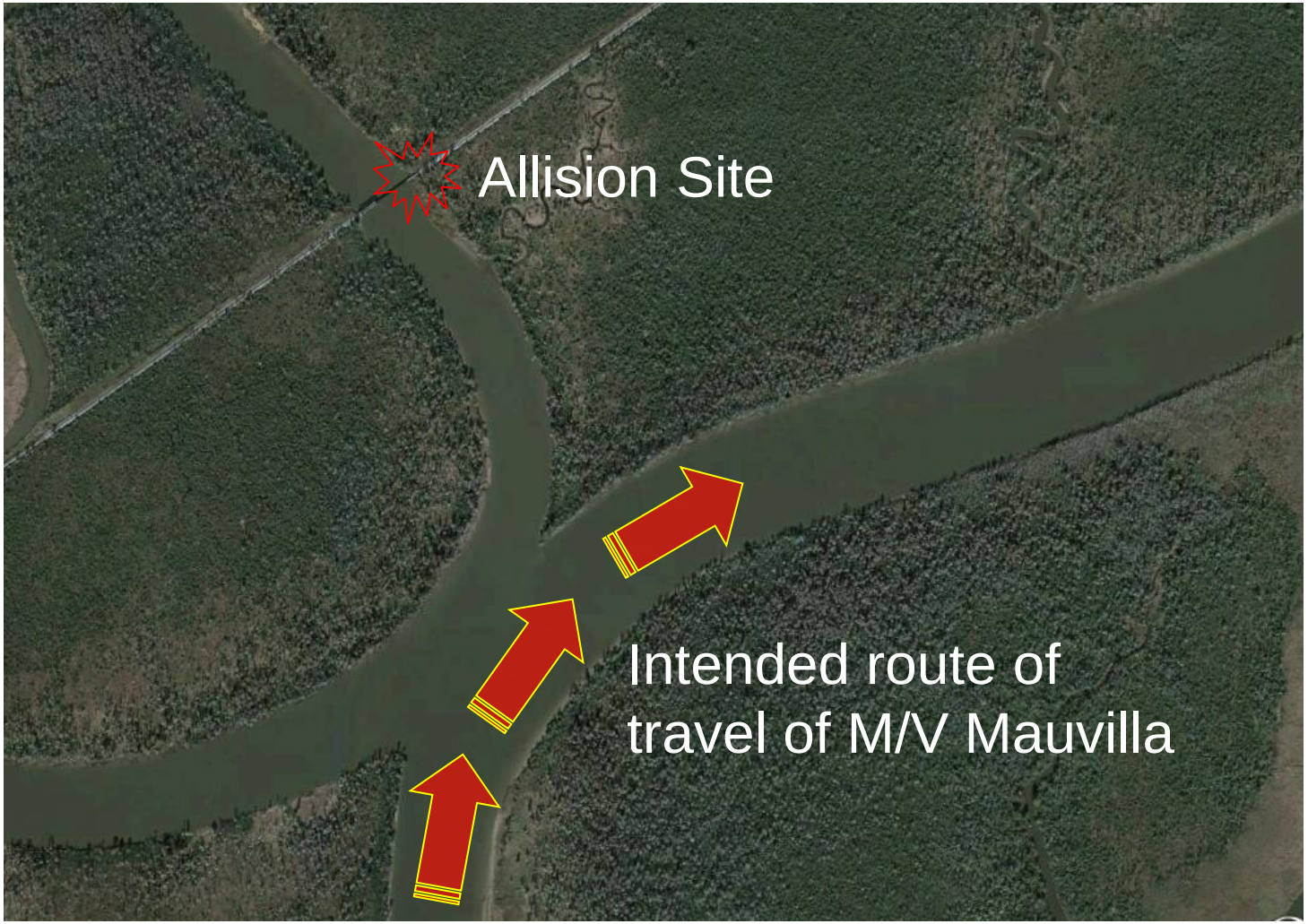
BIG BAYOU CANOT



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CHRONOLOGY OF USACE IENC DEVELOPMENT

S-57 Standard, Edition 3.1 (For Maritime ENCs)

- 2001 – US Congress tasked USACE to produce IENCs
- 2001 – present – USACE produced & maintains 107 IENC cells, covering 21 waterways

IENC Standard, Edition 2.1-2.4 (For Inland ENCs)

- 2010 – Decision made to produce new waterways to Inland ENC standards (3 rivers produced to IENC 2.1)
- 2011 - Conversion of charts from S-57 & IENC 2.1 to Inland ENC 2.2 started
- 2012 – Migration of all charts to IENC 2.2 Completed
- 2014 – Conversion of IENC cells to IENC 2.3 standard
- *2017/2018 – Conversion of IENC cells to IENC 2.4 standard*

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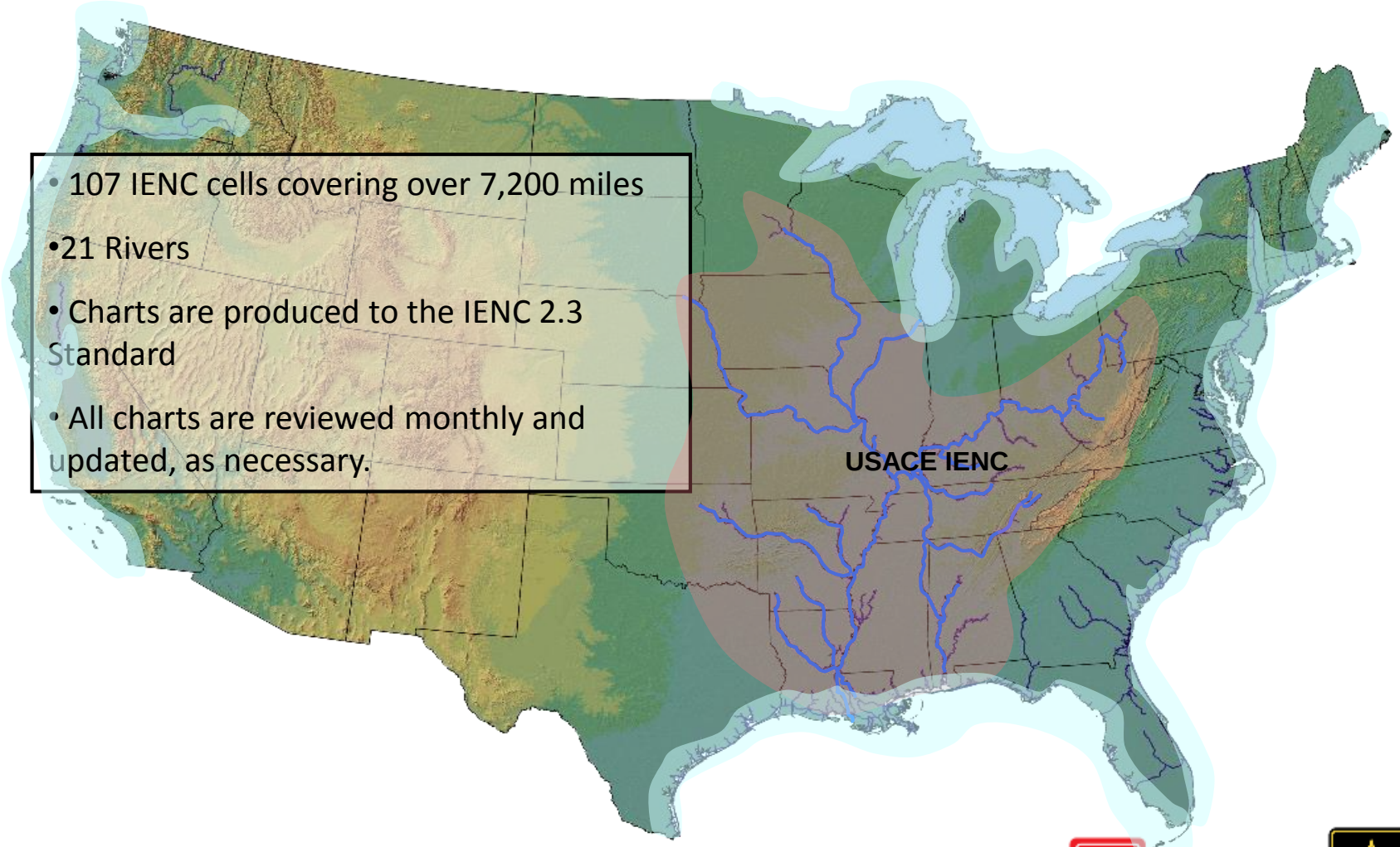
INLAND ENC COVERAGE IN USA



- 107 IENC cells covering over 7,200 miles
- 21 Rivers
- Charts are produced to the IENC 2.3 Standard
- All charts are reviewed monthly and updated, as necessary.

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INTERNATIONAL IENC STANDARDS AND DEVELOPMENT

- International Working Group
- Organized to develop and to maintain a standard for IENCs suitable for inland navigation
- Standard based on the existing standards of International Hydrographic Organization for ‘maritime’ ENCs (S-57)
- Standard will be suitable for all known data requirements for safe and efficient navigation in European, North American, Russian Federation, South American and Asian inland waterways
- It is further intended that IENC standards meet the basic needs for Inland ENC applications, worldwide

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WHY AN “INLAND” STANDARD?

Examples of unique features found in waterways which are not found in maritime waters

- Casino / Gaming Boats

- Fleeting Areas

- Ice Breakers
- Lock Guide Walls
- Exceptional Navigation Structures (Lift bridges/viaducts)

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PRODUCTION PROCESS

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15 USACE Districts & US Army Geospatial Center

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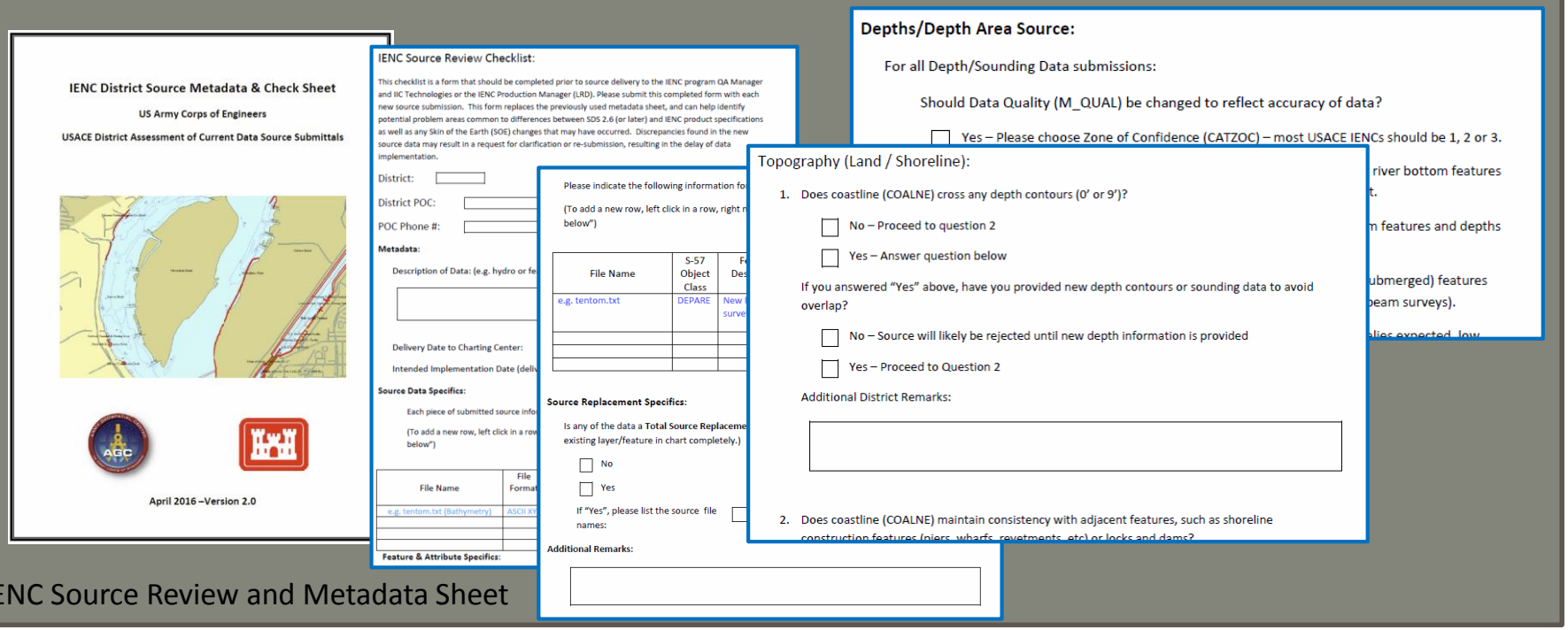
“FORMAL” SOURCE SUBMITTAL



IENC Source Review and Metadata Sheet

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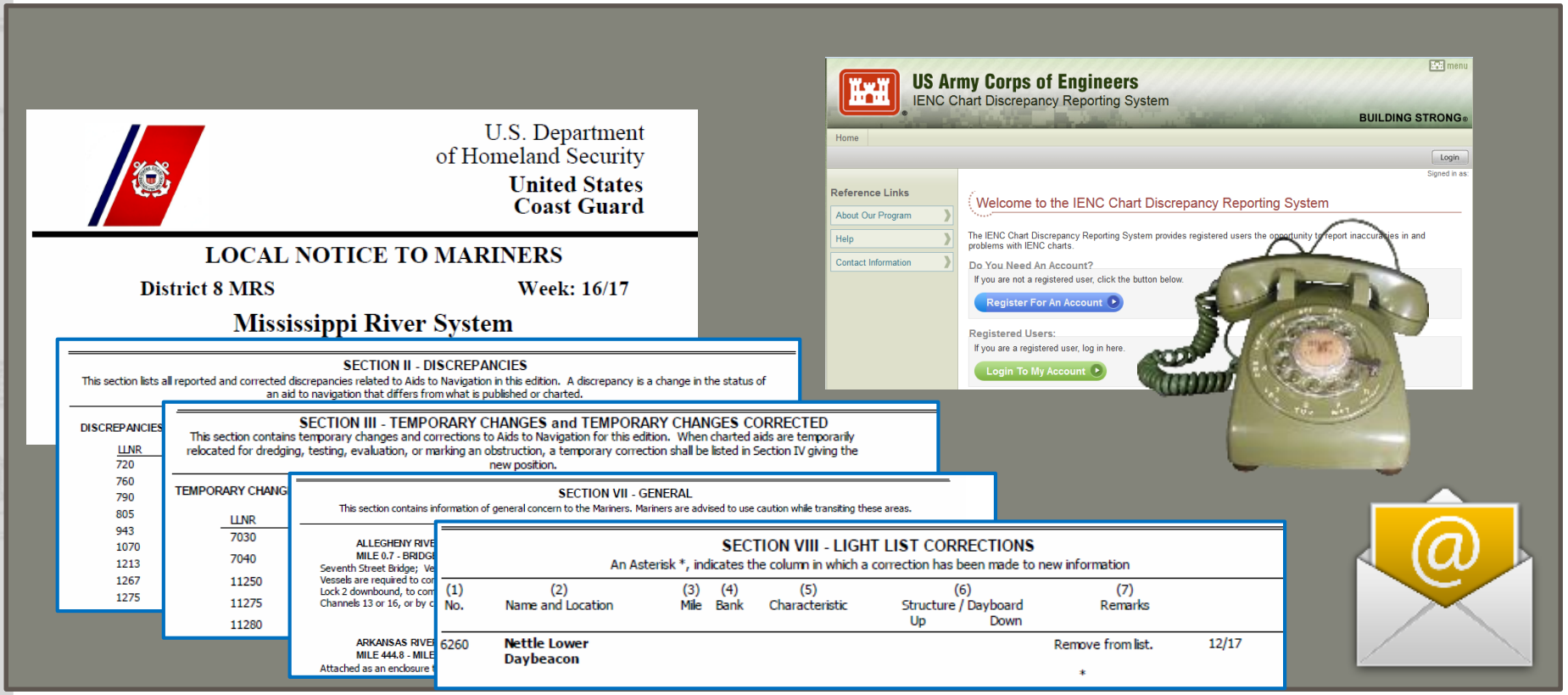
OTHER SOURCES



USCG Navigation Center: https://www.navcen.uscg.gov/
IENC Chart Discrepancy Reporting System: https://ienc-report.usace.army.mil/

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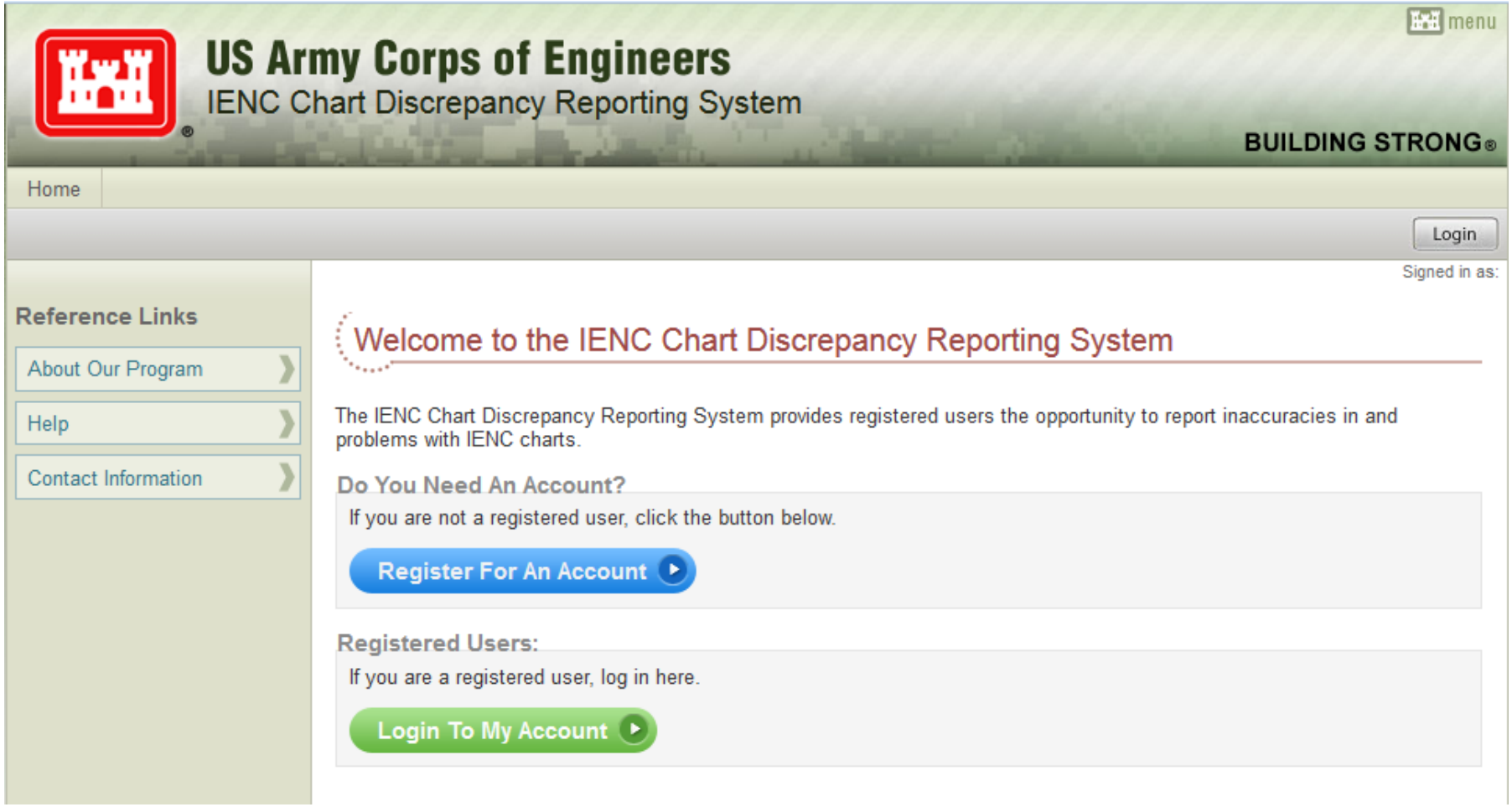
CHART DISCREPANCY REPORTING SYSTEM

https://ienc-report.usace.army.mil/



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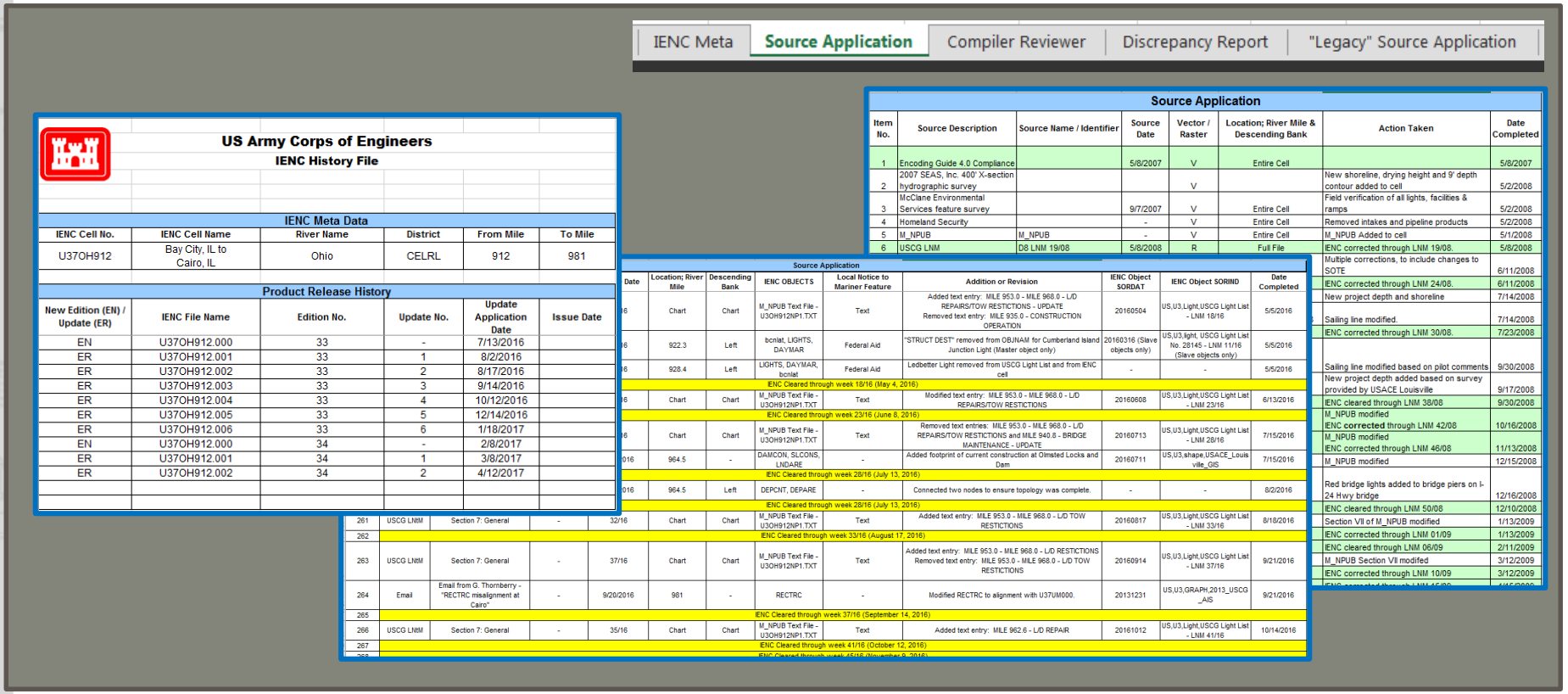
HISTORY FILES



IENC Meta | Source Application | Compiler Reviewer | Discrepancy Report | "Legacy" Source Application

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IENC History File

IENC Meta Data

IENC Cell No.	IENC Cell Name	River Name	District	From Mile	To Mile
U37OH912	Bay City, IL to Cairo, IL	Ohio	CELRL	912	981

Product Release History

New Edition (EN) / Update (ER)	IENC File Name	Edition No.	Update No.	Update Application Date	Issue Date
EN	U37OH912.000	33	-	7/13/2016	
ER	U37OH912.001	33	1	8/2/2016	
ER	U37OH912.002	33	2	8/17/2016	
ER	U37OH912.003	33	3	9/14/2016	
ER	U37OH912.004	33	4	10/12/2016	
ER	U37OH912.005	33	5	12/14/2016	
ER	U37OH912.006	33	6	1/18/2017	
EN	U37OH912.000	34	-	2/8/2017	
ER	U37OH912.001	34	1	3/8/2017	
ER	U37OH912.002	34	2	4/12/2017	

Source Application

Item No.	Source Description	Source Name / Identifier	Source Date	Vector / Raster	Location; River Mile & Descending Bank	Action Taken	Date Completed
1	Encoding Guide 4.0 Compliance		5/8/2007	V	Entire Cell		5/8/2007
2	2007 SEAS, Inc. 400' X-section hydrographic survey			V		New shoreline, drying height and 9' depth contour added to cell	5/2/2008
3	McClane Environmental Services feature survey		9/7/2007	V	Entire Cell	Field verification of all lights, facilities & ramps	5/2/2008
4	Homeland Security		-	V	Entire Cell	Removed intakes and pipeline products	5/2/2008
5	M_NPUB	M_NPUB	-	V	Entire Cell	M_NPUB Added to cell	5/1/2008
6	USCG LNM	D8 LNM 19/08	5/8/2008	R	Full File	IENC corrected through LNM 19/08.	5/8/2008
						Multiple corrections, to include changes to SOTE	6/11/2008
						IENC corrected through LNM 24/08.	6/11/2008
						New project depth and shoreline	7/14/2008
						Sailing line modified.	7/14/2008
						IENC corrected through LNM 30/08.	7/23/2008
						Sailing line modified based on pilot comments	9/30/2008
						New project depth added based on survey provided by USACE Louisville	9/17/2008
						IENC cleared through LNM 38/08	9/30/2008
						M_NPUB modified	
						IENC corrected through LNM 42/08	10/16/2008
						M_NPUB modified	
						IENC corrected through LNM 46/08	11/13/2008
						M_NPUB modified	12/15/2008
						Red bridge lights added to bridge piers on I-24 Hwy bridge	12/16/2008
						IENC cleared through LNM 50/08	12/10/2008
						Section VII of M_NPUB modified	1/13/2009
						IENC corrected through LNM 01/09	1/13/2009
						IENC cleared through LNM 06/09	2/11/2009
						M_NPUB Section VII modifed	3/12/2009
						IENC corrected through LNM 10/09	3/12/2009

Source Application

	Date	Location; River Mile	Descending Bank	IENC OBJECTS	Local Notice to Mariner Feature	Addition or Revision	IENC Object SORDAT	IENC Object SORIND	Date Completed
	16	Chart	Chart	M_NPUB Text File - U3OH912NP1.TXT	Text	Added text entry: MILE 953.0 - MILE 968.0 - L/D REPAIRS/TOW RESTICTIONS - UPDATE Removed text entry: MILE 935.0 - CONSTRUCTION OPERATION	20160504	US,U3,Light,USCG Light List - LNM 18/16	5/5/2016
	16	922.3	Left	bcnlat, LIGHTS, DAYMAR	Federal Aid	"STRUCT DEST" removed from OBJNAM for Cumberland Island Junction Light (Master object only)	20160316 (Slave objects only)	US,U3,light, USCG Light List No. 28145 - LNM 11/16 (Slave objects only)	5/5/2016
	16	928.4	Left	LIGHTS, DAYMAR, bcnlat	Federal Aid	Ledbetter Light removed from USCG Light List and from IENC cell	-	-	5/5/2016
		IENC Cleared through week 18/16 (May 4, 2016)							
	16	Chart	Chart	M_NPUB Text File - U3OH912NP1.TXT	Text	Modified text entry: MILE 953.0 - MILE 968.0 - L/D REPAIRS/TOW RESTICTIONS	20160608	US,U3,Light,USCG Light List - LNM 23/16	6/13/2016
		IENC Cleared through week 23/16 (June 8, 2016)							
	16	Chart	Chart	M_NPUB Text File - U3OH912NP1.TXT	Text	Removed text entries: MILE 953.0 - MILE 968.0 - L/D REPAIRS/TOW RESTICTIONS and MILE 940.8 - BRIDGE MAINTENANCE - UPDATE	20160713	US,U3,Light,USCG Light List - LNM 28/16	7/15/2016
	016	964.5	-	DAMCON, SLCONS, LNDARE	-	Added footprint of current construction at Olmsted Locks and Dam	20160711	US,U3,shape,USACE_Louisville_GIS	7/15/2016
		IENC Cleared through week 28/16 (July 13, 2016)							
	016	964.5	Left	DEPCNT, DEPARE	-	Connected two nodes to ensure topology was complete.	-	-	8/2/2016
		IENC Cleared through week 28/16 (July 13, 2016)							
261	USCG LNM	Section 7: General	-	32/16	Chart	Chart	M_NPUB Text File - U3OH912NP1.TXT	Text	Added text entry: MILE 953.0 - MILE 968.0 - L/D TOW RESTICTIONS	20160817	US,U3,Light,USCG Light List - LNM 33/16	8/18/2016
262	IENC Cleared through week 33/16 (August 17, 2016)											
263	USCG LNM	Section 7: General	-	37/16	Chart	Chart	M_NPUB Text File - U3OH912NP1.TXT	Text	Added text entry: MILE 953.0 - MILE 968.0 - L/D RESTICTIONS Removed text entry: MILE 953.0 - MILE 968.0 - L/D TOW RESTICTIONS	20160914	US,U3,Light,USCG Light List - LNM 37/16	9/21/2016
264	Email	Email from G. Thornberry - "RECTRC misalignment at Cairo"	-	9/20/2016	981	-	RECTRC	-	Modified RECTRC to alignment with U37UM000.	20131231	US,U3,GRAPH,2013_USCG_AIS	9/21/2016
265	IENC Cleared through week 37/16 (September 14, 2016)											
266	USCG LNM	Section 7: General	-	35/16	Chart	Chart	M_NPUB Text File - U3OH912NP1.TXT	Text	Added text entry: MILE 962.6 - L/D REPAIR	20161012	US,U3,Light,USCG Light List - LNM 41/16	10/14/2016
267	IENC Cleared through week 41/16 (October 12, 2016)											

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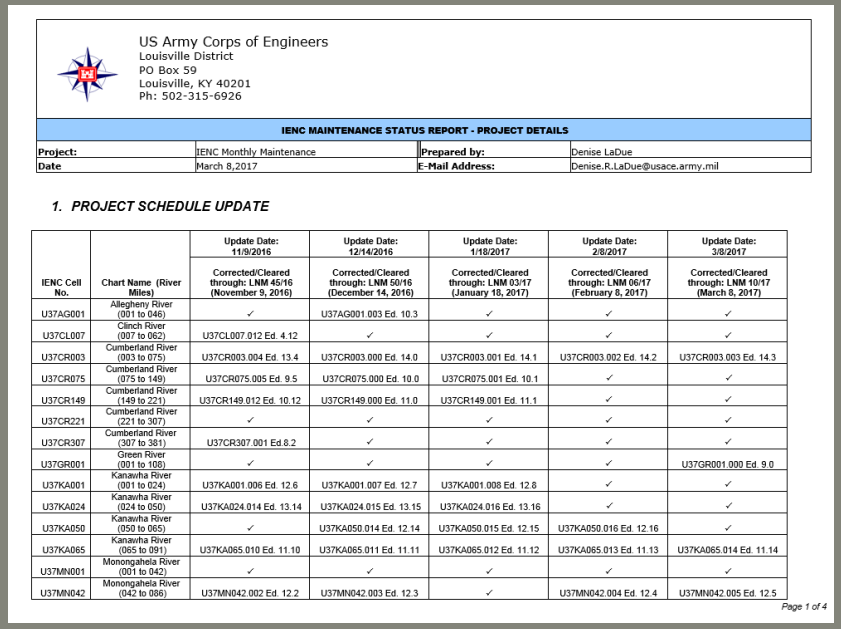
STATUS REPORT



US Army Corps of Engineers
Louisville District
PO Box 59
Louisville, KY 40201
Ph: 502-315-6926

IENC MAINTENANCE STATUS REPORT - PROJECT DETAILS

Project:	IENC Monthly Maintenance	**Prepared by:**	Denise LaDue
Date	March 8,2017	**E-Mail Address:**	Denise.R.LaDue@usace.army.mil

1. PROJECT SCHEDULE UPDATE

IENC Cell No.	Chart Name (River Miles)	Update Date: 11/9/2016 Corrected/Cleared through: LNM 45/16 (November 9, 2016)	Update Date: 12/14/2016 Corrected/Cleared through: LNM 50/16 (December 14, 2016)	Update Date: 1/18/2017 Corrected/Cleared through: LNM 03/17 (January 18, 2017)	Update Date: 2/8/2017 Corrected/Cleared through: LNM 06/17 (February 8, 2017)	Update Date: 3/8/2017 Corrected/Cleared through: LNM 10/17 (March 8, 2017)
U37AG001	Allegheny River (001 to 046)	✓	U37AG001.003 Ed. 10.3	✓	✓	✓
U37CL007	Clinch River (007 to 062)	U37CL007.012 Ed. 4.12	✓	✓	✓	✓
U37CR003	Cumberland River (003 to 075)	U37CR003.004 Ed. 13.4	U37CR003.000 Ed. 14.0	U37CR003.001 Ed. 14.1	U37CR003.002 Ed. 14.2	U37CR003.003 Ed. 14.3
U37CR075	Cumberland River (075 to 149)	U37CR075.005 Ed. 9.5	U37CR075.000 Ed. 10.0	U37CR075.001 Ed. 10.1	✓	✓
U37CR149	Cumberland River (149 to 221)	U37CR149.012 Ed. 10.12	U37CR149.000 Ed. 11.0	U37CR149.001 Ed. 11.1	✓	✓
U37CR221	Cumberland River (221 to 307)	✓	✓	✓	✓	✓
U37CR307	Cumberland River (307 to 381)	U37CR307.001 Ed.8.2	✓	✓	✓	✓
U37GR001	Green River (001 to 106)	✓	✓	✓	✓	U37GR001.000 Ed. 9.0
U37KA001	Kanawha River (001 to 024)	U37KA001.006 Ed. 12.6	U37KA001.007 Ed. 12.7	U37KA001.008 Ed. 12.8	✓	✓
U37KA024	Kanawha River (024 to 050)	U37KA024.014 Ed. 13.14	U37KA024.015 Ed. 13.15	U37KA024.016 Ed. 13.16	✓	✓
U37KA050	Kanawha River (050 to 065)	✓	U37KA050.014 Ed. 12.14	U37KA050.015 Ed. 12.15	U37KA050.016 Ed. 12.16	✓
U37KA065	Kanawha River (065 to 091)	U37KA065.010 Ed. 11.10	U37KA065.011 Ed. 11.11	U37KA065.012 Ed. 11.12	U37KA065.013 Ed. 11.13	U37KA065.014 Ed. 11.14
U37MN001	Monongahela River (001 to 042)	✓	✓	✓	✓	✓
U37MN042	Monongahela River (042 to 086)	U37MN042.002 Ed. 12.2	U37MN042.003 Ed. 12.3	✓	U37MN042.004 Ed. 12.4	U37MN042.005 Ed. 12.5

Page 1 of 4

- Monthly change log
  - Current edition
  - Which cells changed
  - Descriptive summary of changes
- Summary of all History files in a small package

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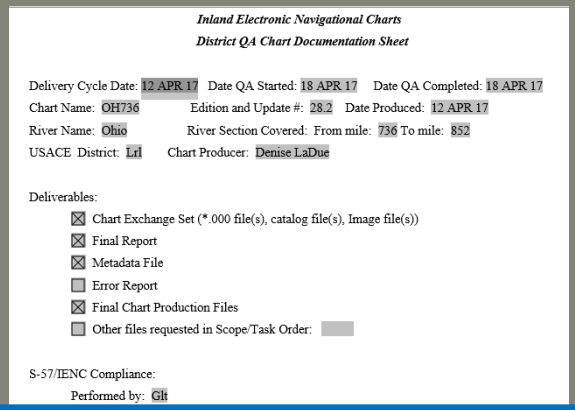
QA



Inland Electronic Navigational Charts
District QA Chart Documentation Sheet

Delivery Cycle Date: 12 APR 17 Date QA Started: 18 APR 17 Date QA Completed: 18 APR 17
Chart Name: OH736 Edition and Update #: 28.2 Date Produced: 12 APR 17
River Name: Ohio River Section Covered: From mile: 736 To mile: 852
USACE District: Lrl Chart Producer: Denise LaDue

Deliverables:

- ☒ Chart Exchange Set (*.000 file(s), catalog file(s), Image file(s))
- ☒ Final Report
- ☒ Metadata File
- ☐ Error Report
- ☒ Final Chart Production Files
- ☐ Other files requested in Scope/Task Order:

S-57/IENC Compliance:
Performed by: Glt

Compiler / Reviewer Information

Source Application Item No.s	Completed By	Date Complete	Reviewed By	Review Complete; Ready for USACE Review	USACE Reviewer	Approved Date	Notes
166-168	Denise LaDue CELRL-OP-E	12/16/2013	Todd Davis CELRL-OP-TM				Sharps Bar light removed in Dec. delivery.Removed 1 MORFAC at Mile 961.0 and 1 at Mile 961.4 (Verified)
169-170	Denise LaDue CELRL-OP-E	1/14/2014	Todd Davis CELRL-OP-TM				Metropolis Light has been removed
171-172	Denise LaDue CELRL-OP-E	2/13/2014	Todd Davis CELRL-OP-TM				Added text entry: MILE 962.5-MILE 966.0 - USACE VESSEL RESTRICTION Removed text entry: MILE 963.0 - MILE 966.0 - NO PASSING ZONE/CHANGE IN L/D OPERATING HOURS VERIFIED BY LOOKING AT TXT FILE
173-175	Denise LaDue CELRL-OP-E	3/19/2014	Todd Davis CELRL-OP-TM				Owens Island Light changed from 934.6 to 934.2
177-179	Denise LaDue CELRL-OP-E	5/8/2014	Todd Davis CELRL-OP-TM				Verified - SCAMIN changed to 60,000 for LNDRGN (P) & (A Verified - Modified text entry: MILE 962.5-MILE 966.0 - USACE V RESTRICTION
180-184	Denise LaDue CELRL-OP-E	6/17/2014	Todd Davis CELRL-OP-TM				Verified - Added CATSEA, Added CATCBL, Bird Nesting Platforr Added text entry
185-186	Denise LaDue CELRL-OP-E	7/10/2014	Todd Davis CELRL-OP-TM				Verified-Added text entries: MILE 925.0 - DREDGE OPERATION a 963.0-MILE966.0 - USACE VESSEL RESTRICTION. Removed text MILE 962.5-MILE 966.0 - USACE VESSEL RESTRICTION
187-189	Gerald Thornberry CELRL-OP-E	8/28/2014	Todd Davis CELRL-OP-TM				Verified -"DISCONTINUED" added to OBJNAM for Grand Chain La Daybeacon / Removed text entries: MILE 925.0 - DREDGE OPERA
	Denise LaDue						

Discrepancy Reports

Discrepancy Report No.	Reference Source Application	Discrepancy Description	Date Reported	Date Resolved
248		small DEPARE and DEPCNT from 20140820 remains inside new DEPARE and DEPCNT in Lock 53 pool at mile 956.6 (Sharps Bar)	5/9/2016	
249		small DEPARE and DEPCNT from 20141209 remains inside new DEPARE and DEPCNT in Lock 52 pool, backchannel of Cumberland Island at Cumberland River mile 1.0	5/9/2016	

- Contains QA comments
  - "PASSED" if all is okay
  - Otherwise, a statement describing the problem with the edit to help the Producer resolve the issue

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IENC CLOUD

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IENC CLOUD BACKGROUND

- Federal Geographic Data Committee (FGDC) issued an RFP in Dec, 2011 to sponsor pilot project with 10 Federal agencies to distribute their public data free for one year on Amazon Web Services (cloud), ending March, 2013. Named the Geocloud Program.

- IENC was chosen because of relatively small dataset and expertise with ArcGIS. Approval was given by CIO, USACE to distribute public navigation data on AWS

- https://www.ienccloud.us

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IENC CLOUD BACKGROUND

- Advantages include
  - very high reliability of server performance
  - cost effective data hosting
  - scalable CPU availability
  - remote access for data updates

- ArcGIS Server 10.1
  - Over 6000 GIS layers uploaded
  - Clients
    - ArcMap, ArcGIS Explorer
    - ArcGIS JavaScript
    - Google Earth
    - ArcGIS.com

- Experienced over 9 million downloads

IENC Cloud

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IENC CLOUD: DOWNLOADABLE FILES

- IENC
  - “S-57” Exchange Set
  - Shapefile
  - KML/KMZ
  - GeoPDF
- USCG Buoys
  - “S-57” Exchange Set
  - Shapefile
  - KML/KMZ
  - Updated every Tuesday

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IENC CLOUD: SPECIAL DOWNLOADABLE FILES

- Southwest Pass
- Wilkenson to Smoke Bend
- Belmont
- Fairview

- S57 Exchange Set only
- Use with NOAA ENC
- Soundings and contours
- Southwest Pass is updated weekly

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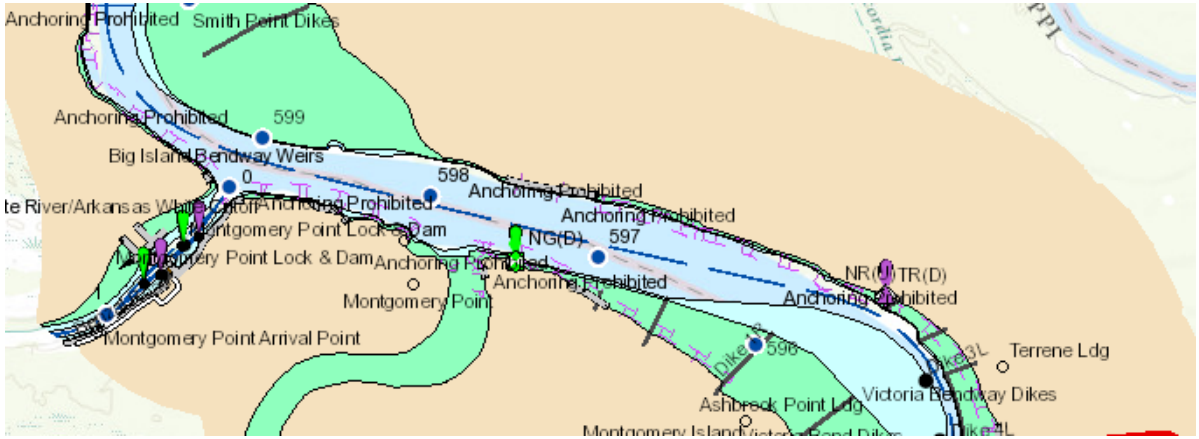
IENC CLOUD: IENC WEB SERVICES

- ArcMap Service
  - Online viewer
  - REST Service
- Web Map Service (WMS)
- Web Feature Service (WFS)
- KML Service
  - Google Earth

- Services by
  - IENC cell
  - IENC object
  - Entire dataset



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IENC CLOUD: USCG BUOY WEB SERVICES

- ArcMap Service
  - Online viewer
  - REST Service
- KML Service
  - Google Earth
- Updated weekly

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IENC CLOUD: CATALOG WEB SERVICES


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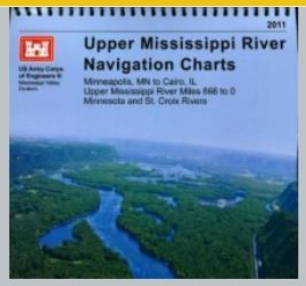
PAPER CHARTS
GOVERNMENT PUBLISHING OFFICE (GPO)

INLAND ELECTRONIC NAVIGATIONAL CHARTS

HOME ABOUT BACKGROUND FEATURES LINKS CONTACT



Inland Chart Books

Current USACE chart books can be purchased from the Government Publishing Office (GPO) bookstore, by accessing the USACE Navigational Chart "store". Charts may be available at a lower cost directly from the Corps Districts, however, for consumer convenience, charts are now available for purchase through the GPO. Many hard copy chart books are available from the Corps districts. The cost, scale, features, and update cycles may be different from district to district.

Alabama River

Last published in 2014, the Alabama River Navigation Charts are available to download in pdf format (11 x 17 inches) from the Mobile District.

Allegheny River

Last published in 2004, the Allegheny River Navigation Charts are available to download in pdf format (14 x 8.5") from the Pittsburgh District or for hardcopy purchase from the GPO Bookstore.

Arkansas River

Last published in 2003, the McClellan-Kerr Navigation Charts are available for download in pdf format (16 x 8") and can be ordered as hard copy books from the Tulsa District.

Lower Mississippi River

Last published in 2015, the Lower Mississippi River Navigation Charts are available for download in pdf format (11 x 17") from the New Orleans District and are also available for hardcopy purchase from the GPO Bookstore.

Missouri River

Published in 2014, the Missouri River Navigation Charts (Miles 0-499) are available for download in PDF format (14 x 8.5") from the Kansas City District.

Published in 2014, the Missiouri River Navigation Charts (Miles 499-735) are available for download here in PDF format (14 x 8.5") from the Omaha District.

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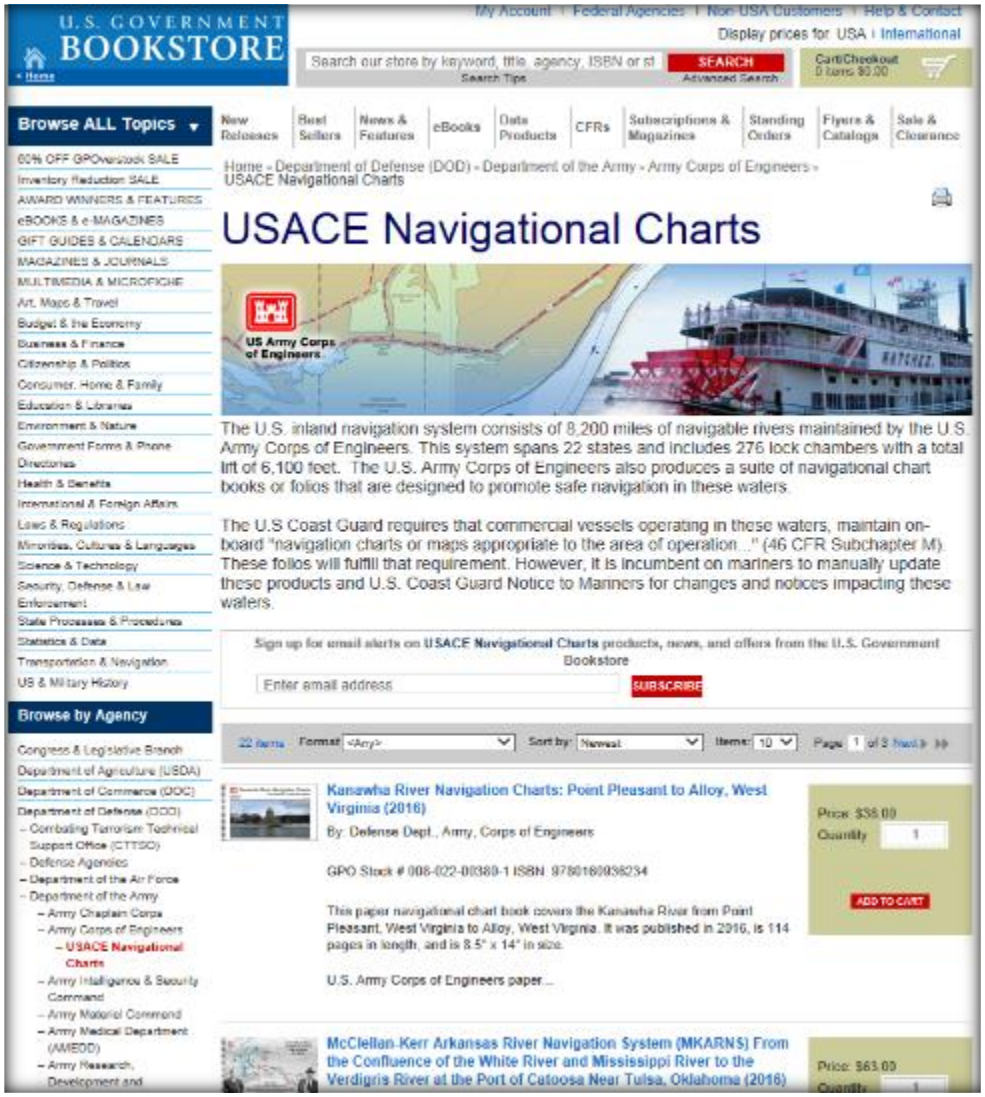
“PRINT ON DEMAND” PAPER CHARTS GOVERNMENT PUBLISHING OFFICE (GPO)



A One-Stop-Shop for all USACE Paper Chart Books

- 20/22 Chart Books Available
  - 1 to be released in 2017
  - 1 to be released in 2018

Current production guidance

– EP 1130-2-520 NAVIGATION AND DREDGING OPERATIONS AND MAINTENANCE GUIDANCE AND PROCEDURES

https://bookstore.gpo.gov/agency/1784

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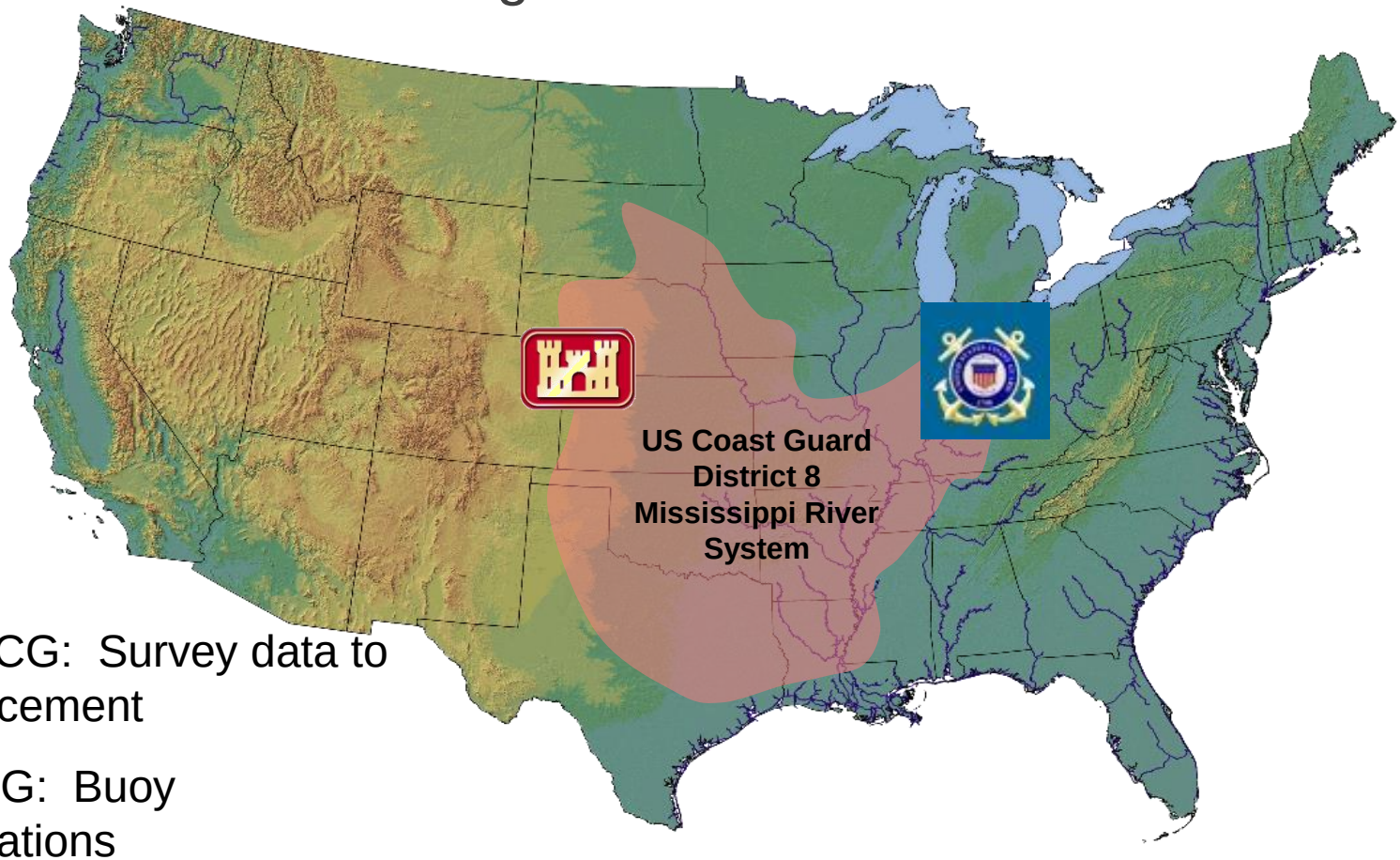
PARTNERING: USCG

Buoy Placement Data Sharing



USACE → USCG: Survey data to aid in buoy placement

USCG → USCG: Buoy Coordinate locations

Buoy IENC Overlay updated and published weekly by USACE

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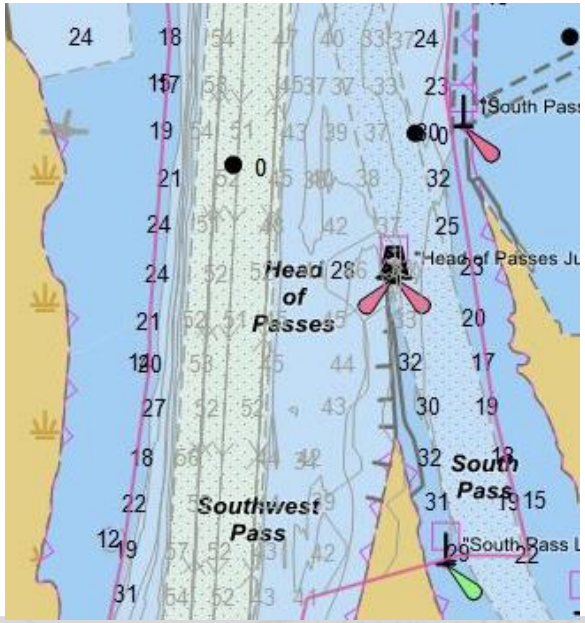
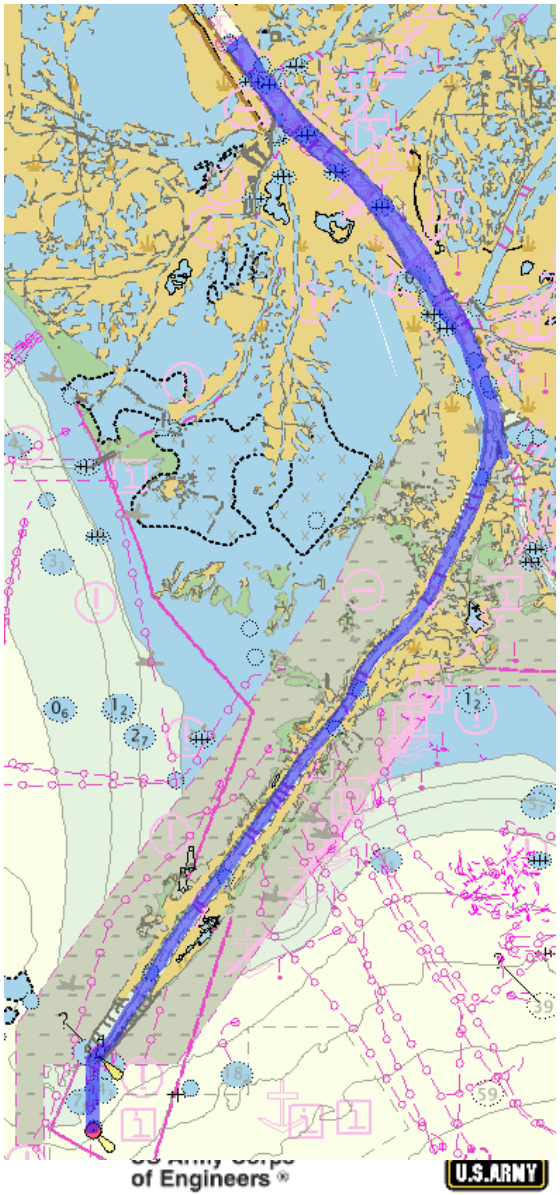
IENC OVERLAY: MISSISSIPPI RIVER (SOUTHWEST PASS)

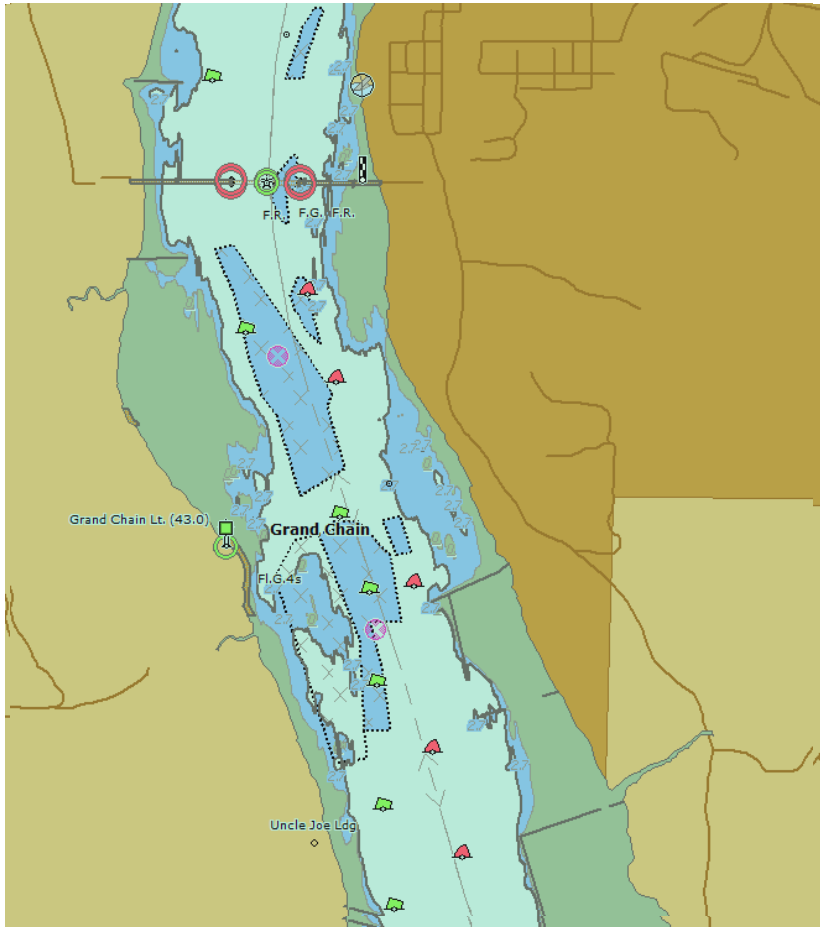
- USACE survey data for SW Pass → updated weekly
- Overlay file, 3UASW000 overlays on NOAA ENCs (US4LA30M & US4LA33M)
- USACE Survey data for 3 other areas on the Lower MS River → updated monthly or as needed





IENC OVERLAYS: USCG BUOY PLACEMENT DURING LOW WATER EVENT 2012

- USACE Survey data → USCG for rock pinnacle area on Upper Miss River near Grand Chain
- USCG Cutters used surveys to place buoys
- USCG → Excel file with Buoy Locations
- USACE created Buoy Overlay for USCG & Towing



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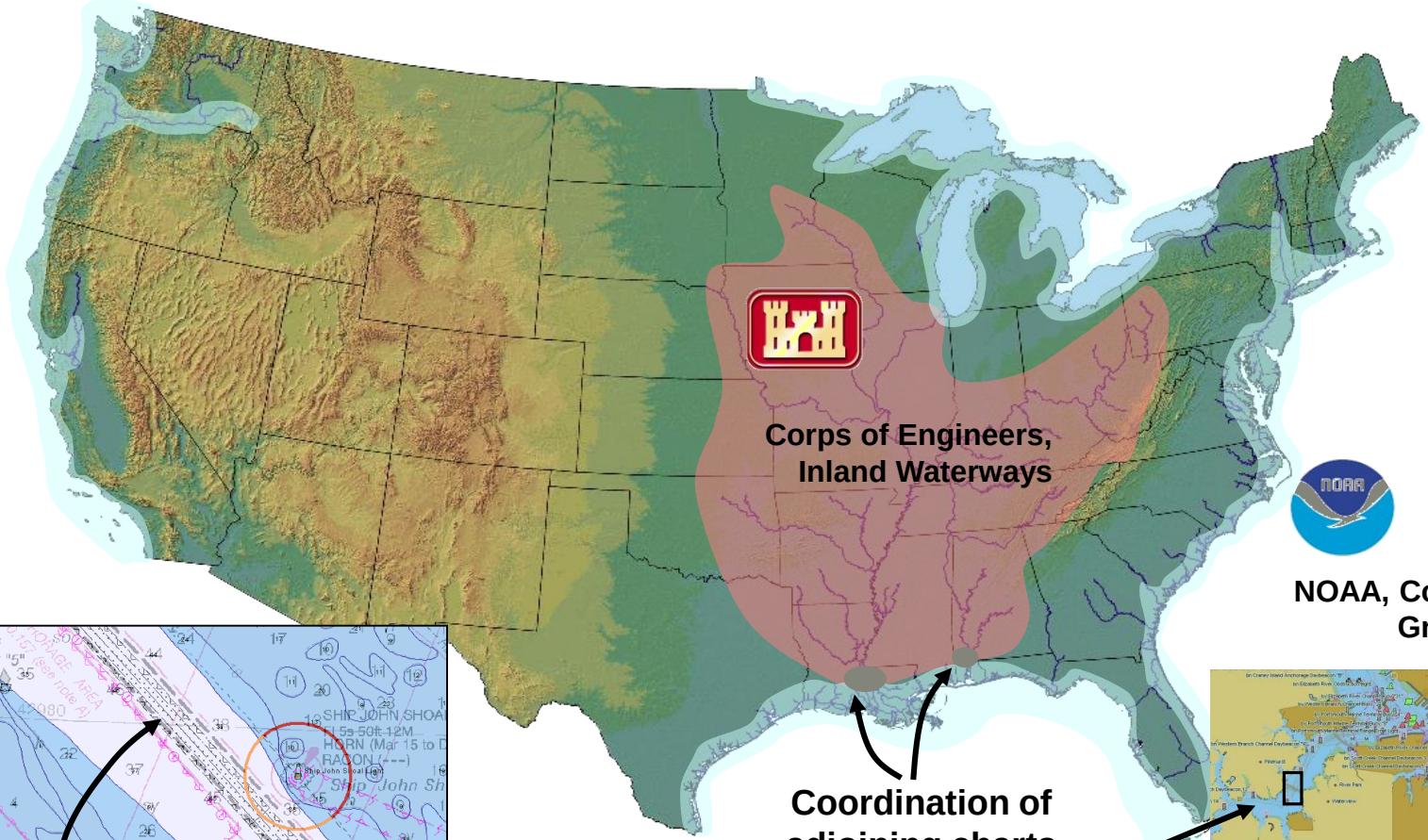
PARTNERING: NOAA COORDINATION AND DATA SHARING



Corps of Engineers, Inland Waterways

NOAA, Coastal and Great Lakes

More consistent and reliable channel data from Corps for NOAA charts

Coordination of adjoining charts for seamless use by chart systems

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SAFE NAVIGATION
A CAUTIONARY TALE

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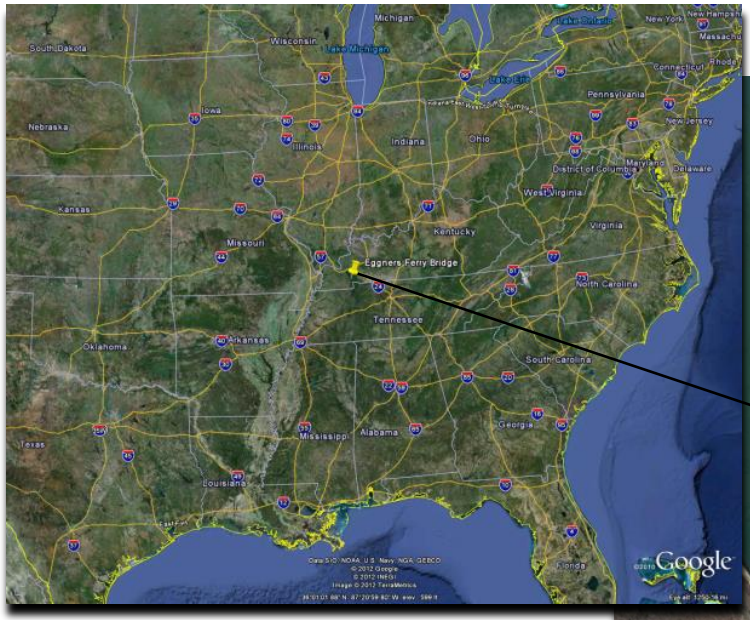
EGGNERS FERRY BRIDGE



26 Jan 2012
Tennessee River Mile 41.7

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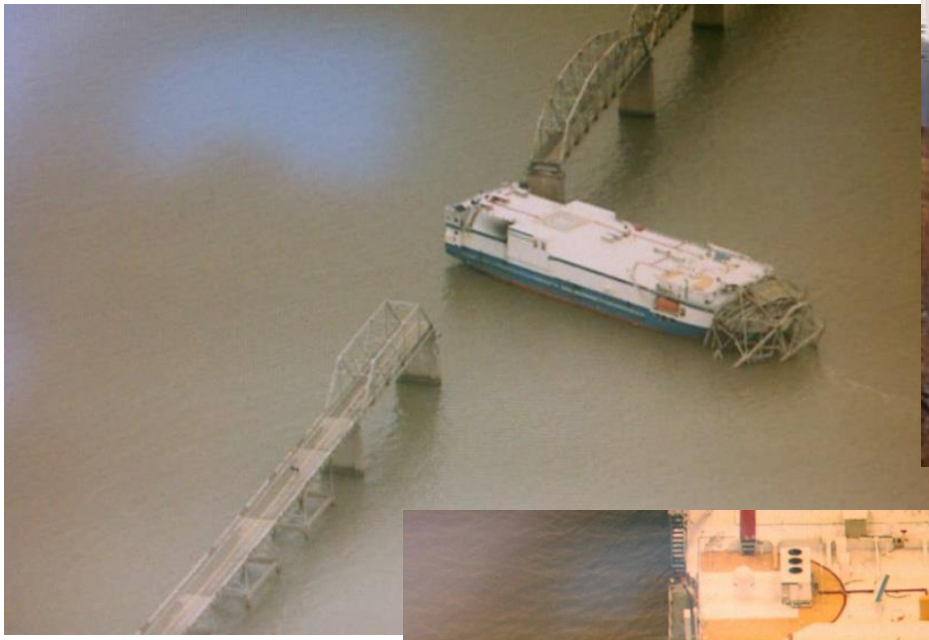
EGGNERS FERRY BRIDGE ALLISION

Delta Mariner transited the wrong navigation span



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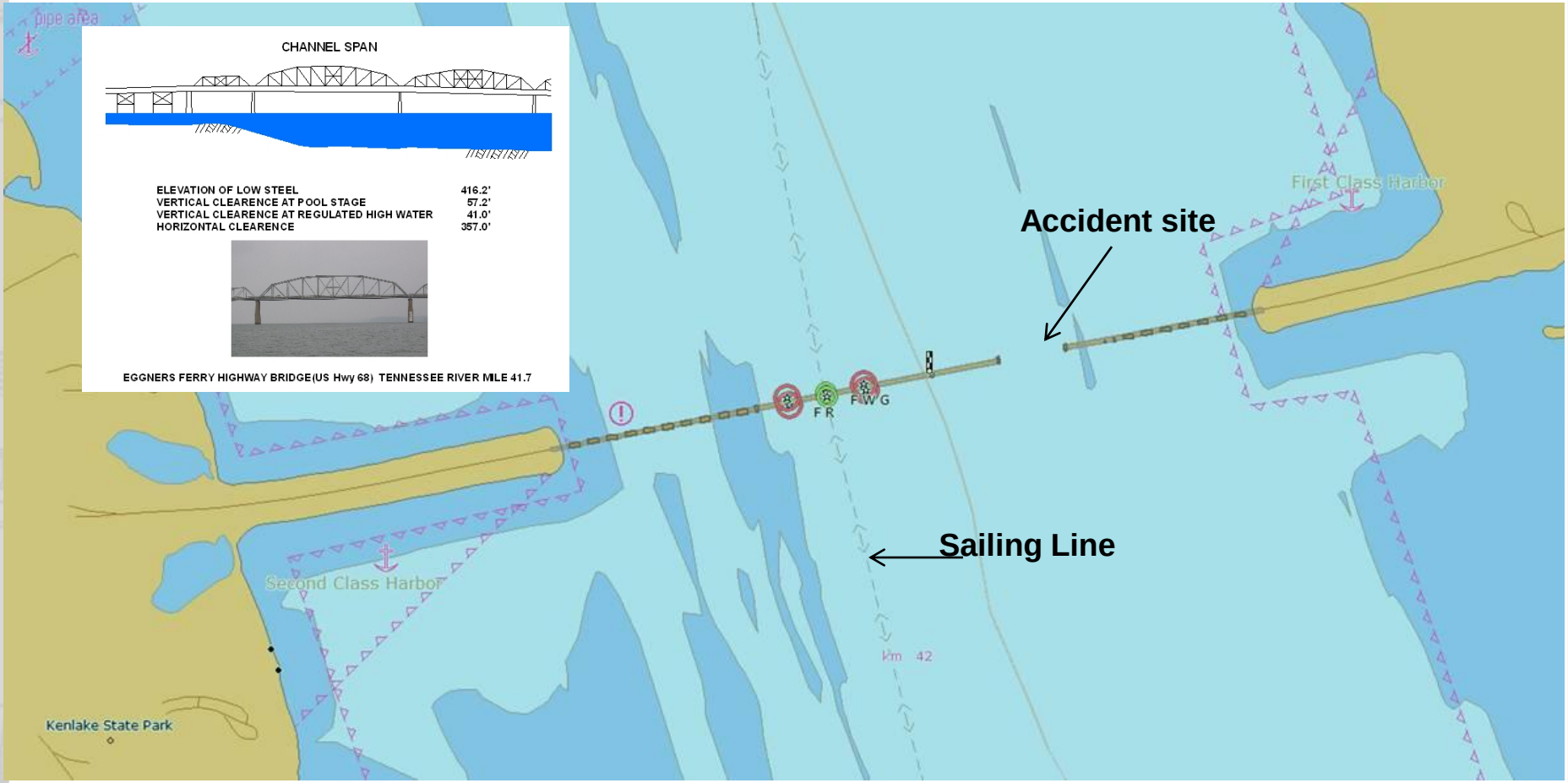
EGGNERS FERRY BRIDGE ALLISION



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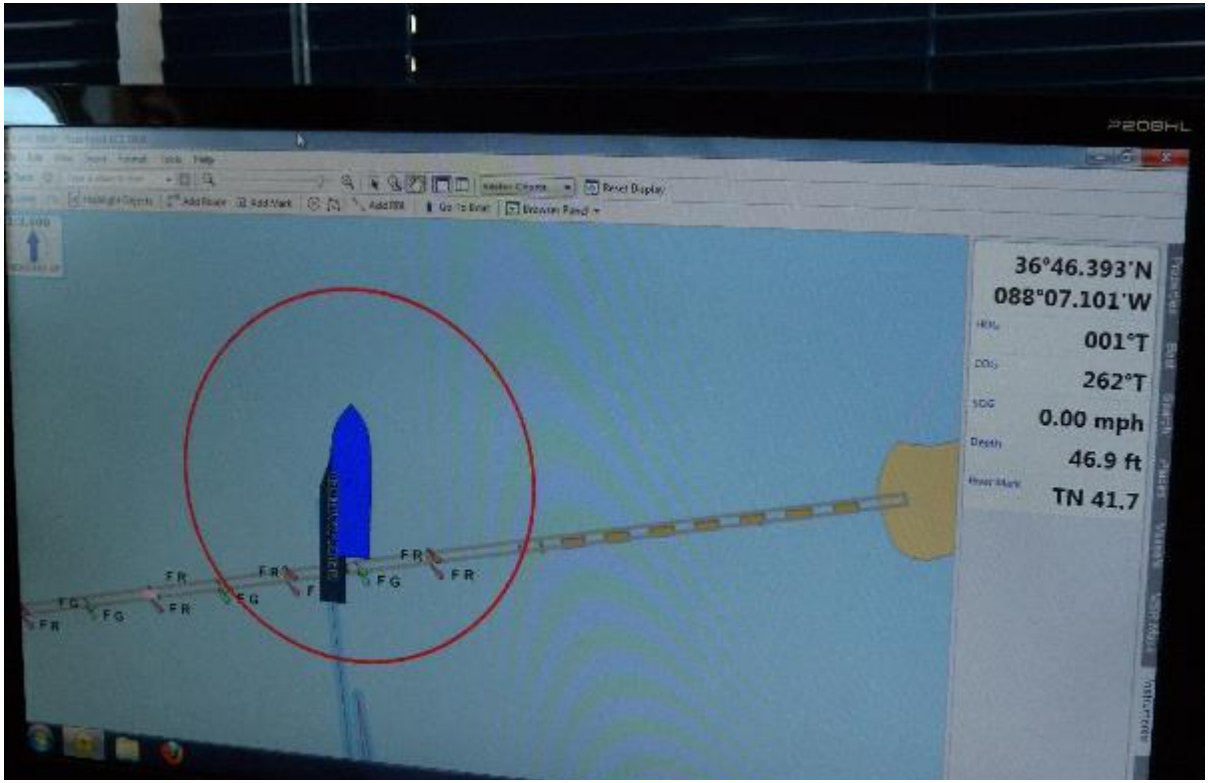
EGGNERS FERRY BRIDGE ALLISION



- Boat was empty, therefore higher in the water
- Pilot turned off all safety depth information in Rose Point
- Display has no sailing line or river miles

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TN River Mile 41.7 HWY68-80 Bridge completed in 2016

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Tows can turn the lights off by going to a marine channel, and click 3 times rapidly.

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EFFICIENT NAVIGATION

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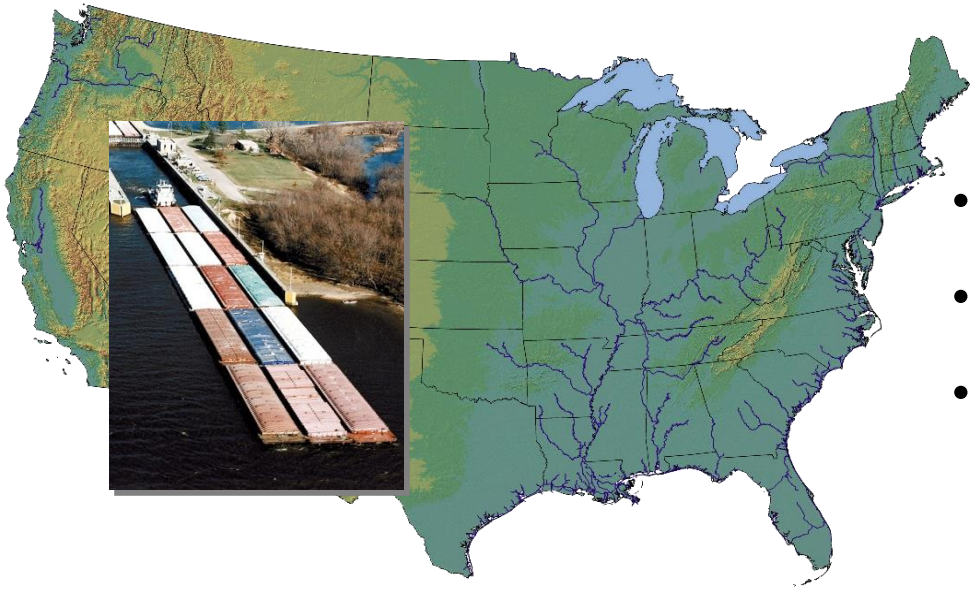
SAFE AND EFFICIENT NAVIGATION



- 25,000 miles of waterways
- 239 lock chambers lifting 6,100’
- 565.9 million tons of commodities
  - 29% petroleum
  - 22% coal / coke
  - 17% other raw materials
  - 16% food & farm products
  - 9% chemical
  - 7% manufactured products

Equivalent Units	22,500 Tons =
	One 15 Barge Tow
	225 Railroad Cars
	900 Large Semi Trucks

Source: Navigation Data Center “TRANSPORTATION FACTS & INFORMATION”, 2016

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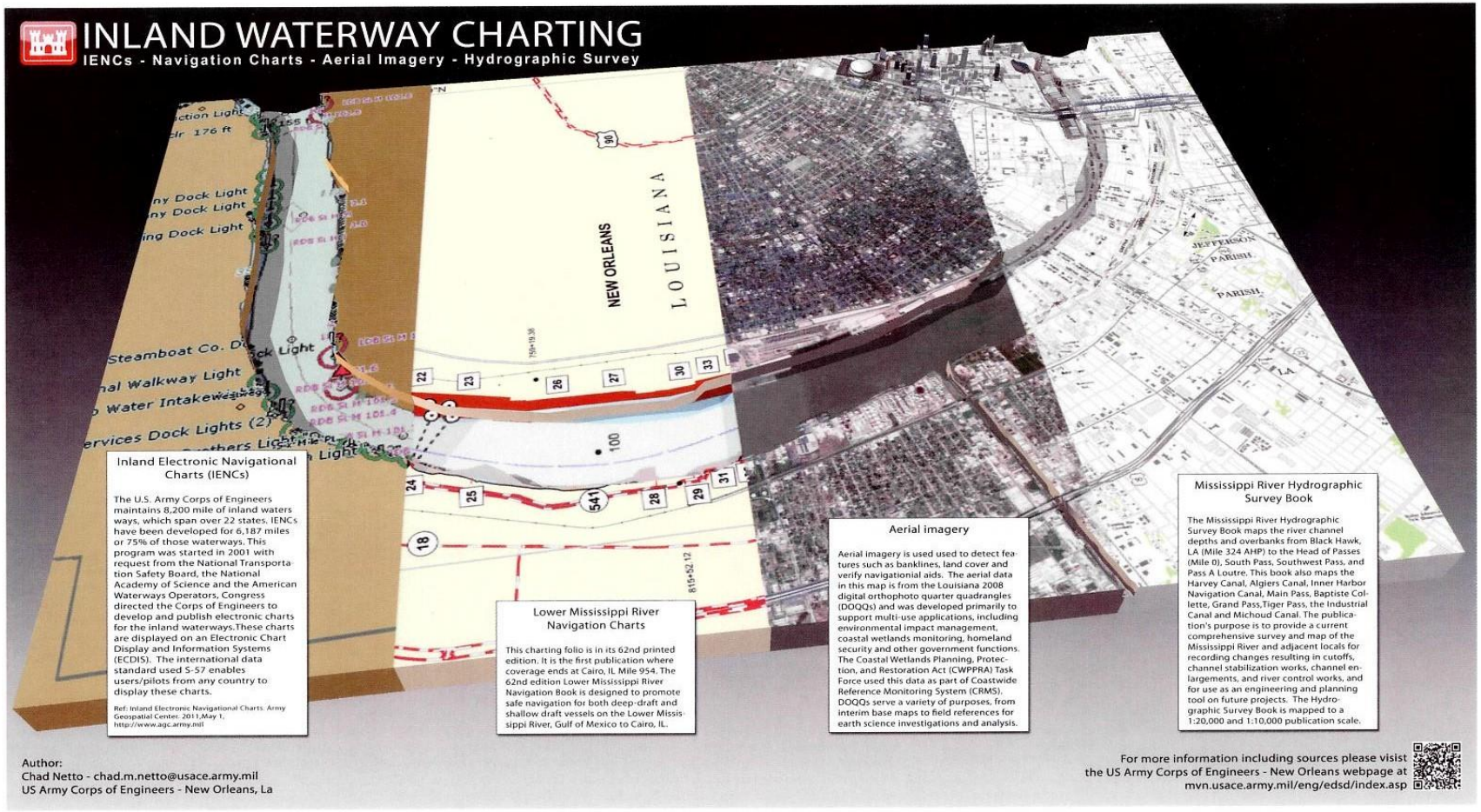
QUESTIONS?



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