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Vessel Impacted by Structure on the Ohio River: Louisville District

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PURPOSE: This Dredging Operations Technical Support (DOTS) Program technical note presents the results of a study undertaken by the Navigation Branch, US Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL), at the request from the Louisville District (LRL) to examine an incident involving a single vessel and structure in a high-water condition. The vessel-position data used in this request were broadcast from an onboard Automatic Identification System (AIS) transceiver and received by US Army Corps of Engineers (USACE)–owned Lock Operations Management Application (LOMA) tower sites located along the Ohio River.

INTRODUCTION: Vessel position information is broadcast via an AIS transceiver onboard a vessel that can provide a set of position reports as high temporal resolution as often as every 2 sec.* These position reports are georeferenced and provide a rich data source for understanding waterway utilization by commercial vessels (most of which are required to carry AIS when transiting US waters) and some recreational vessels. Details about AIS technical specifications and carriage requirements are available from multiple standard-setting bodies (IALA 2008; IEC 2001; ITU-R 2014; PIANC 2019; USCG, n.d.; US Code of Regulations 2019).

In the United States, the US Coast Guard (USCG) is responsible for setting AIS carriage requirements (US Code of Regulations 2019) and for maintaining the Nationwide AIS (NAIS) archive of historic vessel position reports received from the network of AIS stations maintained by the USCG (USCG, n.d.). The NAIS also receives data from a network of AIS towers operated and maintained by the USACE through the LOMA program. These LOMA towers are located primarily at lock-and-dam sites along inland waterways (ERDC 2017).† In addition to being sent to the NAIS, any AIS data collected through the LOMA network is visible to USACE staff via the LOMA viewer. The LOMA program is made of three parts: (1) over 160 field-hardware sites that translate radio signals from AIS transceivers into data that are shared across the CorpsNet network, (2) the LOMA viewer software that allows users to visualize vessel positions on their computer screen, and (3) technical staff that manage and maintain the hardware, software, and data flow

* For a full list of the spelled-out forms of the units of measure and unit conversions used in this document, please refer to *US Government Publishing Office Style Manual*, 31st ed. (Washington, DC: US Government Publishing Office 2016), 248–52 and 345–7, respectively. https://www.govinfo.gov/content/pkg/GPO-STYLEMANUAL-2016/pdf/GPO-STYLEMANUAL-2016.pdf.

† Kress, M. 2023. Unpublished. Lock Operations Manage Application (LOMA) Program. LOMA Program. Internal program document. Vicksburg, MS: USACE ERDC.

across network elements (LOMA Program 2023). This DOTS-request utilized data were collected by the LOMA sites and analyzed by LOMA technical staff.

The USACE LOMA Program receives and handles AIS data as shown in Figure 1. This process starts at data acquisition (when vessels broadcast their AIS messages, shown as a *green line*, which are received by other vessels and shore sites), and continues by moving that data across multiple networks (*red-*, *blue-*, or *black-dashed* lines) to translate and deliver vessel-position data to the end users (Figure 1) including the USCG NAIS archive (LOMA Program 2023).

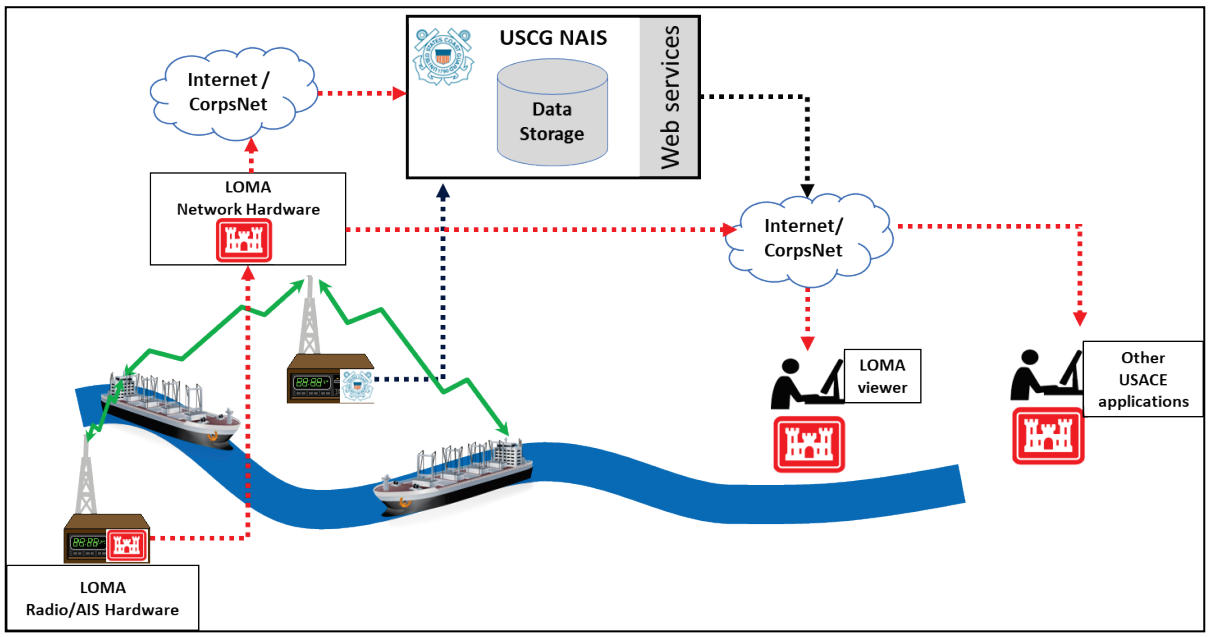

Figure 1. Diagram of Lock Operations Management Application (LOMA) program components. *Green lines* are raw Automatic Identification System (AIS) radio transmissions between vessels and tower sites. *Red dashed* lines are AIS data translated by LOMA hardware and moved across a network (CorpsNet and internet). The *Dark-blue dashed* line is AIS data from US Coast Guard (USCG) sites. The *Black dashed line* represents any data from USCG Nationwide Automatic Identification System (NAIS) shared via webservices to the US Army Corps of Engineers (USACE) (LOMA Program 2023).

METHOD: This study was based on the timeline of a vessel allision that resulted in the short-term sinking of the vessel. The time of impact was provided by the USACE LRL, with a location description including Ohio River mile marker 921.5 at Hamletsburg Island. At the time of the reported incident, the area of interest was impacted by flood-category water levels, which generally allowed vessels to pass over Hamletsburg Island. The south end of the island is where the allision occurred.

The data files for the LOMA system are in the form of a comma separated value file. The initial date and time value in the file is a Unix timestamp. The Unix timestamp was converted to Central Time Zone. Based on the time given for the incident, the data for 5 March 2020 was accessed. A buffer of plus or minus 2 hr was included in the search for the incident based on the timestamp to allow for any possible inconsistency in time reported.

The refined data set was then entered into an open-source program, OpenCPN (Register 2000), where the playback could then be viewed to determine if the data included the reported incident or if any additional information would be needed to identify the incident within the existing record of AIS-derived vessel position reports. After the full video playback was created, the playback file was trimmed to include only the time and data required to study the reported incident. This fine tuning of the playback file can be done in consultation with the requestor if needed as part of the DOTS request process. Screen captures were created by pausing the playback and taking screen shots as necessary to create an informative series of time-lapse still images that captured the key events during the incident.

RESULTS: The track line of the vessel at the start of the time period of interest is shown below in Figure 2 (north up). As the vessel, heading downstream, approached Hamletsburg Island, the speed over ground (SOG) reported via AIS was approximately 10 kn. The vessel decided to pass over the first island based on the image in Figure 2. The *green triangle* represents the vessel GPS position, with the leading point of the triangle representing the vessel heading. The *purple line* at the stern, or upstream end of the triangle, represents the historical track line, where the vessel had been. The *black* and *green line* extending from the point at the *front* of the triangle represents the projected course if the vessel stays on the same heading as it had at the moment of the AIS broadcast.

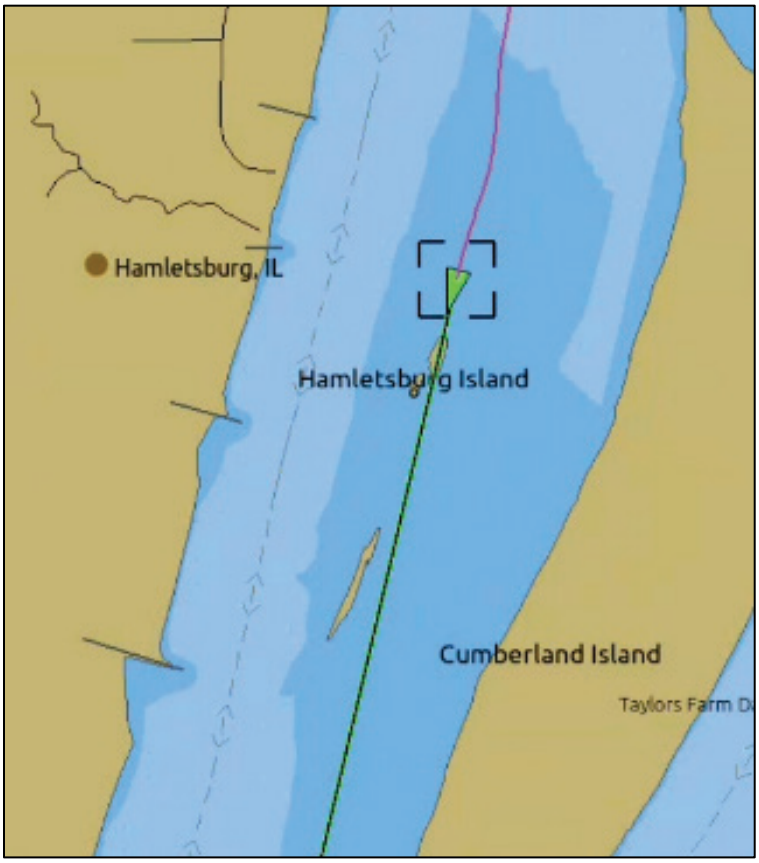

Figure 2. Vessel about to pass over the first island.

The vessel maintained course passing over the first island and approached the second island, shown in Figure 3.

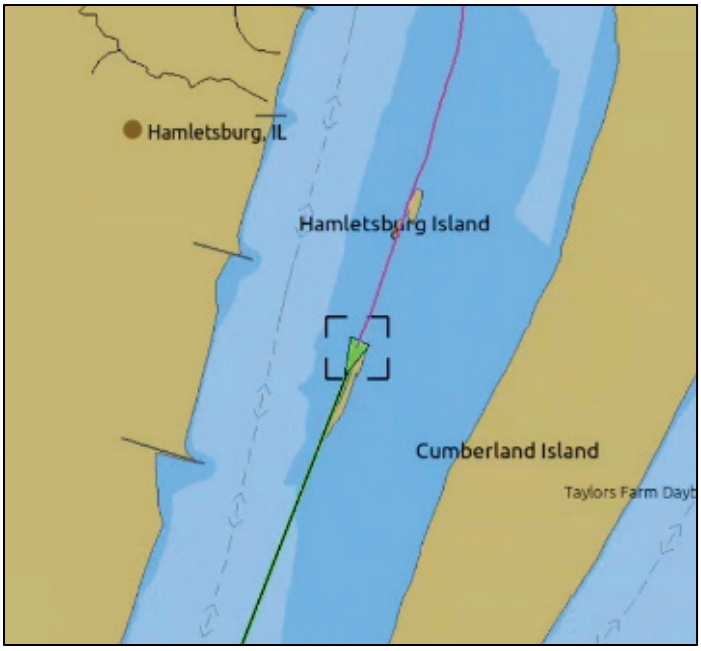

Figure 3. Vessel passing over second island.

As the vessel passed over the second island, there was a sudden yaw to starboard, and the SOG dropped significantly. This is the presumed moment of impact. The vessel reportedly sank within 7 min of this sudden yaw event. The yawing is indicated by the screenshot in Figure 4.

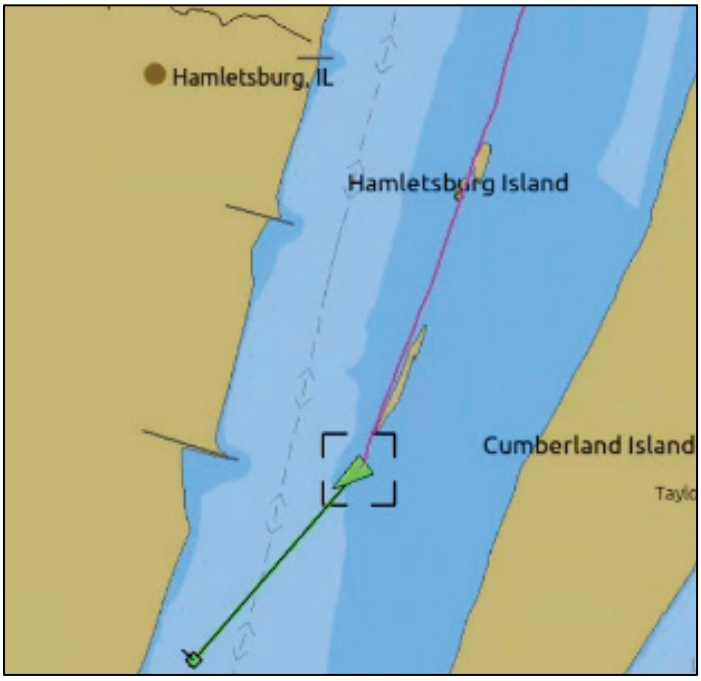

Figure 4. Yawing indication from impact with the underwater structure.

SUMMARY: This DOTS technical note describes the way that AIS data collected via LOMA towers were used to provide playback information to a USACE district requiring information about

a vessel incident. Specific details about the incident have been deliberately omitted from this publication. Any questions about the LOMA program, vessel playback, or technical capabilities should be directed to the authors.

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