United States Army Corps of Engineers

Dredge Hurley

NOTICE

This report contains information and data that is proprietary in nature and should not be released to others. For questions concerning the report, please contact either USACE DQM Support Center, Mobile, AL at (877) 840-8024.

Contents

Dredging Contacts

Dredge Owner

United States Army Corps of Engineers Memphis District

Dredge Monitoring System Provider

The Dredge Monitoring System is provided by the United States Army Corps of Engineers, Memphis District. The monitoring system is composed of the Dredgepack positioning and monitoring software. Some sensor data comes directly to into Dredgepack, while others are received to a PLC before being transmitted to Dredgepack. Dredgepack then compiles all sensor data into a JSON string to be transmitted via the Internet to the DQM Database.

Dredge Monitoring System Provider Point of Contact

See above Points of Contact.

Dredge Information

Mission

The U.S. Army Corps of Engineers, Memphis District, uses the dustpan dredge Hurley to remove sediment from within the navigation channels of the Mississippi River. Dustpan dredges are unique to the Mississippi River system and work to maintain a navigable channel for commercial navigation to move unimpeded. The Hurley has a large suction head with high velocity water jets that loosen the silt and sand materials on the river bed and pump this material through a floating pipeline and is deposited outside the navigation channel near the riverbank.

History

The Dredge Hurley was built in 1993 by Halter Marine in Moss Point, Mississippi for the USACE Memphis District. It was originally built to replace the 1933-built Dredge Burgess and designed to dredge to a maximum depth of 40 feet. Not long after entering service, the need to dredge deeper was realized. A project to lengthen the dredge and increase its digging depth was authorized in 1997 and concept engineering was completed in 1999.

In 2000, portions of the project were funded and completed. New azimuth bow thrusters and a new ladder hoist system were installed. The new A-frame and ladder hoist winch was sized for the eventual planned lengthening of the dredge and ladder. Extreme high water in 2007 brought the need for a deep digging dredge was re-realized. Soon, the lengthening project was authorized and funded. In 2009, the ladder extension project began at Ensley Engineer Yard in Memphis. The ladder was lengthened by 48 feet to a total length of 108 feet. The vessel hull was also increased by 48 feet from 305 to 353 feet. This increased length allows the dredge Hurley to dredge up to 75 feet deep.

Dredge Features

The Dredge Hurley is 348.5 feet long and 58 feet wide. Its hull is 11 feet deep, and its draft is 7 feet. It is a self-propelled dredge and operates using anchor wires and its propellers. There is one dredge pump on board and it is powered by dual 1500HP electric motors. The Hurley has a 38-inch diameter suction pipe with a 32-inch diameter discharge pipe.

Table of Dredge Characteristics

Dredging Method	Dustpan	
Dredge Length	348.5 ft	
Dredge Width	58 ft	
Dredge Hull Depth	11 ft	
Average Draft	7 ft	
Ladder Length	108 ft	
Minimum & Maximum Dredging Depths	0 ft	75 ft
Maximum Cut Width	32 ft	
Number & Type of Pumps	1 Main Pump	
Minimum & Maximum Pump RPM		
Minimum & Maximum Slurry Velocity	0	
Inner Diameter of Suction/Discharge Pipes	32 in	38 in
Dredge Advance Mechanism	Self-Propelled & Anchor Wires	

Pipeline Dredge Hurley Instrumentation Plan

Averaging

No external averaging is done to the sensor data collected.

Internet Connection Type and Provider

Data is transmitted from the Dredge Hurley to the DQM Center database via satellite internet.

Sensor Installation, Repair, Replacement or Modification Methods

The dredge operators and inspectors will monitor the data coming from the sensors daily as part of their standard operating procedure. If data appears suspect, then the inspector and/or electrician will investigate and troubleshoot the sensors to resolve the problem. If a sensor needs to be repaired, replaced or modified the chief engineer or electrician onboard will be responsible for ensuring the work is completed as quickly as possible to ensure quality data is being transmitted to the DQM database.

Procedure to Change Contract Number

Whenever the Dredge Hurley moves to a new contract, the dredge inspector onboard will manually enter the new contact number into the DQM shore side software.

Description of How the UTC Time Stamp is Collected

The UTC (Coordinated Universal Time) time stamp is collected from the data string received from the GPS.

Pipeline Dredge Hurley Instrumentation Plan

Sensor Descriptions, Locations & Calibration Methods

Suction Head Position & Heading

The Hurley is outfitted with a Furuno SC-50 Satellite Compass and SC-303 antenna that provides both position and heading. Vessel heading is determined by decoding the phase data in the GPS carrier frequency. There are three GPS antennas within the SC-303 and by analyzing the signals received by each of these antennas the vessel's heading can be calculated.

- **Brand Name & Model:** Furuno SC-50 Satellite Compass & SC-303 antenna unit
- **Accuracy:**
    - **Horizontal Position: GPS:** 10 meters **DGPS:** 5 meters **WAAS:** 3 meters
    - **Heading:** 0.5° RMS
- **Any Calculations Done External to the Instrumentation:** Dredgepack software uses the inputs from the satellite compass to calculate the given X,Y location and orientation of the dredge in the project's horizontal datum. This location is then used in conjunction with measured offsets and the ladder angle information to find the position and orientation of the suction head.
- **Sensor Location:** The GPS antenna is located on top of the pilot house. It is mounted 2 feet port of the dredge centerline and 7.25 feet aft of the rear end of the house.

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Suction Head Depth

An inclinometer is installed on the ladder to determine the suction head depth. The inclinometer measures the angle of the ladder to the horizontal. This measurement, along with the geometry of the ladder, is used to calculate the depth of the suction head using basic trigonometry.

- **Brand Name & Model:** eTrac Engineering TiltTrac Inclinometer
- **Accuracy:** ±0.1°
- **Any Calculations Done External to the Instrumentation:** The suction head depth is calculated within Dredgepack using the length from the trunnion to the suction head and the angle reported by the inclinometer.
- **Sensor Location:** The inclinometer is mounted on the port side of the dredge ladder, approximately 3.75 feet port of the dredge centerline. It is mounted approximately 2 feet forward of the trunnion.
- **Calibration Procedure:** The suction head depth is calibrated periodically by raising the ladder so that the suction head is even with the water level and adjusting the suction head depth to read zero.

Slurry Velocity

An electromagnetic flow sensor is used to determine the velocity of the slurry flowing through the dredge piping. The electromagnetic flow sensor works utilizing Faraday's Law. The sensor consists of two magnetic coils opposite the pipe from each other, and two electrodes positioned perpendicular to the coils. A magnetic field is applied across the pipe which causes a voltage difference perpendicular to the magnetic field. This voltage difference is measured by the electrodes and is proportional to the velocity of the slurry through the pipe.

- **Brand Name & Model:** Krohne Optiflux 4000
- **Accuracy:** ± 0.5% of flow rate for flows > 3.3 fps; ± 0.018 fps for flows < 3.3 fps
- **Any Calculations Done External to the Instrumentation:** None
- **Sensor Location:** The velocity flow meter is located in the discharge line approximately 14.5 feet after the main pump.
- **Pipe Diameter at Sensor Location:** 38 inches
- **Calibration Procedure:** There is no calibration procedure for the velocity meter.

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Slurry Density

A nuclear density gauge provides a non-contact measurement of the density of the slurry flowing through the dredge piping. The density gauge consists of a radiation source and a scintillation detector mounted on opposite sides of the pipe. A beam of radiation is transmitted from the source to the detector. As the density of the slurry changes, the amount of radiation reaching the detector changes.

- **Brand Name & Model:** Vega Ohmart DSG
- **Accuracy:** Typically ± 1% of span
- **Any Calculations Done External to the Instrumentation:** None
- **Sensor Location:** The density meter is located in the discharge line approximately 17.5 feet after the main pump.
- **Pipe Diameter at Sensor Location:** 38 inches
- **Calibration Procedure:** No calibration procedure.

Pipeline Dredge Hurley Instrumentation Plan

Pump RPM

The dredge pump motor RPMs are measured with a General Electric Tachometer Generator. A tachometer generator measures the rotational rate of the dredge pump motor shaft using an internally generated electrical signal.

- **Brand Name & Model:** General Electric Tachometer Generator 5BC46AB2014B
- **Any Calculations Done External to the Instrumentation:** The dredge pump motor rpm is divided by the gear ratio to determine the rpm of the pump.
- **Sensor Location:** The GE Tachometer Generator is located in the engine room.
- **Calibration Procedure:** There is no calibration procedure.

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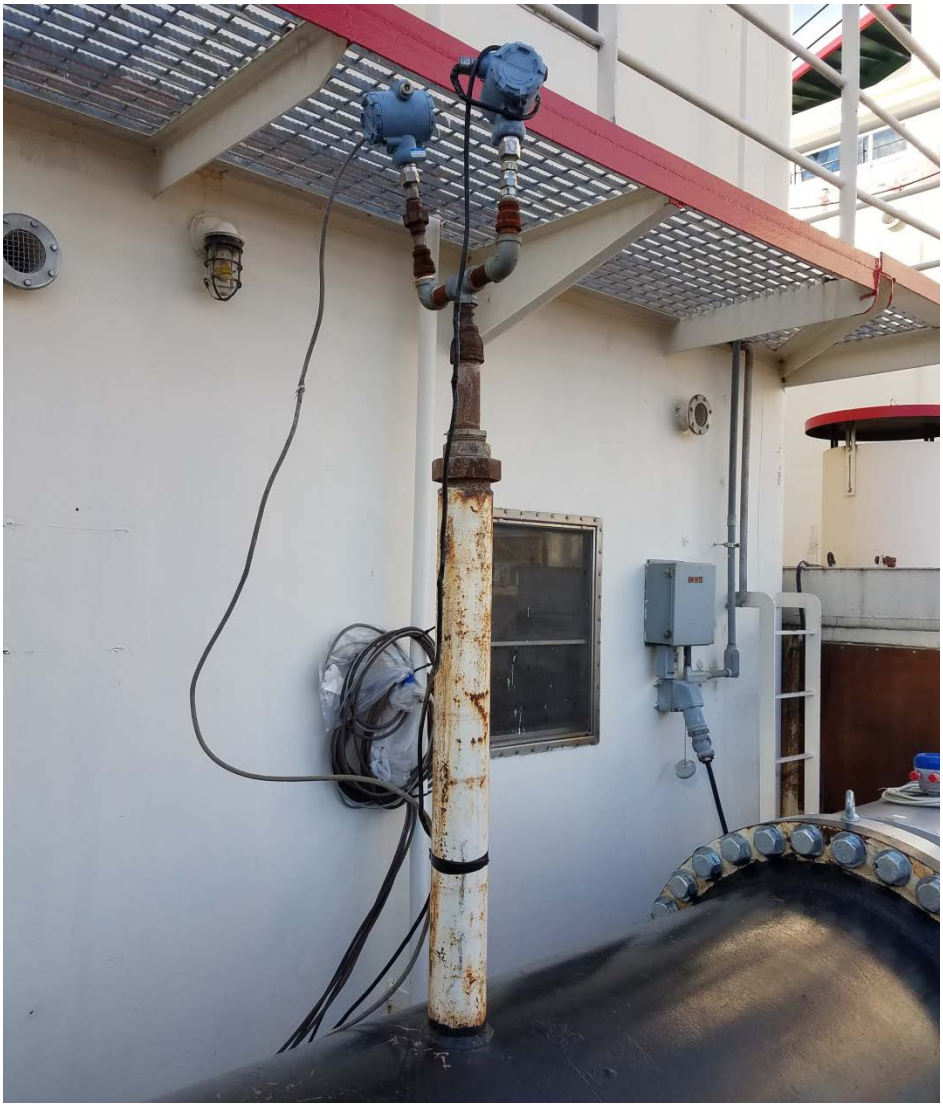
Pump Vacuum

A pressure sensor is installed near the inlet location in the “eye” of the dredge pump. The operation of the pump causes the pressure to drop near the inlet which creates suction and draws more fluid into the pump. The pump vacuum sensor measures the suction or vacuum at the inlet induced by the pump.

- **Brand Name & Model:** OMEGA PX605-30V30GI
- **Accuracy:** ±0.4%
- **Any Calculations Done External to the Instrumentation:** None
- **Sensor Location:** The pump vacuum sensor is installed approximately 5.5 feet before the eye of the main dredge pump.
- **Calibration Procedure:** The sensor comes pre-calibrated from the factory and there is no re-calibration procedure.



Pump Outlet Pressure

A pressure sensor is installed near the outlet location of the dredge pump. While the pump is running, the impeller vanes spin the fluid within the casing, causing it to gain velocity and pressure as it moves radially outward. Once the fluid exits the impeller it is forced through the outlet. The pump outlet pressure sensor measures the pressure in the pipeline at this point.

- **Brand Name & Model:** Rosemount 2088
- **Accuracy:** Varies with operational mode, max variance of ±0.075%
- **Any Calculations Done External to the Instrumentation:** None
- **Sensor Location:** The pump outlet pressure sensor is installed in the discharge pipeline approximately 20.5 feet after the main pump.
- **Calibration Procedure:** The sensor comes pre-calibrated from the factory and there is no re-calibration procedure.

Pipeline Dredge Hurley Instrumentation Plan

Manual & Calculated Parameters

Vertical Correction

The vertical correction is applied to the dredge suction head depth (which is referenced to the water surface) in order to obtain a dredging elevation in the project's vertical datum.

- **Method of Obtaining Vertical Correction:** The vertical correction is obtained by interpolating between known river stage values up and down river from the dredging location.
- **Procedure for Updating Vertical Correction Source Name:** The dredge inspector will manually enter the source of river stage values whenever the dredge changes locations and/or the source changes.

Pipeline Lengths

- **Method of Measuring Pipe Lengths:** The majority of pipeline sections used are of a fixed and known length, so the pipeline length is measured by counting and adding the lengths of the pipeline sections together. Any non-standard pipeline sections will be measured manually with a measuring tape or similar measuring device.
- **Procedure for Reporting & Updating Pipeline Lengths:** When setting up on site, dredge crew or inspectors will perform a measurement on each section (floating, submerged & shore) of dredge pipeline. After this preliminary measurement, the inspectors or other USACE personnel on site will be responsible for updating the pipeline lengths whenever sections of pipeline are added or removed from the discharge line.

Booster Pumps

- **Method & Procedure for Reporting Booster Pumps that are Added or Removed from Service:** The dredge Hurley does not utilize booster pumps.

Dredge Advance

- **Method & Procedure for Calculating & Reporting Daily Dredge Advance:** Daily dredge advance is being calculated by Dredgepack utilizing the position of the suction head over the course of the day. This daily total dredge advance value is then transmitted to the DQM Database at midnight for the previous day.

Discharge Information

- **Method & Procedure for Reporting & Updating Outfall Location, Description, Position, Elevation & Heading:** The dredge Hurley does NOT currently have instrumentation to report the horizontal position of the end of the discharge pipe. As the Hurley will be discharging into open water, Discharge Pipe Elevation & Heading are not required. The description of the Discharge Location will be manually entered into the DQM system by the dredge inspector or other USACE personnel on site at project startup or whenever the location changes.

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Discharge Position

- **Brand Name & Model:**
- **Accuracy:**
- **Any Calculations Done External to the Instrumentation:**
- **Sensor Location:**

Discharge Elevation & Heading

The dredge Hurley will always be discharging through its floating pipeline or a spill barge into open water, and therefore discharge elevation and heading is not required to be transmitted to the DQM database.

Non-Effective Events

- **Method & Procedure for Reporting Non-Effective Events:** Non-effective work events are logged by the leverman as they occur throughout the dredging day. The leverman will record the start and end times of the non-effective event as well as a description of the cause of the non-effective event. Those non-effective work events will then be entered into the DQM system the following day by the dredge inspector when they are completing their daily reports. The dredge inspector will assign the "Dredge Function Code" that best matches the description of the non-effective time.

Quality Control

Quality Control Systems Manager

The onboard dredge inspector will be the Quality Control Systems Manager.

Quality Control Process

The captain, levermen, engineers and dredge inspector are onboard the dredge every day and perform quality control throughout the day with real-time observations of the data. If any discrepancies are noted in the sensor data, the sensor will be troubleshot as described in the DPIP section entitled "Sensor Installation, Repair, Replacement or Modification Methods". Additionally, the dredge inspector will QC the data from the leverman's log prior to manually entering the information into the shore side data entry program.

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Dimensioned Drawings