SECTION 35 20 23.23

HOPPER DREDGE SILENT INSPECTOR

PART 1 GENERAL

1.1 DESCRIPTION

The work under this contract requires use of the Silent Inspector (SI) System to monitor the dredge's status at all times during the contract, and to track trip number, time-position history, instrument readings, vessel state, compute tons dry solids, report data, and manage data history. This performance-based specification section identifies the minimum required output and precision and instrumentation requirements. The requirements may be satisfied using equipment and technical procedures selected by the Contractor.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office responsible for review of the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00, "SUBMITTAL PROCEDURES":

SD-01, Preconstruction Submittals

Dredge Plant Instrumentation Plan; G, SAM-OP-J

SD-07 Certificates

Letter of Silent Inspector Certification; G, OP

1.3 PAYMENT

No separate payment will be made for installation, operation and maintenance of the SI system as specified herein for the duration of the dredging operations; all costs in connection therewith will be considered a subsidiary obligation of the Contractor and covered under the contract unit prices for dredging in the bidding schedule.

1.4 SILENT INSPECTOR CERTIFICATION

The Contractor is required to have a current Silent Inspector Certification for the dredge instrumentation system to be used under this contract at the time of

issuance of the Notice to Proceed. Certification shall be based on an on-site dredge inspection conducted by Silent Inspector Support Center personnel.

The inspection shall include:

- A series of data quality checks as described in paragraph 3.5 “Compliance Inspection and Quality Assurance Checks”,
- Verification of data acquisition and transfer (Paragraph 3.2).
- Review of the Dredge Plant Instrumentation Plan (DPIP) as described in Paragraph 1.5.

A Silent Inspector Certification is valid for one year from the date of certification. The owner or operator of the dredge shall contact the SI Support Center at 1-877-840-8024 on an annual basis to schedule re-inspection, allowing ample time for re-certification, and coordinate this with all local authorities. The Contractor shall have personnel, who are familiar with the SI system instrumentation and have the expertise to recalibrate sensors, on site during the inspection. Re-inspection is required for any yard work which produces modification to displacement (e.g. change in vessel lines, repositioning or repainting hull marks), modification to hopper volume (change in hopper dimensions or addition or subtraction of structure) or changes in sensor type or location. These changes will be reported in the sensor log section of the DPIP. If the SI system has been disabled or turned off, re-calibration of all sensors and concurrent re-certification will be required. This is not to be construed that data must be continually transmitted if the dredge is between jobs or engaged in a non-government project which does not require certification.

1.5 DREDGE PLANT INSTRUMENTATION PLAN (DPIP)

The Contractor shall have a DPIP on file with the National SI Support Center. This document shall describe how sensor data will be collected, how quality control on the data will be performed, and how sensors/data reporting equipment will be calibrated and repaired if they fail. A description of computed dredge specific data and how the sensor data will be transmitted to the Silent Inspector Database shall also be included. The Contractor shall submit to the SI support Center any addendum or modifications made to the plan subsequent to its original submission, prior to Notice to Proceed. The Contractor shall also maintain a copy of the DPIP on the dredge which is readily accessible to Government personnel at all times.

The DPIP shall include the following as a minimum:
(DPIP must have table of contents in the following order)

- Dredging Company
  - Dredge Point of Contact
  - Phone Number
- Dredge Monitoring System Provider

        - Dredge Monitoring System Point of Contact
        - Telephone Number
- Dredge Name
- Sensor data collection method
    - Any averaging
    - Route from sensor to SI computer
- SI Computer Hardware & Components
    - Brand names and specifications
    - User guides and owner manuals
- Sensor repair, replacement, installation, modification or calibration methods
- Dimensioned Drawings of the Dredge
    - A typical plan and profile view of the dredge showing:
        - Hopper cross section
        - Locations of required sensors referenced to:
            - Fore and aft perpendicular
            - Hopper length, depth, width, zero reference
            - External hull draft markings (latitudinal, longitudinal, keel)
            - Each other
        - Overall dredge dimensions
        - Dimensions of draghead
            - Length
            - Pipe inside diameter at sensor locations
            - Offset to positioning system antenna
- Criteria and method used to increment load number
- Description of how the UTC date/time stamp is collected
- Positioning system
    - Brand name and specifications
    - Dredge heading instrumentation brand name and specifications
    - Instrument used to calculate COG
    - Any calculation done external to the instrumentation
    - Certificates of calibration and/or manufacturer certificates of compliance
    - Description of how dredge speed is determined
- Tide
    - Description of how tidal information is entered into the data string.
- Hull status
    - Instrumentation brand name and specifications
    - Certificates of calibration and/or manufacturer certificates of compliance
    - Any calculation done external to the instrumentation
- Drafts:

- Instrumentation brand name and specifications
- Certificates of calibration and/or manufacturer certificates of compliance
- Any calculation done external to the instrumentation

- Displacement:
  - Method used by Contractor to calculate displacement based on fore and aft draft
  - Method used by Contractor to calculate lightship displacement
  - Hydrostatic curves
  - Tables listing (fresh and salt water) displacement as a function of draft certified by a licensed marine surveyor/ naval architect independent of the Contractor (feet and tenths of feet)
    - These methods and tables shall be an accurate reflection of the current configuration and displacement
- Hopper Ullage:
  - Sensor brand name and specifications
  - Certificates of calibration and/or manufacturer certificates of compliance
  - Any calculation done external to the instrumentation
  -
- Hopper Volume:
  - Method used by Contractor to calculate hopper volume based on fore and aft hopper ullage
  - Table listing the hopper volume as a function of hopper ullage, certified by a licensed marine surveyor/ naval architect independent of the Contractor (feet and tenths of feet). Upon approval, each page of the ullage table will receive the visible, dated Silent Inspector stamp. The Contractor shall include his copy of the SI stamped table in the on-board copy of the DPIP.
    These methods and tables shall be an accurate reflection of the current configuration and volume
- DragHead
  - DragHead Depth
    - Sensor brand name and specifications
    - Certificates of calibration and/or manufacturer certificates of compliance
    - Any calculation done external to the instrumentation
  - DragHead Depth Check
    - Method used
    - If applicable sensor brand name and specifications

        - If applicable certificates of calibration and/or manufacturer certificates of compliance
        - If applicable any calculation done external to the instrumentation
    - Drag Head Position
        - Sensor brand name and specifications
        - Any calculation done external to the instrumentation
        - Certificates of calibration and/or manufacturer certificates of compliance
- Slurry Density and Velocity Sensors:
    - Sensor brand name and specifications
    - Any calculation done external to the instrumentation
    - Certificates of calibration and/or manufacturer certificates of compliance
- Pump RPM
    - Sensor brand name and specifications
    - Any calculation done external to the instrumentation
    - Certificates of calibration and/or manufacturer certificates of compliance
    - Description of the pump for which the RPM is reported
- Criteria used to determine
    - Minimum pump effort
    - Pumping water
    - Material recovery
    - Pumpout
- Pumpout
    - Criteria used to determine pumpout
    - Sensor brand name and specifications
    - Any calculation done external to the instrumentation
    - Certificates of calibration and/or manufacturer certificates of compliance
- Refractometer:
    - Brand
    - Resolution and accuracy
    - Method of calibration
- Criteria used to determine open/closed status of hopper
- Documentation of :
    - Test methods used by the Contractor to provide quality control of data
    - Verification that the reported values are applicable for the sensor and application
- Log of sensor performance and modifications
- Log of Contractor data backup as per Paragraph 3.3.7

Any changes to the computation methods shall be approved by the Silent Inspector Support Center prior to their implementation.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 REQUIREMENTS FOR REPORTED DATA

The Contractor shall provide, operate and maintain all hardware and software to meet these specifications. The Contractor shall be responsible for replacement, repair and calibration of sensors and other necessary data acquisition equipment needed to supply the required data.

Repairs shall be completed within 48 hours of any sensor failure. Upon completion of a repair, replacement, installation, modification or calibration, the Contractor shall notify the Contracting Officer's Representative. The Contracting Office's Representative may request re-calibration of sensors or other hardware components at any time during contract execution as deemed necessary.

The Contractor shall keep a log of sensor repair, replacement, installation, modification and calibration in the dredge's onboard copy of the DPIP. The log shall contain a three-year history of sensor maintenance to include: the time of sensor failures (and subsequent repairs), the time and results of sensor calibrations, the time of sensor replacements, and the time that backup sensor systems are initiated to provide required data. It shall also contain the name of the person responsible for the sensor work. Only sensors that affect the data reported in paragraph 3.3.6, "Reporting Metadata", are affected by this logging requirement.

3.1.1 Date and Time

The date and time shall be reported to the nearest second and referenced to UTC time based on a 24-hour format.

3.1.2 Load Number

The load number documents each instance of loading the hopper with dredge material. Load numbering will begin at number 1 at the start of the contract, and will be incremented by 1 at the completion of each dump/emptying of the hopper.

3.1.3 Vessel Horizontal Positioning

Horizontal positioning of the antenna location shall be obtained using a positioning system operating with a minimum accuracy level of 1 to 3 meters

horizontal Circular Error Probable (CEP). Positions shall be reported as Latitude/Longitude WGS 84.

3.1.4 Draghead Horizontal Positioning

Horizontal positioning of the dragheads shall be obtained using a positioning system operating with a minimum accuracy level of 1 to 3 meters horizontal Circular Error Probable (CEP). Positions shall be reported as Latitude/Longitude WGS 84.

3.1.5 Hull status

Open/closed status of the hopper, corresponding to the split/non-split condition of a split hull hopper dredge shall be monitored. For dredges with hopper doors, the status of a single door that is the first opened during normal disposal operations may be monitored. An "OPEN" value shall indicate the hopper door is open, or in the case of split hull dredges, the hull is split. A "CLOSED" value indicates the hopper doors are closed, or in the case of split hull dredges, the hull is not split.

3.1.6 Dredge Course

Dredge course-over-ground shall be provided using industry standard equipment. The Contractor shall provide dredge course over ground to the nearest whole degree with values from 000 (true north) to 359 degrees referenced to a clockwise positive direction convention.

3.1.7 Dredge Speed

Dredge speed-over-ground shall be provided in knots using industry standard equipment with a minimum accuracy of 1 knot.

3.1.8 Dredge Heading

Dredge heading shall be provided using industry standard equipment. The dredge heading shall be accurate to within 5 degrees and reported to the nearest whole degree, with values from 000 (true north) to 359 degrees referenced to a clockwise positive direction convention.

3.1.9 Tide

Tide data shall be obtained using appropriate equipment to give the water level with an accuracy of $\pm$ 0.1 feet and a resolution of 0.01 feet. Tide values above project datum described in the dredging specification shall be entered with a positive sign, those below with a negative sign.

3.1.10 Draft

Draft measurements shall be made in feet with an accuracy of 0.1 feet, and reported with a resolution to the nearest 0.01 feet relative to the fore and aft draft marks. Industry standard pressure sensors, or an equivalent system, may be used. Two draft sensors, one fore and one aft, are required. At the discretion of the SI Support Center, a system may use other means of measuring drafts if accuracies and resolution are maintained relative to the draft marks

3.1.11 Hopper Ullage

Fore and aft hopper material ullage shall be measured to the nearest 0.01 feet with a minimum accuracy of $\pm$ 0.1 feet relative to the hopper zero reference elevation. A minimum of two sensors is required, one fore and one aft. If only two sensors are used, they shall be mounted in locations as near as possible to the hopper centerline, and away from discharge flume turbulence and foam. If one sensor is offset to port or starboard, the other sensor shall be offset to the opposite side of the hopper. If more than one fore or one aft sensor is used, they shall be placed near the corners of the hopper and the average value of the fore sensors and the average value of the aft sensors shall be reported.

3.1.12 Hopper Volume

Hopper volume shall be reported in cubic yards, based on the most accurate method available for the dredge. The minimum standard of accuracy for hopper volume is interpolation from the certified ullage table, based on the average fore and aft ullage readings.

3.1.13 Displacement

Dredge displacement shall be reported in long tons, based on the most accurate method available for the dredge. The minimum standard of accuracy for displacement is interpolation from the certified displacement table, based on the average fore and aft draft readings.

3.1.14 Empty Displacement

Empty displacement shall be reported in long tons, and shall be the lightship value of the dredge, or the weight of the dredge with no material in the hopper, adjusted for fuel and water consumption.

3.1.15 Draghead depths

Draghead depths shall be reported with an accuracy of $\pm$ 0.5 feet and a resolution to the nearest 0.1 feet as measured from the surface of the water with no tidal adjustments. Minimum accuracies are conditional to relatively calm water.

3.1.16 Slurry Densities of Dragarms

A density metering device, calibrated according to the manufacturer's specifications, shall be used to record the slurry density of each dragarm to the nearest 0.0001 g/cc with an accuracy of $\pm$ 0.001g/cc. If the manufacture does not specify a frequency of re-calibration, calibration shall be conducted prior to commencement of work.

3.1.17 Slurry Velocities of Dragarms

A flow metering device, calibrated according to the manufacturer's specifications, shall be used to record the slurry velocity of each dragarm to the nearest 0.001 fps with an accuracy of $\pm$ 0.1 fps. If the manufacture does not specify a frequency of re-calibration, calibration shall be conducted prior to commencement of work. The slurry velocity shall be measured in the same pipeline inside diameter as that used for the slurry density measurement.

3.1.18 Pump RPM

Pump RPM shall be measured with the highest level of accuracy that is standard on the vessel operational displays, either at the bridge, at the drag tenders controls, or in the engine room. Dredges with multiple pumps per side shall report RPM for the pump that best describes the dredging process (typically the outboard pump). If requirements of paragraph 3.1.19 are determined based on pump RPM, then that value shall be reported.

3.1.19 Dragarm Production Criteria

For the purposes of SI, a dragarm pump can only operate one of three ways and each shall be mutually exclusive of the other two.

3.1.19.1 Minimum Pumping Effort

For Minimum Pumping Effort a “TRUE" value shall mean the hopper dredge’s dredge pumps are idling (assuring minimum dragarm intake velocity) or off. The logic can be triggered either with Pump revolutions per minute below a certain idle threshold or dragarm slurry velocity at or below the idle speed threshold (depending on the particular dredge plant and project). The only permissible values are “TRUE” and “FALSE”. The criteria for minimum pump effort may be unique to each dredge.

3.1.19.2 Pumping Water

For Pumping Water a “TRUE” value shall indicate the dredge is not digging material but is pumping water (or very low-density material) through the dredge pump(s). For example, when the slurry density is less

than 1.05 grams per cubic centimeter, the dredge is considered to be pumping water. Other parameters such as pump vacuum may be used to satisfy the pumping water requirement. These criteria may be unique to each dredge. The only permissible values are “TRUE” and “FALSE”.

3.1.19.3 Material Recovery

For Material Recovery a “TRUE” value shall indicate the dredge is digging material. The only permissible values are “TRUE” and “FALSE”. Example; when the slurry velocity is greater than 10 feet per second and the density is greater than 1.05 grams per cubic centimeter, material recovery is “TRUE”. These criteria may be unique to each dredge.

3.1.20 Pumpout

When the hopper is being pumped out, a “True” value shall be reported; when it is not, a “False” value shall be reported. The only permissible values are “TRUE” and “FALSE”.

3.2 SILENT INSPECTOR SHIP SERVER COMPUTER SYSTEM

The Dredge shall be equipped with an SI computer system consisting of a computer, monitor, keyboard, mouse, printer, data modem, UPS, and network hub. The computer system shall be a stand alone system, exclusive to the SI monitoring system, and will have USACE SI software installed on it. The Contractor is not responsible for maintaining the Silent Inspector computer software. If the SI Ship Server (including printer and other hardware) fails to operate properly, the SI Support Center will work with the Contractor to determine the nature of the problem. If a hardware problem is identified, or if a part of the system is physically damaged, then the Contractor shall be responsible for repairing it within 48 hours of determination of the condition.

3.2.1 Hardware Requirements

The Contractor shall provide and dedicate an on-board computer for the use of the Silent Inspector system. This computer shall run Corp’s software and receive data from the Contractor’s data reporting interface. This computer shall consist of, at a minimum, an Intel Celeron or AMD Sempron (or equivalent) microprocessor with no less than a 2.8 Gigahertz CPU. The computer shall contain a hard disk no smaller than 80 Gigabytes, include at least 1 Gigabyte of system memory, and support the Windows XP operating system. The Contractor shall be responsible for obtaining component vendor software drivers if the drivers are not provided with the latest release of the Windows XP operating system software. The computer shall also contain an Ethernet adapter that supports 10BaseT Unshielded Twisted Pair connections that shall connect to the network hub (Contractor shall supply a stranded Category 5 UTP patch cable to the network hub and one spare).

Also, the computer shall have a standard 101 key keyboard, Microsoft compatible mouse, two unoccupied serial ports, an unoccupied universal serial bus port, and a CD-ROM drive (16X speed or faster). It shall also have a minimum 17-inch (viewable-size measured diagonally) video monitor capable of supporting at a minimum XVGA resolution of 1204X768 pixels and 32 bit color quality. The computer screen and keyboard will be located in a position suitable for data viewing and data entry to the satisfaction of the Contracting Officer's Representative.

3.2.2 Network Hub

The SI Ship Server computer shall communicate via IEEE 802.3 Ethernet and the TCP/IP networking protocol. The Contractor shall provide a network hub to allow the temporary addition of the Contracting Officer's representative's portable computer to the computer network. The hub shall provide a minimum of four RJ-45 ports that support Category 5 Unshielded Twisted-Pair Network wiring.

3.2.3 UPS

The Contractor shall supply an Uninterruptible Power Supply (UPS) for the computer and networking equipment. The UPS shall provide backup power at 1kVA for a minimum of 10 minutes. The UPS shall have a serial interface to the SI Ship Server computer to communicate UPS status. The Contractor shall ensure that sufficient power outlets are available to run all specified equipment.

3.2.4 Printer

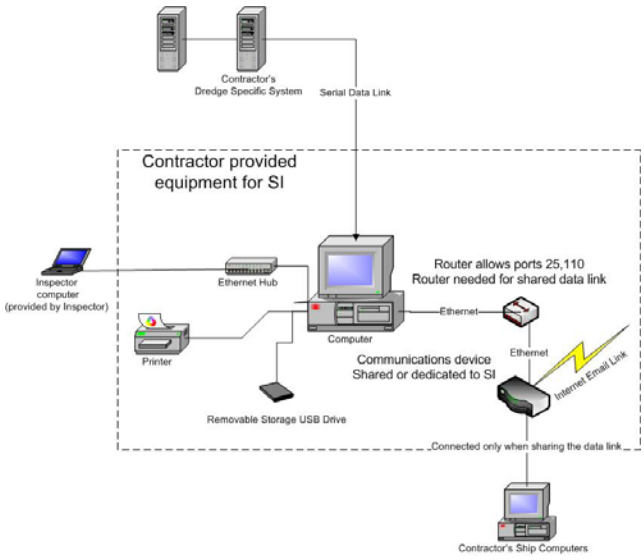
The Contractor shall supply a printer and driver software (when necessary) for use with the SI computer. The printer shall support the Universal Serial Bus interface (cable supplied by the Contractor), and shall have a minimum resolution of 300 dots per inch and have a rated print speed of 6 pages per minute (black and white) or higher and support color. Additionally, the printer shall have minimum paper capacity of 50 pages of 8.5X11 inch paper. The Contractor shall be responsible for maintaining a supply of printer paper and other consumables such as printer cartridges. Printer usage will not exceed 500 pages per month.

3.2.5 Data Communication Device

The Contractor may select any commercial satellite, cellular phone, or other data communications system available to transmit the data to the SI Database over an internet connection using Simple Mail Transfer Protocol (SMTP) based emails. The Contractor shall provide an Ethernet connection from the SI Ship computer to the data communication device, and Internet Transmission Control Protocol SMTP port 25 on the device shall remain open to allow email transmission from the SI computer.

If the communications device for transmitting data is not exclusive to the SI computer, then a router should be configured to block all inbound connections to the SI computer.

3.2.6 Figure of Contractor Provided Equipment



3.3 DREDGE MONITORING DATA

3.3.1 General

Onboard sensors will continually monitor dredge conditions, operations and efficiency and route this information into the shipboard dredge-specific system computer (DSS) to assist in guiding dredge operations. Portions of this Contractor-collected information shall be routed to the SI Ship Server computer on a near real-time basis for archival data storage and compilation into summary reports of dredging operations. The parameters reported to the SI Ship server shall include: date and time, load number, dredge position, draft, vessel speed and heading, draghead depth, ullage and hopper volume, displacement, tidal information, hull status, pumping status, minimum pump effort, density and velocity of the slurry material.

3.3.2 Data Reporting Interface

Standard sensor data shall be sent to the SI Ship Server computer via an RS-232 19200-baud serial interface. The serial interface shall be configured as 8 bits no parity and no flow control.

3.3.3 Data Measurement Frequency

Disposal activities shall be logged with high temporal and spatial resolution. Data shall be logged as a series of events. Each set of measurements (i.e. time, position, etc…) will be considered an event. All required information in paragraph 3.1 shall be collected within one second of the reported time. A data string for an event shall be sent to the SI Ship Server computer every 10 seconds or less; but never more frequently than one per second. If the dredge is within 2 miles of the disposal or dredging area, a failure to send a data string to the SI Ship Server computer within 25 seconds of the previous event shall result in a dredge down status determination by the automated monitoring system. Activities, such as the start or end of a disposal sequence or an elapsed time of 10 seconds since the last event, shall have an event time resolution of one second.

3.3.4 Data Reporting

The system shall transmit data to the SI Database continuously from mobilization until the last USACE post-dredging survey has been accepted. If the data communications device (paragraph 3.2.5) is non-operable, either because of hardware failure or poor local operating conditions, or if the device does not have the capability to send approximately 1 megabyte of data per day, then manual backups shall be performed for each day the device is inoperable. Using protocol contained in the SI Control Center and SI Send Data programs, the Contractor shall download all collected data to an approved medium (CD, flash drive etc…), and transmit this file to the SI Database. The Contractor shall copy the data to a contractor provided flash drive using the Copy Data button on the SI Ship Server computer's SI Control Center Menu. The flash drive will then be moved to an email capable computer that has the SI Send Data program installed, and that program will be used to send the flash drive data to the SI database. The Contractor shall email a carbon copy of the data transfer notification to the Contracting Officer's Representative. Before downloading data, the Contractor shall click the Read Return Receipt button on the Control Center menu to read the receipt file from the previous transmission. Complete instructions on how to backup SI data, perform SI data transfer (Contractor) and the downloadable executable for SI Send Data can be found at http://si.usace.army.mil/QAR.asp. In the event of sensor failure, a manual dump log shall be maintained and submitted on a daily basis to the Contracting Officer's Representative.

3.3.5 Reporting Data Format

Data shall be reported as an eXtensible Markup Language (W3C standard XML 1.0) document as indicated below. Data tags that are marked optional may be omitted or reported according the XML convention of <TAG_NAME/> to signify an empty tag. Line breaks and spaces are added for readability, but the carriage return, line feed character combination is only added to delineate records (HOPPER_DREDGING_DATA tag) for actual data transmission.

<?xml version="1.0"?>
<HOPPER_DREDGING_DATA version = "2.0">

<DREDGE_NAME> **string32** </DREDGE_NAME>
<HOPPER_DATA_RECORD>
<DATE_TIME> **time date string** </DATE_TIME>
<LOAD_NUMBER> **integer string** </LOAD_NUMBER>
<VESSEL_X coord_type = "(LL)"> **floating point string** </VESSEL_X>
<VESSEL_Y coord_type = "(LL)"> **floating point string** </VESSEL_Y>
<PORT_DRAG_X coord_type = "(LL)"> **floating point string**</PORT_DRAG_X>
<PORT_DRAG_Y coord_type = "(LL)"> **floating point string**</PORT_DRAG_Y>
<STBD_DRAG_X coord_type = "(LL)"> **floating point string**</STBD_DRAG_X>
<STBD_DRAG_Y coord_type = "(LL)"> **floating point string**</STBD_DRAG_Y>
<HULL_STATUS> **OPEN/CLOSED string** </HULL_STATUS>
<VESSEL_COURSE> **floating point string** <VESSEL_COURSE >
<VESSEL_SPEED> **floating point string** </VESSEL_SPEED>
<VESSEL_HEADING> **floating point string** </VESSEL_HEADING>
<TIDE> **floating point string** </TIDE>
<DRAFT_FORE> **floating point string** </DRAFT_FORE>
<DRAFT_AFT> **floating point string** </DRAFT_AFT>
<ULLAGE_FORE> **floating point string** </ULLAGE_FORE>
<ULLAGE_AFT> **floating point string** </ULLAGE_AFT>
<HOPPER_VOLUME> **floating point string** </HOPPER_VOLUME>
<DISPLACEMENT> **floating point string** </DISPLACEMENT>
<EMPTY_DISPLACEMENT> **floating point string** </EMPTY_DISPLACEMENT>
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<DRAGHEAD_DEPTH_STBD> **floating point string** </DRAGHEAD_DEPTH_STBD>
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<PUMP_RPM_STBD> **floating point string** </PUMP_RPM_STBD>
<MIN_PUMP_EFFORT_PORT> **true/false/unknown string** </MIN_PUMP_EFFORT_PORT>
<MIN_PUMP_EFFORT_STBD> **true/false/unknown string** </MIN_PUMP_EFFORT_STBD>
<PUMP_WATER_PORT> **true/false/unknown string** </PUMP_WATER_PORT>
<PUMP_WATER_STBD> **true/false/unknown string** </PUMP_WATER_STBD>
<PUMP_MATERIAL_PORT> **true/false/unknown string**</PUMP_MATERIAL_PORT>
<PUMP_MATERIAL_STBD> **true/false/unknown string** </PUMP_MATERIAL_STBD>
<PUMP_OUT_ON> **true/false/unknown string** </PUMP_OUT_ON>

</HOPPER_DATA_RECORD>
</HOPPER_DREDGING_DATA>
Carriage return – ASCII value 13
Line Feed – ASCII value 10

3.3.6 Reporting Metadata

Data shall be reported to the SI Ship Server using the tags and criteria specified in the following table:

Data Tag	**Description**
DATE_TIME	mm/dd/yyyy hh:mm:ss defined as UTC time of the measurement in 24hr format. See paragraph 3.1.10
LOAD_NUMBER	The load number starts at 1 and is incremented by 1 at the completion of the disposal phase of each loading cycle. See

Data Tag	Description
	paragraph 3.1.2
X_POSITION	Longitude in decimal degrees. West Longitude values are reported as negative. The attribute **coord_type** shall be LL. See paragraph 3.1.3
Y_POSITION	Latitude values are to be reported in decimal degrees. Northerly Latitude values are reported as positive. The attribute **coord_type** shall be LL. See paragraph 3.1.3
STBD_DRAG_X PORT_DRAG_X	Draghead Longitude as computed or measured by the Contractor in decimal degrees. West Longitude values are reported as negative. The attribute **coord_type** shall be LL. See paragraph 3.1.4
PORT_DRAG_Y STBD_DRAG_Y	Draghead Latitude as computed or measured by the Contractor in decimal degrees. Latitude values are reported as positive. The attribute **coord_type** shall be LL. See paragraph 3.1.4
HULL_STATUS	The only permissible values for hull status are OPEN or CLOSED. See paragraph 3.1.5
VESSEL_COURSE	The dredge course over ground reported to the nearest whole degree. See paragraph 3.1.6
VESSEL_SPEED	The dredge speed measured in knots at the reported time. See paragraph 3.1.7
VESSEL_HEADING	The dredge heading reported to the nearest whole degree. See paragraph 3.1.8
TIDE	Water level elevation reported in feet; positive above project datum, negative below. See paragraph 3.1.9
DRAFT_FORE DRAFT_AFT	Draft of vessel in feet relative to forward and aft draft marks. See paragraph 3.1.10
ULLAGE_FORE ULLAGE_AFT	Distance from the top of the hopper down to the surface of the dredged material in the hopper (measured in feet). See paragraph 3.1.11
HOPPER_VOLUME	Hopper volume in cubic yards computed from the ullage sensor values. See paragraph 3.1.12
DISPLACEMENT	Displacement of the dredge at the time of measurement in long tons. See paragraph 3.1.13
EMPTY_DISPLACEMENT	Weight of the dredge with a completely empty hopper in long tons. See paragraph 3.1.14
DRAGHEAD_DEPTH_PORT DRAGHEAD_DEPTH_STBD	Depth of the drag head measured from the surface of the water to the lowest fixed point on the draghead (often the heel). See paragraph 3.1.15
PORT_SLURRY_DENSITY STBD_SLURRY_DENSITY	Dragarm slurry density (grams/cubic centimeters). See paragraph 3.1.16
PORT_SLURRY_VELOCITY STBD_SLURRY_VELOCITY	Dragarm slurry velocity (feet/second). See paragraph 3.1.17

Data Tag	Description
PUMP_RPM_PORT PUMP_RPM_STBD	The shaft revolutions per minute of the pumps that are used to pump excavated slurry. See paragraph 3.1.18
MIN_PUMP_EFFORT_PORT MIN_PUMP_EFFORT_STBD	The only permissible values are TRUE or FALSE. See paragraphs 3.1.19 and 3.1.19.1
PUMP_WATER_PORT PUMP_WATER_STBD	The only permissible values are TRUE or FALSE. See paragraphs 3.1.19 and 3.1.19.2
PUMP_MATERIAL_PORT PUMP_MATERIAL_STBD	The only permissible values are TRUE or FALSE. See paragraphs 3.1.19 and 3.1.19.3
PUMP_OUT_ON	The only permissible values are TRUE or FALSE. See paragraph 3.1.20

3.3.7 Contractor Data Backup

The Contractor shall maintain an archive of all data sent to the SI Ship Server computer during the dredging contract. The Contracting Officer's Representative may require, at no increase in the contract price, that the Contractor provide a copy of these data covering specified time periods. The data shall be provided on PC format USB flash drive, CD-ROM, file transfer protocol (ftp) upload, or other storage medium acceptable to the Contracting Officer's Representative. At the end of the dredging contract, the Contractor shall contact the national SI Support Center prior to discarding the data to ensure all data have been appropriately archived. The person who made the call, the date of the call, and the representative who gave permission to discard the data shall be recorded in a separate section at the end of the dredges on-board copy of the DPIP.

3.3.8 Additional Data

An example ASCII format file of sensor data, other than that listed in paragraph 3.3.5 "Reporting Metadata", which will be supplied to the SI Ship Server computer shall be provided in the DPIP.

3.3.9 Data Reporting Example

```
<?xml version="1.0"?>
<HOPPER_DREDGING_DATA version = “2.0”>
  <DREDGE_NAME>Essayons</DREDGE_NAME>
    <HOPPER_DATA_RECORD>
        <DATE_TIME>04/11/2002 13:12:05</DATE_TIME>
        <LOAD_NUMBER>102</LOAD_NUMBER>
        <VESSEL_X coord_type =  "LL">10.123345</VESSEL_X>
        <VESSEL_Y coord_type =  "LL">-80.123333</VESSEL_Y>
        <PORT_DRAG_X coord_type =  "LL">10.123351</PORT_DRAG_X >
        <PORT_DRAG_Y coord_type =  "LL">-80.123337</PORT_DRAG_Y >
```

```
        <STBD_DRAG_X coord_type =  "LL">10.123347</STBD_DRAG_X >
        <STBD_DRAG_Y coord_type =  "LL">-80.123339</STBD_DRAG_Y >
        <HULL_STATUS>CLOSED</HULL_STATUS>
        <VESSEL_COURSE>258</VESSEL_COURSE>
        <VESSEL_SPEED>3.4</VESSEL_SPEED>
        <VESSEL_HEADING>302</VESSEL_HEADING>
        <TIDE>-0.1</TIDE>
        <DRAFT_FORE>10.05</DRAFT_FORE>
        <DRAFT_AFT>15.13</DRAFT_AFT>
        <ULLAGE_FORE>10.11</ULLAGE_FORE>
        <ULLAGE_AFT>10.22</ULLAGE_AFT>
        <HOPPER_VOLUME>2555.2</HOPPER_VOLUME>
        <DISPLACEMENT>4444.1</DISPLACEMENT>
        <EMPTY_DISPLACEMENT>2345.0</EMPTY_DISPLACEMENT>
        <DRAGHEAD_DEPTH_PORT>55.10</DRAGHEAD_DEPTH_PORT>
        <DRAGHEAD_DEPTH_STBD>53.21</DRAGHEAD_DEPTH_STBD
        <PORT_DENSITY>1.02</PORT_DENSITY>
        <STBD_DENSITY>1.03</STBD_DENSITY>
        <PORT_VELOCITY>22.1</PORT_VELOCITY>
        <STBD_VELOCITY>23.3</STBD_VELOCITY>
        <MIN_PUMP_EFFORT_PORT>false</MIN_PUMP_EFFORT_PORT>
        <MIN_PUMP_EFFORT_STBD>false</MIN_PUMP_EFFORT_STBD>
        <PUMP_WATER_PORT>true</PUMP_WATER_PORT>
        <PUMP_WATER_STBD>true</PUMP_WATER_STBD>
        <PUMP_MATERIAL_PORT>false</PUMP_MATERIAL_PORT>
        <PUMP_MATERIAL_STBD>false</PUMP_MATERIAL_STBD>
        <PUMP_OUT_ON>false</PUMP_OUT_ON>
    </HOPPER_DATA_RECORD>
</HOPPER_DREDGING_DATA>
<cr>
<lf>
```

3.4 PERFORMANCE REQUIREMENTS

The Contractor's Silent Inspector system shall be fully operational at the start of dredging operations. To meet contract requirements for operability, the Contractor's system shall provide a minimum 95 percent data return and be 95 percent compliant with DPIP requirements. Data return percentage is defined as the total number of quality data strings sent by the DSS system to the SI Ship Server computer divided by the total possible number of records that could be sent by a system in good working order. Quality data strings are considered to be those providing accurate values for at least 34 of the 35 parameters reported. DPIP compliance is determined by percent of items listed in paragraph 1.5 to be at minimum compliance. After fifty percent project completion, combined percentage of data return and DPIP compliance should equal 95 percent or greater. If repairs necessary to restore 95 percent data return are not made within

48 hours, or if the Contractor fails to report required data within the specified time window for dredge measurements (see paragraph 3.3.2 “Data Measurement Frequency” and 3.3.3 “Data Reporting”); the system will be declared not fully operational, and the Contractor will be assessed liquidated damages equivalent to the additional oversight hours that would be required for Corps personnel to be on site from the first full day after the system is deemed not operational through to the time when the system is returned to fully operational status. For this contract, the liquidated damages shall be ***$*** _____ per day.

3.5 QUALITY ASSURANCE CHECKS

The quality assurance checks listed below are a part of the annual SI dredge certification procedure. Quality assurance checks are required prior to the commencement of dredging and, at the discretion of a Contracting Officer’s Representative, periodically throughout the duration of the contract. Detailed instructions for performing these checks and a spreadsheet for recording the results are available at http://si.usace.army.mil/downloads.asp.

3.5.1 Displacement (Draft) Check

The Contracting Officer’s Representative will periodically verify the accuracy of the fore and aft draft sensors by comparing the vessel hull draft marks to the corresponding sensor readings indicated on the SI screen. The vessel’s hull draft reading will be viewed from a contractor supplied auxiliary vessel circling the dredge. The Contracting Officer’s Representative will review the difference between averaged drafts recorded by the instruments and those estimated from the draft marks to insure that the system is operating within the acceptable accuracy of approximately $\pm$ 0.1 ft. in calm seas conditions, and will direct the Contractor to re-calibrate or repair system components as necessary. This check may be performed separately or as a part of the Water Load Test.

3.5.2 Draghead Depth Check

The Contracting Officer’s Representative may require periodic calibration checks of the reported draghead depth using manual means such as tape measures or sounding lines to directly measure draghead depth. The Contractor shall furnish a steel tape, chain, or wire with clearly visible flags/tags placed at 1 foot increments within the operational range of the dragarm. These devices shall be capable of measuring the depth below the water surface to the lowest fixed point of each draghead (often the heel) with sufficient length to measure 5 feet more than the maximum project depth. Pressure sensors may be used to verify calibration of the draghead sensors only in areas where current flow past the vessel/dragarm cannot be reduced sufficiently to allow safe handling of manual measuring devices. Pressure sensors, used for this purpose shall be vented pressure gages and shall be subjected to an annual manufacturer’s calibration. Prior to the dragarm depth check, the sensor shall be checked at a known depth, and may be required to be

zeroed at this point according to manufacturer's specifications. Care shall be taken not to kink the cable or restrict the vent during deployment.

The Contracting Officer's Representative will review the draghead depth data to insure that the system is operating within acceptable accuracy, and may direct the Contractor to re-calibrate or repair system components as necessary. If a bubbler type system is used, weekly calibration of the draghead sensors is recommended, as they are sensitive to environmental conditions.

3.5.3 Hopper Ullage Check

The Contracting Officer's Representative will periodically check the reported hopper ullage using a tape measure or other distance measuring device. The Contractor shall furnish a clearly readable weighted tape, marked in tenths of a foot, capable of measuring throughout the full range of hopper depth. The weight for this tape shall be a 6-inch diameter disk weighing between 2 and 3 pounds. The Contracting Officer's Representative will review the hopper ullage data to insure that the system is operating within acceptable accuracy (0.1 feet), and may direct the Contractor to re-calibrate or repair system components as necessary. This check may be performed separately or as a part of the Water Load Test.

3.5.4 Position Check

During inspection the reported position of the dredge will be verified by comparison with readings from a handheld GPS receiver. Throughout the contract, the Contracting Officer's Representative will periodically take readings from an independent GPS to verify locations.

3.5.5 Water Load Test

Water Tests shall consist of pumping the hopper out to its lowest level and then filling it to capacity with water, taking ullage and draft measurements at both levels to determine hopper volume and displacement. The objective of the water test is to validate the dredge's reported displacement and hopper volumes. If the results of the water test indicate that the system is not operating within acceptable accuracy, the Contractor shall correct the deficiencies causing the error and repeat the water test until the results are acceptable.

The Contractor shall provide a handheld refractometer with automatic temperature compensation to measure the hopper water specific gravity during water tests. The refractometer shall be capable of measuring the hopper water specific gravity with a resolution of 0.001 and minimum accuracy of $\pm$ 0.001. The Contractor shall also provide a water-sampling device to retrieve a sufficient volume of water from various depths in the hopper to accurately determine specific gravity with the refractometer, and a sufficient volume of deionized water for calibration of the device.

3.6 LIST OF ITEMS TO BE PROVIDED BY THE CONTRACTOR

DPIP	Sec 1.5 Dredge Plant Instrumentation Plan
SI SYSTEM	
Sensor Instrumentation	Sec. 3.1 Specifications for Reported Data
Ship Server Computer	Sec. 3.2 Silent Inspector Ship Server Computer
DREDGE DATA	
Event documentation	Sec. 3.3.3 Data Measurement Frequency
Summary reports for each load	Sec. 3.3.4 Data Reporting
Daily detailed data backups	Sec. 3.3.4 Data Reporting
QA EQUIPMENT ON DREDGE	
Ullage tape	Sec. 3.5.3 Hopper Ullage Check
Dragarm depth chain	Sec. 3.5.2 Draghead Depth Check
Refractometer –measuring in grams/cubic centimeter with a resolution of 0.001 and a minimum accuracy of $\pm$ 0.001 with calibration water	Sec. 3.4.5 Water Load Test
Water sampling device	Sec. 3.4.5 Water Load Test