

SECTION 11800

SATELLITE TELEMETRY SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The OWNER is accepting separate sealed proposals from manufacturers of Supervisory Control and Data Acquisition (SATELLITE TELEMETRY SYSTEM) System equipment for the installation of new remote telemetry units to monitor elevated and ground storage tank, master meters, chemical parameters, etc.; and control pump station installations to operate said water distribution system. The CONTRACTOR shall provide design, programming, documentation, equipment, installation and start-up services for SATELLITE TELEMETRY SYSTEM system. The CONTRACTOR shall install all SATELLITE TELEMETRY SYSTEM equipment specified herein including all wiring and conduit to connect to equipment at the sites.
- B. The system specified herein shall be manufactured by High Tide Technologies, LLC., or equal.

1.02 GENERAL PROJECT INFORMATION

- A. Proposal submitters not meeting all of the qualifications as defined in Paragraph 1.06 need not apply and will not be accepted.
- B. The project shall be completed within 30 to 60 days after the proposal due date.
- C. Not all of the defined sites are identical. See the attached Figure 1 for site locations.
- D. All of the existing motor starters, transformers and field instrumentation shall be reused.
- E. The project shall include all work required to create a working satellite telemetry system suitable for the existing sites and up to (enter #) additional locations. The project work shall include all software, all screens, and documentation for the complete system.

1.03 DEFINED TELEMETRY SITES

- A. Central Hosted Software

The satellite telemetry system shall provide a web based software host on

High Tide Technologies, LLC server. An individual URL will be created for the OWNER and assigned to this project. The software will provide the following status: tank levels, pump status (on/off), valve status (open/closed), alarm status of each site. The software will provide tabular and graphical history on: tank levels, pump starts/stops, pump run time, flow meter totalized flow, hourly meter totalized flow, alarm history, and monthly reports. The software will provide pages to configure and manage text and voice alarms. The software will provide the OWNER with the ability to manually control each pump and demand read each tank unit for current status. The software will provide the following alarms: Power Loss, Power Restored, Low Battery, Pump Fail (if feedback provided such as Fail to Start, Temperature Fail, Overload), Low Tank Level, High Tank Level, and Entry Alarms as provided.

Each office PC provided by the OWNER shall be equipped with a web browser with Microsoft Internet Explorer 5.0 or Netscape 4.0 or better.

- B. Water Tanks
 - a. A/C Power Provided by OWNER
 - i. List Site Names and Geometry
 - b. A/C Power Not Provided by OWNER or not available (Provide solar powered RTU)
 - i. List Site Names and Geometry
- C. Pump Stations
 - a. List Site Names, Number of Pumps

1.04 SITE MINIMUM INPUT/OUTPUT STRUCTURE

Each existing site is unique and currently does not contain a standard input and output structure.

A. Tanks

Each unique tank site shall contain a minimum of Five analog inputs, Five digital inputs, and Five digital outputs for monitoring and control of various tank functions. The inputs and outputs shall be determined by OWNER.

B. Booster Pump Station

Each unique pump station site shall contain a minimum of five analog inputs, five digital inputs, and five digital outputs for monitoring and control of various pump station functions. The inputs and outputs shall be determined by OWNER.

1.05 SITE INSPECTIONS

A. Site Inspections

All defined sites may be inspected prior to proposal submittal. The OWNER shall provide one (1) person to provide access to all sites.

1.06 QUALIFICATIONS

A. Manufacturers Qualifications: Only manufacturers who have been regularly engaged in the supply of Supervisory Control and Data Acquisition (satellite telemetry system) equipment for at least 3 years and capable of meeting the following criteria need respond.

B. Installers Qualifications: Only firms who have been regularly engaged in the installation of Supervisory Control and Data Acquisition (satellite telemetry system) equipment for at least 3 years need respond.

C. Each responsible manufacturer shall meet the following minimum qualifications and shall:

1. Have completed a minimum of three (3) satellite telemetry system applications throughout the regions – no exceptions.
2. Provide the OWNER with references and phone numbers of each of the three satellite telemetry systems. A minimum of two names per each SATELLITE TELEMETRY SYSTEM reference shall be provided. References will be contacted and completed work verified by the ENGINEER and OWNER.
3. Acknowledge that shipment of the SATELLITE TELEMETRY SYSTEM RTU nodes and related equipment shall be authorized only by the ENGINEER and OWNER group – no exceptions.
4. Utilize only UL listed and rated components in enclosure manufacture.
5. Provide 100 percent of all hardware and software technical manuals to the ENGINEER and OWNER in digital format. The manuals shall be in Adobe pdf format.
6. Provide all system concept, layout, design, and telemetry setup notes in Microsoft Word or Excel formats to the ENGINEER and OWNER.

7. Provide a warranty and emergency support for a period of not less than one (1) year after the ENGINEER and OWNER accept each satellite telemetry system node.
8. Provide primary technical support to the OWNER by full-time qualified staff members only. Temporary or part-time staff members do not qualify as full time employees. Technical support provided by manufactures representatives, salespersons or local distributors is not acceptable - no exceptions.

1.07 REFERENCES

- A. Publications listed below form part of specification to extent referenced. Publications are referenced in text by basic designation only.
 1. NATIONAL FIRE PROTECTION AGENCY (NFPA)
 - a. ANSI/NFPA 70 (1999) National Electric Code

PART 2 PRODUCTS

2.01 DEFINITION

- A. Remote Terminal Units

2.02 REMOTE TERMINAL UNIT DESCRIPTION

- A. The satellite telemetry system design shall use High Tide Technologies' Model HTT2000 or HTT3000 satellite monitoring/control unit, or equal.
 1. RTUs shall be installed at the locations specified.
 2. General: The OWNER's existing system shall remain in-place and operational until all components of the system are eventually replaced by the new SATELLITE TELEMETRY SYSTEM system.
- B. Manufacturer's products, including design, materials fabrication, assembly, examination, inspection, and testing shall be in accordance with ANSI/NFPA 70, except as modified herein or indicated otherwise.

- C. Contractor's Responsibility: Provide a complete satellite telemetry system, including RTUs, and satellite telemetry equipment; indicating devices; controls; power supplies; enclosures; conduit, wire, and installation. Provide interconnecting wiring for the system to be based upon general requirements of specified components with spare capacity. Coordinate the interconnecting wiring requirements with OWNER provided instruments and provide necessary wiring for the system. Coordinate the loop impedance requirements of the equipment provided and provide additional loop isolation, noise suppression, surge protection, drivers, and other devices necessary to provide a complete and operating system properly installed and protected in accordance with the device manufacturer's recommendations.
- D. Electrical wiring diagrams including Cable Interface drawings for each RTU shall be included.

2.03 NOT USED

2.04 BASIS OF DESIGN

- A. The satellite telemetry system is based on Stellar satellite modems, ANSI C protocol Software – no exceptions.

2.06 SATELLITE MODEM SYSTEM REQUIREMENTS

A. Modems

1. The modems shall use the mobile frequency designated by the Orbcomm Satellite System.
2. The modems shall be able to be programmed.
3. The communication protocol shall be Orbcomm Satellite Communication standard.
4. The modems shall be model ST2500 by Stellar Communications, LTD or approved equal.
5. One modem shall be installed at each of the selected sites except for the treatment plant, which will have high speed internet access provided by the owner.

B. Antennas

1. Omni-directional antennas tuned specifically for the Orbcomm Satellite frequency bands.
2. Proper grounding shall be provided as part of price proposed at each site, including wiring, conduit, clamps, and any other item for state-of-the-art grounding.
3. One antenna shall be installed at each of the specified sites, with the exception of the water treatment plant.

C. Antenna Cable Lengths

The following minimum standard cable lengths shall be used during the bidding process:

1. Water Treatment Plant – Not Applicable
2. Tank sites – at the locations specified
3. Booster Pump – at the locations specified.
4. The actual as-installed cable lengths may be more or less per site.

D. Antenna Mounting

1. All antennas shall be mounted with galvanized clamps or other non-corroding attachment devices.
2. The mounting of the antennas shall be in such a manner to prevent welding, drilling or other corrosion and stress inducing modifications, or damage to paint systems.
3. All antennas shall utilize existing non-load bearing structures such as safety rails for mounting points.
4. Antennas shall be mounted in a manner so that cables and antennas do not interfere with safety equipment or harnesses while climbing up or on the structures.
5. Cutting into a wall or structural member is not acceptable.
6. All antennas shall be mounted to insure the most direct view of the horizon in all directions when ever possible at the remote sites. When some blockage can not be avoided the view of the Northeast horizon is preferred
7. Antenna masts shall be provided where necessary to elevate the antenna high enough to insure direct view of the horizon in all

directions, and shall include the mast and all attachment hardware.

At tank sites if the antenna is not mounted on top of the tank the antenna mounting must be at least one tank diameter away from the tank. In this case the view of the Northeast sky is preferred.

8. Antenna lightning arrestors should be used at all tank sites.

E. Antenna Connection Sealing

1. All antenna connections shall be wrapped in self-vulcanizing tape to keep all moisture away from the connections..

2.07 NOT USED

2.08 NOT USED

2.09 SITE COMMUNICATIONS

A. Methods

1. Each RTU shall be capable of communicating via the ORBCOMM Satellite System with the High Tide Technologies central server.

2.10 SITE CONTROL

A. Control Methods

1. The control of the typical remote booster pump shall be based upon the comparison of adjustable setpoints and dynamic tank levels. The pump shall be able to be controlled by the tank of interest. Provide override pump control from the web based software.
2. Each booster pump location shall have an operator interface on the web based software for display of local alarm messages, pump status, relevant remote tank levels, and setpoints.
3. Provide the booster pump site with the ability to operate pumps manually by providing Hand-Off-Auto (H-O-A) switches. The OWNER may specify that the software reflect the status of the H-O-A switch.
4. When the switch is in the "Hand" position, the pump shall be manually controlled by the switch and without the aid of a functioning RTU controller.

5. When the switch is in the “Auto” position, the RTU or controller shall automatically control the pump.

2.11 SUBMITTALS

A. General

Within 7 days after receiving the contract, the Manufacturer shall submit all component data sheets in an orderly manner for review and approval.

1. All data sheets shall be printed out from PDF format files. Legible copies from catalogs will also be accepted. All copies shall be clear and legible.
2. The specified product in the data sheet shall be highlighted with a pointed stamp to clearly identify the submitted item.
3. The sheets shall list all pertinent product data such as name, catalog number, model number, nameplate data, dimensions etc.
4. The submitted data shall be organized into separate loose-leaf three-ring binders according to the type of site such as master, tanks, and booster pump station, etc.
5. A detailed description and/or list of functions, including spares for future items, for each SATELLITE TELEMETRY SYSTEM site shall be submitted to the ENGINEER. The Manufacturer shall meet with OWNER and ENGINEER, as requested, to fully explain functionality submittal.
6. Five (5) duplicate copies of the submittals shall be required.

B. Submittals

1. Manufacturer’s Catalog Data
 - a. Software.
 - b. DC power supplies.
 - c. Control relays.
 - d. Hardware.
 - e. Enclosures.
 - f. Modems
 - g. Surge Protection

3. Operation and Maintenance Manuals
 - a. "Quick Start" Software Guide
 - b. Operations and Maintenance Manual

2.13 PROGRAMMABLE RTU PROCESSOR

- A. Provide a High Tide Technologies system, or equal. The control system shall consist of individual RTUs located at each monitoring location. The capability shall exist to allow for expansion of the system by the addition of hardware and/or software. Program development is the responsibility of the Manufacturer of the satellite telemetry system.
 1. All hardware of the RTU shall operate at an ambient temperature of minus 20 to 60 degrees C (-4 to 140 degrees F), with an ambient temperature rating for storage of minus 40 to plus 60 degrees C.
 2. All RTU hardware shall function continuously in the relative humidity range of 5 to 95 percent with no condensation.
 3. Each RTU shall have at least one dedicated serial port.
- B. Processor Hardware
 1. The processor shall be an integral piece of the modem, and will provide control program execution and support remote or local programming.
 2. The user program, data, and operating system shall include EEPROM or equivalent for backed memory storage.
 3. Each processor shall contain enough base memory for at least 30% growth room after the program has been completed and tested.
 4. The front enclosure of the processor shall include an RS232 serial port.
 5. All system modules, local and remote chassis shall be designed to provide for free airflow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be permitted.
- C. RTU Power Supplies

1. The RTU power supplies shall operate in compliance with an electrical service of 85-265 VAC, single phase, in the frequency range from 47 to 63 Hz, or 17-32 VDC.
2. The manufacturer shall, if electrical power is unavailable, provide a solar powered RTU.
3. The RTU shall have an integral AC to DC power converter.
4. The power supply shall monitor the incoming line voltage for proper levels. When the power supply is wired to utilize AC input, the system shall function properly within the range of 85 to 265 VAC. When the power supply is wired to utilize DC input, the system shall function properly within the range of 17 to 32 VDC. In addition, the power supply shall provide surge protection and isolation.
8. In addition to the electronic protection described above the power supply shall offer a failsafe fuse that is not accessible by the customer.

D. RTU Networking and Communications

1. RTUs in the satellite telemetry system shall have standard communications that support ASCII or Modbus protocols.
2. The RTU shall have a standard programming instruction that allows bi-directional satellite messaging with the central server.
3. The RTUs shall support both scheduled and unscheduled communications between the central server.

E. Digital Inputs

1. Number of Inputs: Minimum of 5
2. Minimum 5 optically isolated digital inputs
3. Ambient Operating Temperature Rating: Minus 20 degrees C to 60 degrees C.

F. Digital Outputs

1. Number of Outputs: 5 Minimum

2. 5 minimum of sync only digital outputs.
3. Ambient Operating Temperature Rating: Zero degrees C to 60 degrees C.
4. External SSR's shall be provided by the Contractor

H. Analog Inputs

1. Input Type: voltage or current
2. Number of Inputs: 5 minimum
3. Input Power: Loop Powered or Sensor Powered.
4. Current/Voltage Ranges: 0-5 dcv or 4-20 mA
6. Resolution: 10 bits.
7. Ambient Operating Temperature Rating: Minus 20 degrees C to 60 degrees C.

I. RTU System Technical Support

1. The manufacturer of the RTU shall provide multiple-channels of technical support to the OWNER. These channels include toll free telephone, fax, and web-based support.
2. The satellite telemetry system manufacturer shall maintain technical assistance toll free telephone "hotline."

2.14 RTU SYSTEM ENCLOSURES

- A. The system enclosure shall contain the RTU, complete with inputs/outputs, power supplies, surge protection, terminals and all associated wiring. The enclosures shall come pre-assembled with all associated components din rail mounted and wired.
- B. Remote Terminal Enclosures: Provide pre-built and wired NEMA 4 or equivalent remote terminal enclosures. Each remote terminal enclosure shall consist of:
 1. One (1) molded NEMA 4 rated enclosure. Enclosures shall be lockable, hinged fiberglass.

2.15 NOT USED

2.16 DC POWER SUPPLIES

- A. Regulated: Solid-State
- B. Input: 85-230 volts ac, single phase, 60 hertz.
- C. 20-24 volts dc.
- D. Output Current: 2.0A.
- E. Ambient Temperature Range: Minus 20 to 50 degrees C.
- I. Mounting: Enclosure-mount acceptable.
- J. Primary Protection: Short circuit protected
- K. Additional Protection: Over-current protection for secondary

2.17 TERMINALS

- A. Provide single-circuit feed-through terminal blocks for all control system enclosures. Provide the following:
 - 1. Voltage Rating: 30 volts AC/DC maximum.
 - 2. Screw Type

2.18 CONDUCTORS

- A. Shielded twisted pairs for signal wiring such as instrument signals. General wiring for enclosures. Group and neatly route conductors within enclosures.
- B. Wire Color Codes: General internal wiring color code specifications for all supplied enclosures/enclosures. There shall be no exceptions.
 - 1. All 120V single-phase AC LINE wiring shall be black.
 - 2. All single-phase AC NEUTRAL wiring shall be white.
 - 3. All wiring originating outside the enclosure/enclosure that is not controlled by the local disconnect or main breaker shall be yellow.
 - 4. All 24V DC positive wiring shall be red.
 - 5. All 24V DC common wiring shall be black.

6. All ground wiring shall be green or green with yellow tracer.

C. Shielded Twisted Pair

1. Tinned, soft copper and insulated with nylon-jacked polyvinyl chloride.

2. Color code each conductor pair.

3. Twist conductors into pairs with a 1-1/2-to 2-1/2-inch lay.

4. Code each pair with a unique pair number.

5. 100 percent shielded coverage, aluminum-polyester.

6. No. 22 AWG.

7. No. 22 AWG stranded copper drain wire.

8. Rated 300 volts, 60 degrees C.

D. Conductors: General internal wiring of specified electrical enclosures. Group and neatly route conductors within enclosures.

1. All wiring internal to the supplied enclosures/enclosures shall be machine tool wiring rated MTW/AWM/TFF with an insulation rating of at 300-volts and UL approved - no exceptions.

2. All non-input/output module point-to-point wiring shall be 16 AWG.

3. All discrete input module to terminal wiring shall be 20 AWG or larger.

4. All discrete output module to terminal wiring shall be 20 AWG or larger.

5. Provide nylon wrapping around wire bundles crossing door hinges for protection.

2.19 SOLID STATE RELAYS

A. Mounting: Din Rail mounted

B. Relay Rating: 24VAC-240VAC, 8 amperes.

C. Contacts: SPST.

D. Coil Voltage: 3.5-30 Volt.

2.22 NOT USED

2.23 NOT USED

2.24 NOT USED

2.25 NOT USED

2.26 NOT USED

2.27 NOT USED

2.28 NOT USED

2.29 NOT USED

2.30 NOT USED

2.31 FIELD INSTRUMENTS

- A. All of the OWNER's existing field instrumentation shall be integrated into the manufacturer's satellite telemetry system, if possible. CONTRACTOR shall notify the ENGINEER should existing instrumentation not be reusable.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Install all equipment in accordance with ANSI C2, ANSI/NFPA 70 and the requirements specified herein.

3.02 WIRING

- A. Install conductors and cables in conduit, unless indicated otherwise.
- B. Complete raceway systems and remove obstructions before pulling conductors into place. Avoid damaging insulation during conductor installation. Use an approved lubricating compound as required to facilitate pulling wires.

3.03 SPLICES AND TERMINATIONS

- A. Make up both mechanically and electrically tight.
- B. Provide with a flashover or insulation value at least 100 percent in excess of wire insulation.
- C. Make splices and terminations in junction boxes.
- D. Make connections in No. 10 AWG and smaller conductors with insulated pressure connectors or wire nut connections.
- E. Use terminal blocks of the proper voltage for interconnecting or splicing control cables, communication cables, and other conductors. Mount terminal blocks in a cabinet and label terminals properly.

3.04 NOT USED

3.05 TESTING

- A. Performance Verification Test: Conduct performance verification tests to demonstrate that control system maintains set-points, and that system is programmed for the correct sequence of operation. Conduct performance verification test one day after work is installed of continuous RTU systems operation and before final acceptance of work. Performance verification test shall demonstrate the following:
 - 1. Field Testing: Calibrate field equipment and verify equipment and system operation before placing the system on-line. Field-testing shall include the following tests.
 - 2. Calibration Accuracy and Operation of Inputs Test: Check for proper calibration and operation of each input instrument. Document each reading for the test report.
 - 3. Operation of Outputs Test: Check the operation of each output to verify correct operation. Command digital outputs on and off. Document each command and result for the test report.
 - 5. RTU Startup and Memory Test: Demonstrate that programming is not lost after a power failure, and RTU controllers automatically resume proper control after a power failure.

6. Surge Protection: Show that surge protection, meeting the requirements of this specification, has been installed on incoming power to the digital controllers and on communications lines.

3.06 FIELD TESTS

- A. Demonstrate compliance of the control system with the contract documents. Furnish personnel, equipment, instrumentation, and supplies necessary to perform calibration and site testing. Ensure that tests are performed by competent employees regularly employed in the testing and calibration of instrumentation systems.
- B. Notify the OWNER of any defective products and workmanship disclosed by the tests.
- C. Testing will include the field and the performance verification tests. Field tests shall demonstrate proper calibration of input and output devices, and the operation of specific equipment. Performance verification test shall ensure proper execution of the sequence of operation and proper tuning of control loops.
- D. Test each device such that each item will function not less than five times.
- E. Tests are subject to oversight and approval by the OWNER.

3.07 TEST REPORTING FOR FIELD TESTING AND PERFORMANCE VERIFICATION TESTS

- A. Document tests with detailed test results. Explain in detail the nature of each failure and corrective action taken.
- B. During and after completion of field tests, and again after the performance verification tests, identify, determine causes, replace, repair or calibrate equipment that fails to meet the specification, and deliver a written report to the OWNER.
- C. Provide a written report containing test documentation after the field tests and again after the performance verification tests. Convene a test review meeting at the job site to present the results to the OWNER. As part of this test review meeting, demonstrate by performing all portions of the field tests or performance verification test that each failure has been corrected. Based on the report and test review meeting, the OWNER will determine either the restart point or successful completion of testing. Do not commence retesting until after receipt of written notification to retest by the OWNER. At the conclusion of retesting, assessment will be repeated.

END OF SECTION