Upgrading an Existing Water Level Station or Installing a New Water Level Station

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1. **Title:** Upgrading an Existing Water Level Station or Installing a New Water Level Station

2. **Purpose**
This procedure shall be used for new stations and when a station is upgraded. This SOP covers a number of issues related to various Steps (3 through 7) as outlined in Center for Operational Oceanographic Products and Services' (CO-OPS) Reliable Operating System (ROS).

3. **Background/History**
In order to install/upgrade a water level station various procedures need to be followed prior and during the installation so that data collection can begin/resume in a timely fashion. CO-OPS relies on expensive and highly technical equipment to collect 6-minute water level data. Furthermore, various CO-OPS teams are involved from installation until the station is operational. Considering all the steps involved with installing a water level station, the following procedures can help simplify the process, minimize errors, and permit quality data ingestion.

4. **Scope/Applicability**
Tester is defined as a person or organization that assembles the whole system and performs testing. At the present time, Testers are the Engineering Division's System Support and Evaluation Branch's Chesapeake Instrument Laboratory (CIL) (east coast), the Field Operations Division's Seattle Instrument Laboratory (SIL) (west coast), and any instrument lab contract support (presently RDSI).

Installer is defined as a person or a team - both government and contractors - who perform annual maintenance, emergency maintenance, DCP upgrade, or installation of a new water level station.

Project Lead is defined as the project manager or lead person who has the delegated authority from CO-OPS' Executive Management Team (EMT) for the planning, execution, control, and monitoring of the project.

Task Manager is defined as the person who has the delegated authority from the Contracting Officer's Representative (COR) who is the technical representative of the contracting officer for a specific contract.

Contractor is a person or organization who has been awarded a specific task order(s) under government contract(s) for the specific project.

5. Main Processes

For a new station installation several procedures must be followed from the installation to when the station is operational and starts to collect and transmit water level data. Various teams and divisions are involved in this procedure. OET assigns Station ID numbers and provides the Station ID's to field crew or contractors. CIL/SIL sets up throughput testing to allow OET to check data ingestion. When testing is complete, the contractor installs or upgrades the station and notifies OET when the work is done. DMAT then reviews the data to make sure the equipment is collecting quality data and CORMS turns on dissemination so that various CO-OPS web products can display the data to the general public.

6. Detailed Sub-Processes/Checklists

(A) Installation of a new water level station

(A1) For a new station, the Project Lead/Task Manager shall request a new station number from CO-OPS Engineering Division's (ED) Operational Engineering Team (OET) by providing the position information - latitude and longitude - of the new station to OET. OET will assign the new station number and inform the Project Lead/Task Manager. The Project Lead/Task Manager shall notify the Chesapeake Instrument Lab (CIL) of the planned station configuration and planned installation date. This request for station hardware shall be made at least 60 days before the planned installation date if the equipment will be from the existing inventory, or 180 days if equipment purchase is required.

(A2) The Tester shall request assignment of transmissions parameters - Platform ID, Channel, and Transmit Time - from OET, at least two weeks before the beginning of the test. OET will assign the transmission parameters and provide the information to the requester. The Tester(s) shall prepare the approved preliminary Xpert Site Report by completing the following fields:

- The Station Name and Station ID number.
- The transmission parameters (assigned Platform ID, Channel, and Transmit Time).
- The serial numbers of all boards and equipment as listed on the approved Site Report for the DCPs to be installed in the field.
- The correct number, type, and serial numbers of the sensors that will be installed on each DCP

(A3) The Tester shall provide an e-mail and the approved preliminary eSite or Xpert Site Report to OET at least three business days prior to the beginning of the test, and within three business days the station information shall be configured by OET in the CO-OPS Database Management System (DMS). The Tester shall provide the testing information in an e-mail such as Test Platform ID, Test Channel Number, Test Transmit Time, Test Station ID, and information about all the sensors that will be used during the system throughput testing for one or more DCP.

Here are a couple of suggested formats for this e-mail message: the first one is for a new station installation and the second one is for an existing station upgrade.

(a) The following is available for DPAS testing for the installation of USCG Mobile, AL.

USCG Sector Mobile, AL (8736897), latitude 30^0/38'/54' N, longitude 88^0 03' 30" W
GOES Transmission parameters are as follows: Platform id 336A14AE, Channel 150W, Transmit Time 00:03:06 (6 second window every 6 minutes), Transmitting as test station id 99999831.

SNS -0.1048 DAT 10.000

The following sensors are tested:
A1 Aquatrak (Xpert)
L1 Battery (Xpert)
D1 Air Temp (Xpert)
E1 Water Temp (Xpert)
C1 Wind Sensor (Xpert)
F1 Barometer (Xpert)

B1 Druck Pressure Sensor (Xpert Dark)
C1 Redundant Wind Sensor (Xpert Dark)
L1 Battery (Xpert Dark)

(b) Kewaunee is broadcasting GOES messages, and is now up for testing:

9087068 Kewaunee, WI, latitude 44^0 27' 50" N, longitude 087^0 30' 04" W
Transmissions are on RDSI 6 Min Test 3.

GOES Transmission parameters are as follows: Platform ID 335EE760, Channel 147E, Transmit Time 00:01:25 (5 second window every 6 minutes), Transmitting as test station id 99999231.

SNS 0 DAT 178.484

The GOES parameters for deployment are:
Platform ID 336B23CE, Channel 150W, Transmit Time 00:04:48 (6 second window every 6 minutes)

The following sensors are tested:
V1 BEI Encoder (Xpert)

V1 BEI Encoder (Xpert Dark)
B1 KPSI 735T (Xpert Dark)

(A5) OET shall configure the test station in DMS and will inform the Tester that the station is ready to be tested. Once a test station is configured, Tester will have up to three weeks to complete the test. In most cases, it will only require a few days, but for new installations, the Tester may need additional time.

(A6) During the testing phase, Tester shall use the exact equipment that will be installed in the field, so that any problems can be identified and rectified prior to the installation. Instead of using the actual Station ID, the Tester shall use the Test Station ID and the assigned transmissions parameters for the testing purposes. OET has provided the test station numbers to the Testers and Installers.

(A7) Once the data has started to transmit properly, OET will check the data from the system under test in DMS, and OET will inform the Tester that the test is complete and the equipment is ready to be shipped to the field for the upgrade/installation. Tester shall also access the CO-OPS website to check the status of the transmissions and sensor data. Tester and OET shall provide a copy of the test results (data plots, e-mails) to be included in the station folder.

(A8) The Tester shall change the test station number to the correct station number in the DCP before the equipment is shipped to the Installer.

(A9) The Tester shall update the preliminary site report if any of the information has been changed during the testing phase and provide the preliminary Site Report and the data results from the end to end test to the Project Lead, Task Manager, Installer, OET, and to distribution, as necessary. OET will make the necessary configuration changes in DMS within 3 business days of the receipt of the site report.

(A10) For contract installations, after receipt of equipment from the Tester, the Contractor shall perform a pre-deployment bench test of the fully assembled and configured system, using Contractor-assigned test station ids by CO-OPS, to verify the operation of appropriate systems and sensors prior to deployment in the field. CO-OPS shall make available to the Contractor the decoder software to decode the raw satellite messages as an additional resource. The Contractor needs to have access to DOMSAT or permission to login to NESDIS for downloading raw data during this phase. The Contractor needs to use the assigned test Station ID for testing but needs to ascertain that the Test Station ID is changed to the correct Station ID before deployment.

The Contractor shall ensure that all equipment is functioning properly prior to transportation to the field. The Contractor shall document and communicate the results of pre-deployment testing to the Task Manager and OET, as appropriate.

(A11) The Project Lead/Task Manager/Installer, as appropriate, shall provide a schedule for the upgrade/installation to OET at least a month prior to the upgrade/installation.

(A12) For a station that is listed on the Hydro Hot List (HHL) and is used as a control station for a hydrographic survey but is planned to be upgraded, then Project Lead/Task Manager/Installer shall discuss the schedule with OET and the Hydro Planning Team (HPT), and postpone the upgrade of the control station till the survey is completed, if and when possible. This should be considered on a case-by-case basis.

The Hydro Hot List is available at http://tidesandcurrents.noaa.gov/hydro.shtml to determine if the affected water level station is listed as operational on the HHL.

For stations that are designated as Remote Stations by CO-OPS, there are additional requirements that need to be considered. For this type of situation, the Project Lead/Task Manager/Installer shall consult the CO-OPS Engineering Review Board (ERB). As additional requirements and SOPs are developed in this area, this SOP will be updated in the future.

(B) Upgrade of a water level station

The Installer shall obtain the transmission parameters from OET as listed in Section A2 above, and also provide an e-mail and the approved preliminary eSite or Xpert Site Report.

The Installer shall perform the specific sequence defined below for upgrading a water level station.

(B1) For upgrades, the Installer shall contact CORMS a few hours prior to the beginning of the upgrade, so that CORMS can notify appropriate personnel and stop the dissemination of data over the web, as appropriate.

(B2) Installer shall remove the older model primary DCP (Sutron 9000 or other) being sure to download the data prior to removal of the DCP. The downloading of all the available data shall be done for both primary and backup DCP and in some cases may involve downloading to various electronics media such as PCMCIA cards, flash cards, hard disks, etc. The intent is to download or copy data in electronic format.

(B3) Generally the bolt holes for the Sutron Xpert DCP box will match that for the older DCP box. But, if it is necessary to facilitate the installation of the new Xpert system, the 8200 DCP can be un-mounted from the wall and carefully placed on a table top, box, or even floor and shall be left running, if possible, while the primary DCP and sensor are being upgraded i.e. when primary sensor data is not available. The Installer shall ascertain that connecting cables are not kinked, broken, or pulled out.

(B4) If the Installer finds that the 8200 DCP cable lengths are not adequate for placing the DCP on the table or floor, where it can be left running, or for non-working 8200 DCP or sensor situations, then the Installer shall contact OET and discuss the situation and obtain the waiver from this requirement. This situation may develop for a station that

was not on the HHL during the planning step as described above, but was placed on the HHL thereafter. In that case, OET shall check the Hydro Hot List (HHL) to determine if the station is required for hydrographic or photogrammetric surveys, as appropriate, and the hydro/photo survey parties shall be notified by the POC of the situation and the possibility of no data for a few hours from the control station during the upgrade.

(B3) The Installer shall install the Sutron Xpert DCP, and upgrade only the primary sensor (acoustic A1, or Pressure N1/NT on the coastal side, and Shaft Angle Encoder V1 in the Great Lakes).

(B4) The Installer shall enable the satellite communications for the primary sensor through the primary DCP (Sutron Xpert).

(B5) The Installer shall contact OET to ascertain that the primary sensor is transmitting good valid data before disconnecting the existing Sutron 8200 DCP and the backup pressure sensor. Once OET confirms that the upgraded primary DCP and primary sensor are collecting and transmitting valid preliminary data, the Installer shall download the available data from the Sutron 8200 DCP, accounting for the time period when the primary sensor was not collecting data. The Installer shall then remove the older model Sutron 8200 DCP and the backup pressure sensor.

(B6) The Installer shall install the redundant DCP (Sutron Xpert Dark) and the redundant pressure sensor (Druck or equivalent).

(B7) The Installer shall enable the communications of the primary DCP (Sutron Xpert) and the redundant DCP (Sutron Xpert Dark).

The following steps are common to both installing a new water level station and upgrading an existing water level station.

(C1) The Installer shall install and enable the communications of the ancillary sensors, as appropriate, such as wind, barometer, water temperature, air temperature, etc., with the primary or redundant DCP, as appropriate. The installed DCP and the corresponding sensors shall match the project plan.

(C2) The Installer shall make certain that all other communication methods such as phone lines, modems, IP modems, etc., are working properly.

(C3) The Installer shall make certain that all system power related equipment such as batteries, solar panels, external AC chargers, etc., are working properly.

(C4) The Installer shall perform level runs and other required tasks as outlined in the appropriate project instructions and task orders, as necessary.

(C5) The Installer shall make certain that the upgraded water level station and all of the installed sensors are collecting good and valid preliminary data, and has received confirmation from OET that all DCPs and sensors are collecting good and valid data before departing the water level station. See additional communications requirements below.

(C6) When in the field, the Installer shall communicate the following with OET via a telephone call (and a follow-up e-mail to document the conversations, actions and results):

- If the tested equipment cannot be used because it was damaged during shipping or a spare sensor/equipment will be used for a valid reason, then the new serial number of the equipment and sensor offset shall be provided to OET.
- When the old Sutron 9000 DCP is taken down and when the Sutron Xpert is installed as described above.
- When the old Sutron 8200 backup DCP is taken down and when the Sutron Xpert Dark DCP is installed with corresponding appropriate sensors, as described above.
- The Installer confirms Sensor Offset (SNS or C1) and Datum Offset (DAT or C2) for acoustic primary sensors, or Accepted Orifice Offset for single/dual orifice primary Paroscientific sensors, or Accepted Datum Offset for the Great Lakes stations, and provides the leveling abstract after the completion of leveling run.
- OET will check the data transmissions from the primary and redundant DCPs and installed sensors in DMS with the predicted data, if available, and shall inform the Installer if there are any problems/issues, etc.
- The Installer shall resolve the problems/issues as discussed with OET, and then OET will inform the Installer that all the data is good. If some problems cannot be resolved, OET will advise the installer the course of actions needed for the resolution.
- Installer must not leave the station until OET informs the Installer that all DCPs and sensors are collecting good, valid, and continuous data. In addition, the Installers shall check with the Task Manager, Project Lead, or supervisors, as appropriate, to get permission to leave a site. The Installer shall also notify CORMS about the completion of the maintenance before departing the tide station.

(C7) OET shall designate station as “Installed/Upgraded” and the data are considered “Developmental” for both new and upgraded stations. OET shall inform appropriate personnel and organizations including CORMS and DMAT about the installation or upgrade.

(C8) After proper notification as described in the Declare Operational Guide, CORMS shall resume the dissemination of the data over the web.

(C9) In the case of a tsunami station, the POC informs NWS HQ that a station is installed or upgraded, and the POC also informs ATWC and PTWC that a station is installed or upgraded. This notification or subsequent notification to NWS HQ and to ATWC/PTWC may include declaration of a tsunami tide station as "Provisionally Operational" ("Tsunami-Capable" status), as appropriate. For existing stations, the notification will be quicker, because the accepted datums, predictions, etc will be available. For new stations, when all the proper and required data quality checks are performed, then data will be declared as "Fully Operational". The declaration of "Fully Operational" status of the data is covered in SOP under ROS Step 7.

(C10) The Installer shall provide all the required deliverables – all documentation and downloaded data - in a timely fashion as listed in the contract documents, or the Standing Project Instructions, as appropriate.

(C11) New installations and upgrades are encouraged to be completed on the weekdays and are generally not recommended for weekends. But if an upgrade or a new installation needs to be done on the weekend, then OET shall configure most of the information prior to the weekend, and the Installer shall call CORMS to make the switch during the weekend. In that case, the first business day after the weekend/holiday, OET will check the station, complete the configuration of datum offset, communicate with the Installer, and authorize departure from the station. Stations where acoustic sensors are switched to Paroscientific pressure sensors or vice a versa, or complex installations, work shall not be done on the weekends as the CORMS weekend switch procedure cannot handle these types of upgrades/installations on weekends and OET intervention is necessary for these types of installations.

(C12) The Installer shall provide the appropriate and necessary information to CORMS operator in case the upgrade/installation is done over the weekend. The Installer shall provide (a) the Station Name and Station ID (b) the assigned transmissions parameters - Platform Id, Channel, and Transmit Time (c) Parameter value (as defined below) to CORMS in the case of a weekend upgrade/installation. The sensor offset value (-0.xxx in meters) is the Parameter value required for a primary acoustic sensor and for a Microwave Water Level sensor. The Accepted Datum Offset value (xx.xxx in meters) is the Parameter value required for a Great Lakes station. The Accepted Orifice Offset(s) for N1 sensor (+/-xx.xxx in meters) is the Parameter value required for a single orifice station. The Accepted Orifice Offsets for N1 and T1 (+/- xx.xxx in meters) are the Parameter values required for a dual orifice station.

7. Quality Assurance/Control

During the procedures detailed above, various quality control measures are taken to prevent errors or mistakes from happening. During the throughput testing, OET verifies that the equipment that will be installed at the station is transmitting. OET checks if the equipment is working properly by checking data ingestion in the database. If data ingestion does not start or if data ingestion is intermittent, OET notifies the tester to fix the problem before the equipment is shipped to the site. When station numbers are

assigned, the OET personnel are required to have their station number calculation(s) verified by other OET personnel. After the crew finishes installing the station, the crew notifies OET and CORMS that the work is complete. OET will notify DMAT so that they can review the data. When review is done, DMAT notifies CORMS to turn on dissemination.

8. Management/Responsibility

OET is responsible for maintain and updating this SOP.

Acronyms:
ATWC – NOAA/NWS Alaska Tsunami Warning Center
CIL – Chesapeake Instrument Laboratory
CO-OPS – Center for Operational Oceanographic Products and Services
COR – Contracting Officer's Representative
CORMS – CO-OPS Continuous Operational Real-Time Monitoring System
COTR – Contracting Officer's Technical Representative
DCP – Data Collection Platform
DMS – Database Management System
EMT- CO-OPS Executive Management Team
EDRB – Engineering Design Review Board
FOD – CO-OPS Field Operations Division
GOES – Geostationary Operational Environmental Satellite
HQ – Headquarters
MSCB – CO-OPS Measurement Systems Configuration Board
NOAA – National Oceanic and Atmospheric Administration
NOS – NOAA National Ocean Service
NWS – NOAA National Weather Service
OET - CO-OPS/RDD Operational Engineering Team
POC – Point of Contact
PTWC – NOAA/NWS Pacific Tsunami Warning Center
RDD – CO-OPS Requirements and Development Division
RDSI – Research and Development Solutions, Inc.
ROS – CO-OPS Reliable Operating System
SIL – Seattle Instrument Laboratory
SMT– CO-OPS Senior Management Team
SOP – Standard Operating Procedures
TM – Task Manager