Uncabled Coastal Surface Piercing Profiler
Remote Operations

Control Number: 8310-62200
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Coastal and Global Scale Nodes
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Revision History

Version	Description	Originator	ECR No.	Release Date
0-01	Initial draft	J. Fram		2014-05-28
0-02	Revision and acoustic modem interface	J. Fram		2015-06-02

Table of Contents

List of Figures

List of Tables

1.0   Scope

This procedure is intended as a reference to Ocean Observatories Initiative (OOI) technicians for remotely operating uncabled coastal surface piercing profilers (uCSPP). The uCSPP is a WET Labs AMP. This document is intended to be used in concert with the uCSPP manual, AMPHostUsersGuide.pdf.

2.0   Purpose

The purpose of this procedure is to inform OOI technicians of the processes for remote uCSPP operation and how to document them. Remote operation of an uCSPP primarily involves knowledge of the AMP GUI interface. It also involves communicating via acoustic modem through the surface mooring adjacent to each uCSPP. Finally, operation also includes knowledge of how to handle emergencies.

3.0   Roles & Responsibilities

The scope and requirements of the procedure apply to all OOI personnel involved in uCSPP operations. Nearly the same procedure could be used by a technician at sea, although the procedure is written with the intent that the operator would be onshore connected via VNC to the OMC.

4.0   Reference Documents

AMPHostUsersGuide.pdf

AMPServerGuide.pdf

5.0   Definitions & Acronyms

OMC – Operations & Maintenance Center

OOI – Ocean Observatories Initiative

uCSPP – Uncabled Coastal Surface Piercing Profiler

AMP – Autonomous Moored Profiler

6.0   Procedure

Remote Operation of the uCSPPs includes interacting with an uCSPP during its moments on the surface when it calls in through an Iridium satellite connection. It is a complex task that requires full knowledge of the uCSPPs and the JProfilerHost interface software installed on the OMC. The technician shall have full familiarity with the AMPHostUserGuide manual and shall have completed the uCSPP training class offered by WET Labs.

6.1. Deployment

After the deck crew is ready to launch a uCSPP, the deploying technician sets the uCSPP to start profiling in 20-60 minutes so that is completely deployed before starting a profile. Upon initial surfacing, it is set to resurface every 8-15 minutes so that it can be checked and its configurations tweaked. This process is detailed in the deployment checklist, 8310-62702. When the uCSPP is ready for long-term operation, the deploying technician will set it to surface at its next scheduled time and then to return to the surface at its steady state profiling interval. The 25m uCSPPs nominally surfaces four times a day while the others surface twice a day. So, for example, if an 80m uCSPP is supposed to surface at 08:00 and 20:00 UTC each day, then the deploying technician would set the uCSPP to have a Start Time of 08:00 and a Profile Interval of 720 minutes. To load these settings on the uCSPP, the deploying technician would hit Start while the uCSPP is at the surface, or check Auto Apply before the

uCSPP surfaces. This is the state that the onshore technician should receive each uCSPP. Note, the uCSPP and the OMC should be on UTC.

6.2. Connecting to the OMC

Connect computer or smart phone to the OMC where the host program is installed via Global Protect. See an OMC system administration for password and directions on how to do this.

Connect to the profiler server running the host problem via VNC. For Endurance, this is 172.28.0.212.

The host program should be open because it was used during deployment. It should have a window with the control GUI, a window with a terminal screen, a profile log screen. One should also open a spreadsheet for use as a manual log.
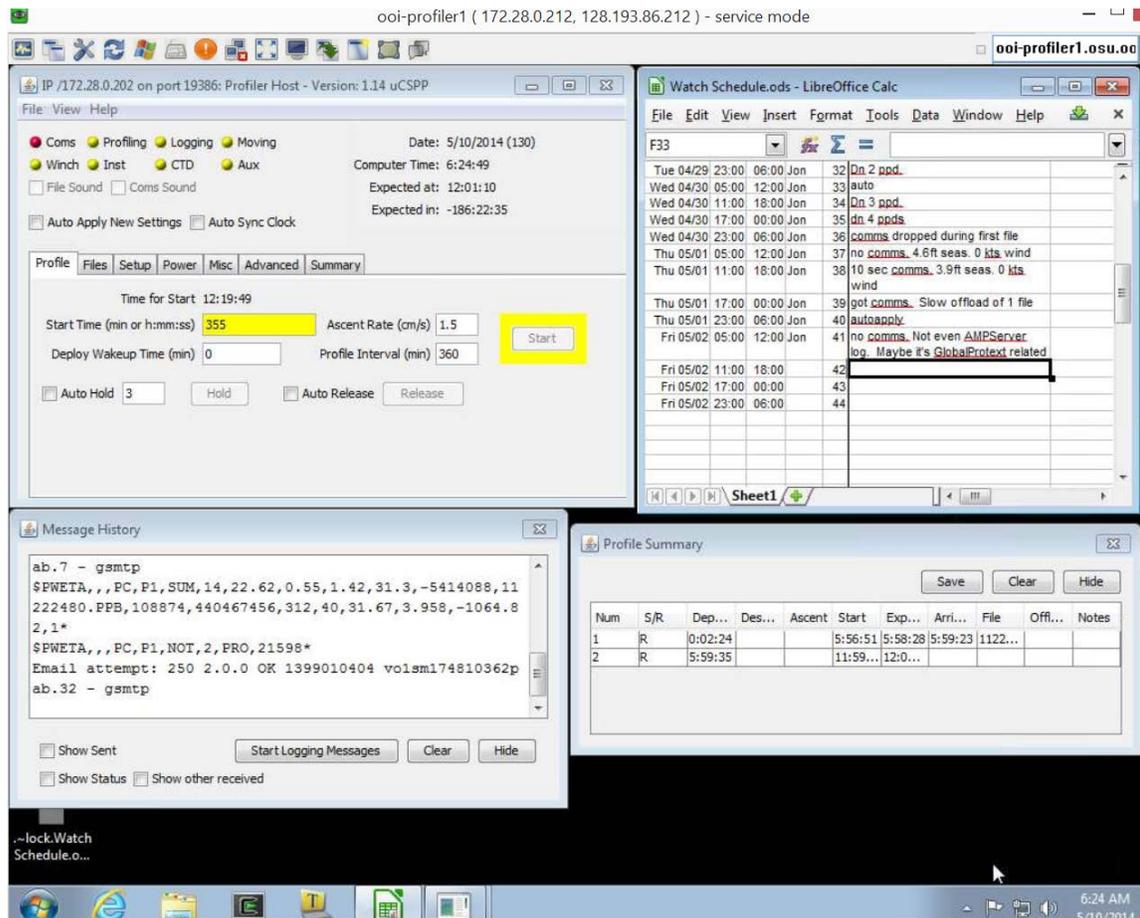
6.3. Setup for autonomous operation

In the Profile tab, select the radio boxes for Auto Release and Offload ppd. This will set up the uCSPP to offload a decimated data file during each surface interval and then return to the bottom. In the Advanced-Manual tab, enter commands to initiate wave height estimation and automatic response. See WHS, DFB, and WHE section in the AMPHostUsersGuide for how to start wave height estimation.

6.4. Scheduling around wave events

The uCSPP is specified to surface when significant wave height is up to 3 meters. Periodically, check the wave forecast. If it is determined that significant wave height will be above 3 meters, then over Iridium change the Start Time to when waves will be below 3

meters. There is no need to change the Profile Interval. Hit Start or Auto Apply to apply the new Start Time setting. Do not hit release because it will end a communications session without applying setting changes. It is also possible to change the Start Time via acoustic modem. See below for details. One can let the wave height estimator measure waves and then choose when to skip profiles, but as of summer 2015 the algorithm for making these decisions has not been shown to work well, so to be safe please manually command the profiler's to avoid the surface when necessary.

6.5. Routine Monitoring

6.5.1. Manual interactions

The profiler will usually establish communications about a minute and a half after it is scheduled to surface. If Auto Apply is selected, then the profiler will get new settings, send summary engineering data, (if selected) send decimated science data, and then return to the bottom. To interact manually with the profiler, deselect Auto Apply. Use Hold and Auto Hold to keep the profiler at the surface.

6.5.2. Start depth

During rough seas waves can unspool the winch while it is off between profiles. If it does this, then the winch's encoder will not log that the winch has unspooled. If this happens the profiler will park higher in the water column than it was set (if Home Spool is being used instead of Home Depth). Reduce Home Spool (even to negative numbers) if this happens. View the Start Depth plot in the Summary tab to determine if unspooling has occurred.

6.5.3. Ascent rate

The ascent rate is typically planned to be 25 cm/s. The mean ascent rate for each profile is plotted on the Summary tab. If it is too slow, which can happen with long intervals between profiles, then increase the Ascent rate by 0.1 units until the desired rate is achieved, and vice versa.

6.5.4. Automatic profile log

An e-mail sent by each profiler after each Iridium communications session. This e-mail includes a summary status message. It also updates the JProfilerHost's onscreen log file. It is OK if a session does not result in this message. During rough seas or high winds the profiler is not always able to maintain a solid Iridium connection. In general, expect about 60% of profiles to result in an e-mail.

6.5.5. Manual profile log

After checking on the profiler, enter what you have done to it and when, including any settings changes, files downloaded, and notable observations. To download files manually during an Iridium session, in the GUI's files tab, click to only view files that have not already been downloaded.

6.6. Troubleshooting

6.6.1. Beacon

If the SBD beacon sends an e-mail message, then the profiler is stuck at the surface. Check the Joubeh website to see if it has broken free or not (for Endurance, https//asset.joubeh.com, username OOI ENDURANCE, password OREGON). If not, try to open a communications session by Iridium to get it to wind down. If one cannot

connect via Iridium, reboot the profiler with an acoustic modem command (see below) and command it back to the bottom. If it will not return to the bottom, then it will need to be retrieved.

6.6.2. Breakaway e-mail

If the profiler determines that it has broken free, then it will send a breakaway e-mail. These e-mails are not always correct. Follow the JProfilerHost manual for addressing breakaway messages. When it goes into a breakaway state, the profile switches the antenna from Iridium to GPS. Go to the Advanced – Break tab, and click Break to get it back in Iridium mode before trying to communicate with it. It can also be returned to the breakaway state by turning on the winch then issuing a BT command. Also, try ranging to it via acoustic modem to see if it has truly broken away. If it has broken away, after a few hours the SBD beacon will confirm that is has done so. If it has not broken away, try issuing a break to get it out of the breakaway state and then sending it a PST command with a time for it to start profiling again. The profiler's breakaway behavior is being updated in summer 2015.

6.6.3. Missed Surfacing

There are many reasons the profiler may not communicate via Iridium as planned. The problem can be at the OMC, seas could be too rough, or the profiler may be stuck below the surface for mechanical, electrical, or software reasons. The uCSPP floats, so if one doesn't here from it for a long time, then it is likely still attached to its anchor. Mechanical reasons include overwrapping the winch, which requires recovery of the uCSPP. Mechanical failures are usually instigated by software failures that cause the profiler to sit too close to the surface for too long. Electrical reasons include bulkhead connector failures and are rare. Software reasons are too numerous to list here. First, check the acoustic modem log to see if responses to the regular acoustic modem messages are normal. Then check the AMPServer log to see if messages were sent, but full communications were not established. Follow debug suggestions in the manual, and then after a few days try to restart the profiler via acoustic modem.

6.6.4. Recovery from troubleshooting

If troubleshooting is successful, the next time the uCSPP surfaces, download the full debug (*.dbg) file to aid in figuring out what happened.

6.6.5. Retrieval

Follow the deployment / recovery procedure 8310-62702.

6.6.6. Read the manual

6.6.7. Live tech support

Contact Jon Fram at Endurance or Bruce Rhoades at WET Labs.

6.7. Data files

Science and engineering data will be telemetered to shore during each deployment.

6.7.1. Available data files

ppd : decimated science data files (except NUTNR and OPTAA)

snd: decimated SUNA/NUTNR data files

acd: decimated ac-s/OPTAA data files

dbg: full debug files

Many other file types are available, but the ones above should be the only ones downloaded over Iridium during a deployment.

6.7.2. Accessing data files

Data are stored on the OMC. Raw data are stored on the same computer as the JProfilerHost is running in, for example, the D:\uCSPP\CE01ISSP\ folder on 172.28.0.212. Use an ftp program such as FileZilla to access these data.

6.7.3. Checking data files

FTP them to a local machine. Run JMAFileProcessor to convert raw to ASCII data. In JMAFileProcessor one can see ASCII output, which can be used for cursory data quality checks. For more detailed analysis, one will need an external data analysis package such as Matlab. To feed CSPP data into OOI's CyberInfrastructure from JMAFileProcessor, click only Secs and Depth in the Format Options and do not click Correct Timestamps.

6.8. Acoustic modem

6.8.1. Usage

There is an opportunity for an acoustic modem session each time the neighboring surface mooring calls in to shore. Normally, one will schedule profiles in the hour before a surface mooring call so that one may communicate with the uCSPP if there is a problem immediately following each profile. Normally, a default set of commands will be sent, including a check of the distance between the acoustic modems on the uCSPP and surface mooring and a request for summary status message from the uCSPP. See JProfilerHost manual for details. If problems occur, one may initiate an unscheduled call, or one may send a different command set.

6.8.2. Logs

Data from each acoustic modem conversation are located in the OMC under the surface buoy DCL with the acoustic modem that talked with a CSPP. Log data are located on the OMC in a folder associated with the DCL that has the acoustic modem (e.g., /home/ce01issm/D00001/dcl17/ucspp). Here is an example:
2014/04/28 12:00:17.116 sent: +++
2014/04/28 12:00:17.684 rcvd: user:1>
2014/04/28 12:00:17.688 sent: ATR2
2014/04/28 12:00:21.443 rcvd: Range 1 to 2 : 175.6 m
2014/04/28 12:00:21.445 sent: AT$V2
2014/04/28 12:00:24.695 rcvd: Remote Battery Voltages
2014/04/28 12:00:24.714 rcvd: DSP Bat = 02.9V
2014/04/28 12:00:24.732 rcvd: Xmit Bat = 19.9V
2014/04/28 12:00:24.735 sent: ATD2
2014/04/28 12:00:27.990 rcvd: CONNECT 00800 bits/sec
2014/04/28 12:00:27.996 sent: $PWETC,,,BC,,DATE*48
2014/04/28 12:00:35.762 rcvd:
$PWETA,BC,,PC,P1,DATE,3,4/28/2014,12:00:38,0.0*14
2014/04/28 12:00:35.872 sent: $PWETC,,,BC,,PFS*19
2014/04/28 12:00:43.328 rcvd: $PWETA,BC,,PC,P1,PFS,1,13*5A
2014/04/28 12:00:43.445 sent: $PWETC,,,BC,,PST*0B

2014/04/28 12:00:51.223 rcvd:
$PWETA,BC,,PC,P1,PST,3,16:00:03,04/28/2014,14350*76
2014/04/28 12:00:51.338 sent: $PWETC,,,BC,,SUM*17
2014/04/28 12:00:59.920 rcvd: $PWETA,BC,,PC,P1,SUM,14,20.42,0.53,1.15,31.8,-
5308623,11184167.PPB,94179,452689920,184,24,32.04,4.025,-2059.01,2*08
2014/04/28 12:01:00.039 sent: +++
2014/04/28 12:01:00.131 rcvd: user:4>
2014/04/28 12:01:00.132 sent: ATH
2014/04/28 12:01:00.225 rcvd: Off Line

6.8.3. Commands

The default commands are:

+++
ATR2   get distance between modems
AT$V2   get modem battery voltages
ATD2   connect to profiler
$PWETC,,,BC,,DATE*48   get date
$PWETC,,,BC,,PFS*19   get profiler state
$PWETC,,,BC,,PST*0B   get profiler start time
$PWETC,,,BC,,SUM*17   get summary status
+++
ATH   close session

Common commands include PST to initiate a profile later than the normal profile interval. For example,

$PWETC,,,BC,,PST,2,18:00:00,05/31/2014*1C

After about a month the ac-s (OPTAA) will be useful because of biofouling, so one might want to turn that instrument and its associated pump off with the commands:

$PWETC,,,,,ENA,2,ACS,0*68

$PWETC,,,,,ENA,2,PMP,0*74

To get the profiler out of breakaway state, issue a break:

$PWETC,,,,,BREAK*02

To turn the wave height estimator algorithm on:

$PWETC,,,,,WHS,4,1,4096,0,1*32

To set the distance from bottom for the wave height estimator algorithm (example uses 3 meters):

$PWETC,,,,,DFB,1,3.0*01

To make the wave height estimator reply with the wave height (meters) and wave period (seconds) in the acoustic modem log, add to the default commands:

$PWETC,,,,,WHE*07

See JProfilerHost manual for the full command set.

Use WET Labs' checksum calculator, SumCalc, to calculate the value of the last two hex characters. To install SumCalc, first install JProfilerHost and JMAFileProcessor following the JProfilerHost manual. Doing this will make one set up Java libraries that

will enable SumCalc to run. The "checksum is calculated by a bitwise exclusive or of the characters from the $ up to, but not including, the * character." The command will work fine without any checksum. However, if a checksum exists, then the controller will use it to calculate whether the command preceding it was transmitted properly. The acoustic modem often garbles some or all characters in each command.

6.8.3.1. PSF Command Interpretation

0. PS_IDLE,   // Profiler Idle
1. PS_DEPLOY_START,   // Waiting for CTD to reach radio depth before sleeping
2. PS_DEPLOY_SLEEP,   // Sleeping state
3. PS_DEPLOY_WAKE,   // Winch Awake
4. PS_DEPLOY_DEPTH,   // Waiting on winch depth sensor
5. PS_DEPLOY_GO,   // Waiting on winch depth reply
6. PS_DEPLOY_MOVING,   // Waiting on winch motion
7. PS_SURFACE,   // attempting to surface
8. PS_DEPLOY_END,   // Surfacing following deploy sleep period
9. PS_HOME_START,
10. PS_HOME_LOG,
11. PS_HOME_GO,
12. PS_HOME_END,
13. PS_PRO_BEDTIME,
14. PS_PRO_SLEEP,
15. PS_PRO_WAKE,
16. PS_PRO_WHE,
17. PS_PRO_SETUP,
18. PS_PRO_END_SETUP,
19. PS_PRO_START,
20. PS_PRO_END,
21. PS_PRO_END_CMD,
22. PS_PRO_END_WAIT,
23. PS_PRO_POST_CAL,
24. PS_PRO_POST_TIMEOUT,
25. PS_PRO_GOTO_RD,
26. PS_PRO_SURFACE,
27. PS_PRO_HOLDING,
28. PS_PRO_RECOVER,
29. PS_BREAKAWAY,
30. PS_IRDMGPS,
31. PS_IRDMDELAY,
32. PS_PRO_CHECK_WAKE_DEPTH,
33. PS_RESET,

6.8.4. Command interface

6.8.4.1. Real-Time

If one needs to make sure a command is sent properly and quickly, then communicate with the uCSPP via the acoustic modem directly through a minicom session after SSH'ing into the DCL.

From the command line in CPM1 (assuming your acoustic modem is on Port

5 of DCL26):

```
ssh dcl26
cd current
bin/dlog_stop 5
bin/ucmd -b "_pon 5"
minicom port5
<ctrl>-a e        # turn on local echo

<communicate with the modem and the uCSPP> <see commands in 6.8.3>

<ctrl>-a q        # end minicom session
bin/ucmd -b "_poff 5"
bin/dlog_start 5
```

Be advised that the acoustic modem wants 18-24 VDC, but the DCL cannot provide it. Thus it is run at 12 V, which is right at the edge of what it can do. Sometimes, when other instruments are running, the DCL port browns out and the modem power cycles or it takes a long time (30+ seconds to power up as it charges capacitors). It may take some time once you've started the minicom session before the modem fully starts up (you'll see about 4 lines of startup text once it does). Consider turning off other instruments before attempting acoustic modem comms with the uCSPP. Also, if you haven't already done so, change the mission schedule so the modem only runs when other instruments do not.

6.8.4.1.   Scheduled

The procedure for issuing commands through scheduled mooring:

1. Make a new spp_commands.txt file that has been created using UNIX line endings (no crlf!). From a UNIX shell, use nano or one of the other editors on the OMC. From Windows, use Notepad++ or the equivalent for this.

2. Name the command file for the dcl it will be sent to, such as instCfg.dcl17.spp_commands.txt

3. Make a new outboundcmd file that has been created using unix line endings (no crlf!). The outbound file should FGET the file name of the command file, as in FGET instCfg.dcl17.spp_commands.txt

4. Using a sftp application like FileZilla or SSH, log into the mooring server, such as 172.28.0.202, using the mooring reference designator as the UID and PWD, such as user ce01issm and password !ce01issm. If spring, not fall, add "x" to the UID and PWD.

5. Put both files in the Cfg2Buoy directory for the active deployment e.g., cd ce01issm /D00002/Cfg2Buoy.

6. Wait until the next telemetry session with the buoy and following acoustic modem session from that buoy.

7. After the file is sent to the buoy, a *.DONE file will replace the command file.

8. If problems, see the top-level v2.1 design doc for uploading an SPP batch command file to the buoy

6.9. Iridium logs

These AMPServer logs keep track of all Iridium data exchanged between the profilers and the OMC. It shows all commands to the profiler ($PWETC) and responses from the profiler ($PWETA). Mostly, this log is used to see if the profiler is calling the OMC. Go to: /home/ooiuser/AMPServerLogs. Log in as ooiuser@172.28.0.202. One possible failure mode is that AMPServer may need to be restarted. See the AMPServer manual for details.

7.0   Attachments

N/A