Introduction:
The NBST is a Neutrally Buoyant, self contained autonomous Sediment Trap. Once deployed it actively adjusts its ballast seeking a pre-programmed neutral depth. Any variations in the depth greater than +/- 10 dB will be corrected. An alarm is set into the real time clock, this determines the overall mission length. At the conclusion of the mission a pin is retracted to close the sample tubes prior to surfacing. Once on the surface an external air bladder is inflated to provide additional buoyancy. It then begins to acquire GPS at hourly intervals. The position information is embedded into the Argos satellite beacon data to aid in recovery. There is also a small LED flasher to facilitate night recoveries. The instrument communicates via an RS-232 port and is menu driven. Any computer when running a terminal emulator can be used to test and program the NBST.

Testing:
It is recommended that the instruments to be deployed be run through a series of tests 3 to 5 days before being loaded on the ship. This provides an adequate amount of time to retest should a problem be encountered. While testing it is useful to maintain a log file for diagnostic purposes.

Storage and Handling:
While ashore, the instrument should be stored in a clean, temperature controlled area. There are a number of O-rings, in particular the pin O-rings that need to be kept clean. Always initiate a pin-out command wiping the pin with a lint free cloth before issuing a pin-in command. Store the pin in a ¾ retracted position, this relieves compression on the O-rings and unbinds the pin drive assembly. The instrument should be stored in the sleep mode to minimize power consumption between deployments. It is anticipated that a set of batteries will provide 6 months to a year of service. Always store the instrument with the comm. port boss plug installed as there can be a loss of vacuum over time if the port is left exposed.

Recovery:
After the sample tubes have been removed the instrument should be given a through fresh water rinse. Pay attention to the pin area, sleeve (air) bladder, and the pancake (oil) bladder. Dry the instrument before attempting to download data. The sockets on the end cap boss plugs must be cleared of water and the anti-chafe tube must be drained. Do not allow water to drip into the comm. port when communicating with the instrument. Always clean the top cap and boss plugs with lint free wipe and lightly grease the boss plug when sealing the instrument. DO NOT USE PAPER TOWELS!!

Contact Information:

WHOI 508-289-2263
Home 508-540-3021
Cell 508-498-0715  cell is on 24/7 !!
Pre-Cruise Testing:
With a terminal program (9600N81) running, attach a communications cable (align with care) to the comm. port and place a magnet over the ‘M’ on the top cap for 30 seconds to awaken the instrument. The Instrument responds with the MAIN Menu, see below:

SELECT YOUR OPTION
1. SET NBST PARAMETERS                             set time date depth
2. DISPLAY MISSION PARAMETERS   show mission parameters
3. RECOVERY AIDS test Argos, GPS, flasher …
4. RELEASE TEST move release pin in/out
5. PUMP AND VALVES test / set piston & air system
6. HARDWARE CHECK display battery, vacuum, T&P info
7. PRINT DATA save to .dat file
8. SET PISTON (BALLAST) when ready to launch
9. START MISSION low power sleep mode
10. GOTO SLEEP
11. CAL. & TEST
12. SET PISTON (ADJUST)
20. DELAYED START
77. RESET INIT. Prior to (1) & if there was an init. error

**** USE ALT-B TO REBOOT FROM EPROM PRIOR TO MISSION ****

WHAT YOU WANT BOSS? enter desired action

Step by step instructions:

At MAIN, hit return – flasher off, menu displayed
Enter 6, verify V1>900, V2>1400, Vac ~75 (<80), P & T

WHAT YOU WANT BOSS? 6
FLASHER off
V1= 102  V2= 154  Vac= 75  pres (cB)= 7  temp (mD)= 21588

Returns to MAIN Menu
Enter 5 – end for end the piston to exercise the batteries.
Piston in then out 10 seconds when parked and sleeping.

WHAT YOU WANT BOSS? 5
FLASHER off
BRAKE, PUMP, AIR VALVE, MENU (1 2 3 4)
SELECT 2
retract piston, extend piston, MENU (1 2 3)
Select 2 extending piston... hit any key to stop
fully extended
limit out
retract piston, extend piston, MENU (1 2 3)
Select 1 fully retracted
retracting piston... hit any key to stop
limit in
retract piston, extend piston, MENU (1 2 3)
Select 2 extend 10 seconds
extending piston... hit any key to stop spacebar to stop
limit out
retract piston, extend piston, MENU (1 2 3)
Select 3 previous menu
BRAKE, PUMP, AIR VALVE, MENU (1 2 3 4)
SELECT 3 test air system
pumps for dP = 8 counts or 2 minutes
inflating - hit any key to stop
Vst= 75 Vinf= 67
hit any key to deflate spacebar
data open
BRAKE, PUMP, AIR VALVE, MENU (1 2 3 4)
SELECT 4 previous menu

From MAIN menu
Select 4 exercise release pin

WHAT YOU WANT BOSS? 4
FLASHER off
RETRACT PIN, EXTEND PIN, MENU (1 2 3)
SELECT 2 extend pin
SELECT 1 retract pin
SELECT 2 stop ¼ out
SELECT 3 return to previous menu

From Main menu
Select 3 recovery aids
WHAT YOU WANT BOSS? 3
FLASHER off
PTT, GPS, STROBE, AUTO-POS, Print ARGOSS, MENU (1 2 3 4 5 6)
SELECT AN OPTION 3 Flasher (strobe) test
strobe on, off, MENU (1 2 3)
SELECT 1
FLASHER on
strobe on, off, MENU (1 2 3)
SELECT 2
FLASHER off
strobe on, off, MENU (1 2 3)
SELECT 3 previous menu
PTT, GPS, STROBE, AUTO-POS, Print ARGOSS, MENU (1 2 3 4 5 6)
SELECT AN OPTION 1 Argos PTT test
Testing Argos PTT - single tx cycle
A5272001123456789012345678901234567890123456789012345678901ABC000000
CRC= 11C7
test message sent
PTT, GPS, STROBE, AUTO-POS, Print ARGOSS, MENU (1 2 3 4 5 6)
SELECT AN OPTION 1
Testing Argos PTT - single tx cycle
A5272001123456789012345678901234567890123456789012345678901ABC000000
CRC= 11C7
test message sent
PTT, GPS, STROBE, AUTO-POS, Print ARGOSS, MENU (1 2 3 4 5 6)
SELECT AN OPTION 6 previous menu
Assuming all has gone well set the parameters for a test mission. Typical mission shown.

From the MAIN menu
Select 1 program mission parameters
WHAT YOU WANT BOSS? 1
FLASHER off
SET TIME, MISSION LENGTH, AUTO-BALLAST, S_DET, PTT, MAIN MENU (1 2 3 4 5 6)
SELECT AN OPTION 1
Year (2 digit): 07
Month: 06
Day: 19
Hour: 10
Minute: 26
Second: 15

THE TIME IS 10:26:15 ON 06/19/07
SET TIME, MISSION LENGTH, AUTO-BALLAST, S_DET, PTT, MAIN MENU (1 2 3 4 5 6)
SELECT AN OPTION 2
minutes set at = 00
Year (2 digit): 07
Month: 06
Day: 19
Hour: 21

THE NBST WILL SURFACE ON (M/D/Y @ Hr) 06/19/07 @ 2100
SET TIME, MISSION LENGTH, AUTO-BALLAST, S_DET, PTT, MAIN MENU (1 2 3 4 5 6)
SELECT AN OPTION 3
NEUTRALLY BUOYANT DEPTH IN CBARS, ENTER 0 TO DISABLE 1500
NBST WILL SEEK A DEPTH EQUAL TO 1500 cB
SET TIME, MISSION LENGTH, AUTO-BALLAST, S_DET, PTT, MAIN MENU (1 2 3 4 5 6)
SELECT AN OPTION 4
SURFACE DETECTOR OFF, ON (1 2)
SELECT 1
SURFACE DETECTION OFF

SET TIME, MISSION LENGTH, AUTO-BALLAST, S_DET, PTT, MAIN MENU (1 2 3 4 5 6)
SELECT AN OPTION 6

SELECT YOUR OPTION
1. SET NBST PARAMETERS
2. DISPLAY MISSION PARAMETERS
3. RECOVERY AIDS
4. RELEASE TEST
5. PUMP AND VALVES
6. HARDWARE CHECK
7. PRINT DATA
8. SET PISTON (BALLAST)
9. START MISSION
10. GOTO SLEEP
11. CAL. & TEST
12. SET PISTON (ADJUST)
20. DELAYED START
77. RESET INIT.
*** USE ALT-B TO REBOOT FROM EPROM PRIOR TO MISSION ***

WHAT YOU WANT BOSS? 2 display mission parameters
FLASHER off

NBST13 Mission Parameters

THE TIME IS 10:27:30 ON 06/19/07
THE NBST WILL SURFACE ON (M/D/Y @ Hr) 06/19/07 @ 2100
NBST WILL SEEK A DEPTH EQUAL TO 1500 cB
SURFACE DETECTION OFF
Argos ID is A5272 00

From MAIN menu
Select 9 start mission – follow NBST flow chart
WHAT YOU WANT BOSS? 9
FLASHER off
STARTING MISSION ... I’LL BE BACK ... CUL !!
FLASHER on
MISSION STARTED AT
THE TIME IS 10:30:01 ON 06/19/07
NBST13 IN MISSION, SEE YOU LATER ...
THE NBST WILL SURFACE ON (M/D/Y @ Hr) 06/19/07 @ 2100
NBST WILL SEEK A DEPTH EQUAL TO 1500 cB
valve open
Prepare Instrument for Launch
hit any key to exit
swipe magnet to initiate pre-launch check
bladder inflates when complete
swipe magnet when ready to launch
extending release pin
end of travel ... locked
FLASHER off
USE MAGNET TO CONTINUE (1) as prompted
hit any key to exit
FLASHER on
continue after pause #1
checking vital signs at 10:30:37 ON 06/19/07
CPU (90)= 101 PVP (120)= 153 Vac (85)= 74
Status (ST) = 0
retracting piston... hit any key to stop
limit in
inflating - hit any key to stop
Vst= 75 Vin= 67
FLASHER off
passed pre-launch tests - prepare sample tubes
USE MAGNET TO CONTINUE (2) as prompted
unplug comm cable now
unplug cable

Disconnect comm. cable and install plug on comm. port. Secure the instrument in a stable location outside with a clear view of the sky. It is recommended that the surface time be chosen so the steps can be observed in real time. Verify Argos reception (test Rx), and
strobe operation – 7 PM to 6 AM. Follow the recovery steps to download data and place the instrument into the low power sleep mode.

LAUNCH PREPARATIONS:

Follow the instructions for pre-cruise testing to initialize the instrument for deployment. Open a log file to save the initialization data. See the NBST launch flow chart for the deployment sequence. Verify and double check the instrument initialization – check the clock and surface time and dates, any errors here can be fatal!! Remember, it is necessary to reset (77) the instrument if any of the initialization data requires changes. When satisfied select (9) from the main menu.

Follow the flow chart. The instrument will extend the release pin and wait pending a swipe of the magnet to continue (pause 1). To continue hold the magnet in position and observe the terminal. The flasher will be activated and the instrument will start a self test sequence – voltages, vacuum and the bladder will be tested. Assuming all is well, the piston will be fully retracted and the air bladder will be inflated. The instrument is in pause 2 and the flasher is off. Remove the comm. cable as instructed, clean and install the comm. port boss plug. The instrument is now ready for launch. Move the NBST to the deck, and take up tension on the pick-up line to provide some stability. Install the tubes and secure with the Titanium hardware provided. Fill the tubes with cold filtered seawater from 150 dB and spike with the brine solution. Double check the m/s plugs are installed and secure and insert the sleeve and washer over the pin. Slip the tube lanyards over the pin from the front half of the top so the pull on the pin is uneven. When ready to launch, hold the magnet in position until the flasher is activated. The instrument will cycle the flasher on and activate the Argos transmitter 5 times before deflating the bladder. It is now ready for launch. The flasher will continue to flash on the minute for 15 seconds for 90 minutes or until the instrument exceeds 30 dB in depth.

RECOVERY:
The NBST starts the recovery sequence at the preprogrammed time. While at depth it retracts the pin to close the tube covers then extends the piston to increase its displacement rising to the surface. This requires 40 + minutes from 150 dB. Once on the surface it acquires a GPS position (20 minutes max.), before activating the Argos transmitter. GPS is then updated on the hour. The GPS position data (Lat., Long., & Time) is embedded (plain text) into the Argos message. Currently the data is being forwarded to sci11 on the Atlantic Explorer. Keep in mind that there can be 2 to 3 hours latency in the data being sent to the ship. Once on deck the sample tubes are removed (do not lose the hardware) and the instrument should be given a fresh water rinse. Remove any excess from the top cap and anti-chafe tube before attempting to communicate with the instrument. Open a log file and install the comm. cable, place a magnet over the ‘M’ to establish communications.

Follow the instructions to dump the data. The download will return you to the MAIN menu. Back up the data on a second (NBSTxx_MO.DAT) file.
min= 10  ** use magnet to exit

HELLO - GOOD TO SEE YOU

FLASHER off
HIT ANY KEY 5 TIMES TO CONTINUE
DATA FROM NBST13
DATA IN 10 SECONDS

<table>
<thead>
<tr>
<th>BAT (V1)</th>
<th>BAT(V2) Vac</th>
<th>PRESSURE</th>
<th>TEMPERATURE</th>
<th>Q</th>
<th>PLST</th>
<th>L</th>
<th>DPDT</th>
<th>DPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>154</td>
<td>73</td>
<td>320</td>
<td>8245</td>
<td>0</td>
<td>314</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>102</td>
<td>150</td>
<td>73</td>
<td>405</td>
<td>4924</td>
<td>0</td>
<td>405</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>103</td>
<td>151</td>
<td>73</td>
<td>749</td>
<td>2765</td>
<td>0</td>
<td>405</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>102</td>
<td>152</td>
<td>73</td>
<td>1220</td>
<td>1994</td>
<td>0</td>
<td>405</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>102</td>
<td>153</td>
<td>72</td>
<td>1622</td>
<td>2047</td>
<td>0</td>
<td>1622</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>102</td>
<td>153</td>
<td>73</td>
<td>2006</td>
<td>2686</td>
<td>0</td>
<td>1622</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>102</td>
<td>153</td>
<td>73</td>
<td>2360</td>
<td>3095</td>
<td>0</td>
<td>1622</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>102</td>
<td>149</td>
<td>72</td>
<td>3140</td>
<td>3350</td>
<td>0</td>
<td>3265</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>102</td>
<td>150</td>
<td>72</td>
<td>3006</td>
<td>3301</td>
<td>0</td>
<td>3265</td>
<td>40</td>
<td>18</td>
</tr>
<tr>
<td>102</td>
<td>151</td>
<td>71</td>
<td>2561</td>
<td>2948</td>
<td>0</td>
<td>2054</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>101</td>
<td>152</td>
<td>71</td>
<td>2064</td>
<td>2889</td>
<td>0</td>
<td>2064</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>152</td>
<td>71</td>
<td>1854</td>
<td>2715</td>
<td>0</td>
<td>1854</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>100</td>
<td>152</td>
<td>71</td>
<td>1852</td>
<td>2735</td>
<td>0</td>
<td>1852</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>152</td>
<td>71</td>
<td>1685</td>
<td>2594</td>
<td>0</td>
<td>1685</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>100</td>
<td>152</td>
<td>71</td>
<td>1689</td>
<td>2412</td>
<td>0</td>
<td>1689</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>152</td>
<td>71</td>
<td>1582</td>
<td>2153</td>
<td>0</td>
<td>1582</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1634</td>
<td>2180</td>
<td>0</td>
<td>1634</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>152</td>
<td>71</td>
<td>1544</td>
<td>1956</td>
<td>0</td>
<td>1544</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1535</td>
<td>1958</td>
<td>0</td>
<td>1535</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1542</td>
<td>1966</td>
<td>0</td>
<td>1542</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1531</td>
<td>2000</td>
<td>0</td>
<td>1531</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1502</td>
<td>2032</td>
<td>0</td>
<td>1502</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1538</td>
<td>2008</td>
<td>0</td>
<td>1538</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1557</td>
<td>1994</td>
<td>0</td>
<td>1557</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1577</td>
<td>1993</td>
<td>0</td>
<td>1577</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1612</td>
<td>2001</td>
<td>0</td>
<td>1612</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1479</td>
<td>1887</td>
<td>0</td>
<td>1479</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1401</td>
<td>1845</td>
<td>0</td>
<td>1401</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>100</td>
<td>153</td>
<td>71</td>
<td>1443</td>
<td>1820</td>
<td>0</td>
<td>1443</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1438</td>
<td>1853</td>
<td>0</td>
<td>1438</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1421</td>
<td>1870</td>
<td>0</td>
<td>1421</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1423</td>
<td>1858</td>
<td>0</td>
<td>1423</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>100</td>
<td>154</td>
<td>71</td>
<td>1419</td>
<td>1864</td>
<td>0</td>
<td>1419</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>
After downloading data, reset (77) the instrument to deflate the bladder. The release pin should be fully extended and ‘parked’. It may require multiple attempts to extend the pin as it seats hard under pressure. Once fully extended - dry and lubricate the pin with a drop of oil. Retract the pin until it is ¾ retracted. Likewise, the main piston should be fully retracted then extended for 10 seconds. Select 10 from the MAIM menu to place the instrument in the low power sleep mode. Remove the comms cable and install the plug after cleaning and lubricating the O-ring. Store the instrument in a safe secure location.
NBST _____ By ____________________       NBST pre-deployment log sheet  7/23/2007

Date ___________________     

Hardware

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V2</th>
<th>Vac</th>
<th>Pres</th>
<th>Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston</td>
<td>Extend</td>
<td>Retract</td>
<td>Set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Bladder</td>
<td>Inflate</td>
<td>Deflate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Release Pin</td>
<td>Out</td>
<td>Lube.</td>
<td>In</td>
<td>Set</td>
<td></td>
</tr>
<tr>
<td>Strobe (flasher)</td>
<td>On</td>
<td>Off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argos PTT</td>
<td>Tx</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Mission

(1) Timeset _____:_____:_____ on ____/____/____
Surface date ____/____/____ at ____00 hours
Depth _____ 1500 cB
Surface _____ off

(2) Time is _____:_____:_____ on ____/____/____
Surface on ____/____/____ at ________ hrs
Seek (depth) ________

(9) Mission started _____:_____:_____ on ____/____/____

After completion of test mission ....

Data OK?? ____________  Argos received ____________
GPS Positions ______________ N ______________ W
Reset (77) ________ Pin set _____ Piston set _____
Sleep _____ Time / Date ________ / ____________

Actual Mission

(1) Timeset _____:_____:_____ on ____/____/____
Surface date ____/____/____ at ____00 hours
Depth _____ 1500 cB
Surface _____ off

(2) Time is _____:_____:_____ on ____/____/____
Surface on ____/____/____ at ________ hrs
Seek (depth) ________
Surface ________
Mission started _____:____:____ on _____/_____/_____

Time - Pause (2) ________ (lab)
Continue ________ (deck)
Launched ________ N ________ W
Sank (fully submerged) ________

After Recovery
Open log file ____________.log
Data OK?? ________ Argos received ________
Backup data file ____________.dat
Recovery position ________ N ________ W
Reset (77) ________ Pin set _____ Piston set _____
Sleep _____ Time / Date ________ / ________