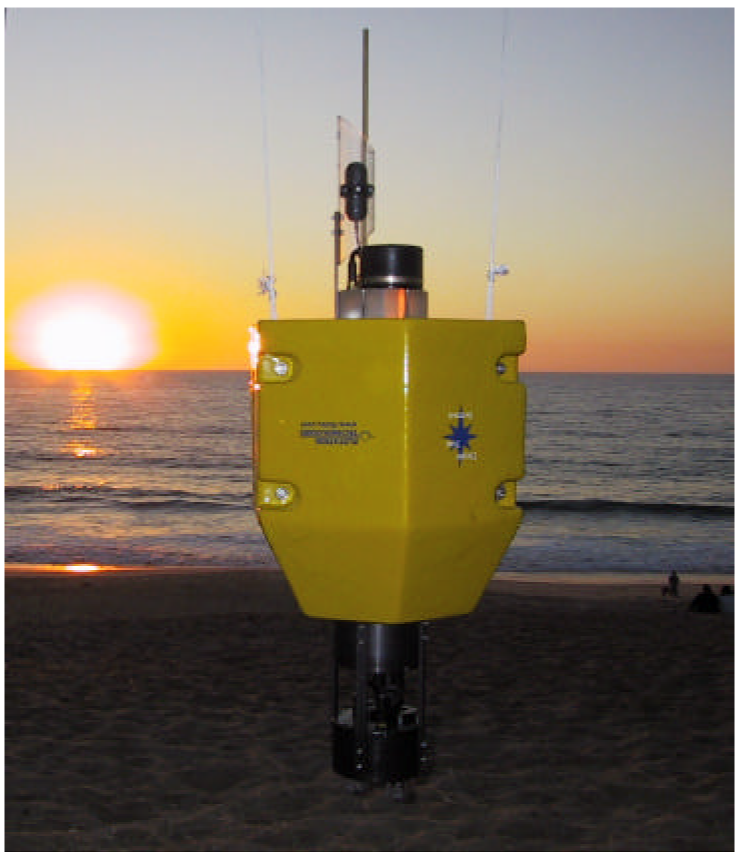
OADR-TM
Rev. 1

Omnidirectional Acoustic Data Recorder



Technical and Operator's Manual
1st Edition, January 2001

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1. Introduction

The Omnidirectional Acoustic Data Recorder (OADR) is a complete system for the autonomous acquisition of high-fidelity acoustic data at depths up to 4000 m.

It is applicable for a variety of acoustic measurements, including ambient noise analysis, detection and analysis of noise from ships, whales or other marine life, or evaluation of oceanic acoustic signal propagation.

The standard instrument records sounds in the range from 2.5 Hz to 2.5 kHz, with a sample rate of 6554 Hz and a resolution of 16-bit (96 dB). High gain and low gain settings further extend the dynamic range, for a total coverage of 44 dB re.1µPa to 200 dB re. 1µPa with the standard hydrophone. The self-noise of the OADR (without hydrophone noise) ranges from 24 dB re. 1 µPa/√Hz at 2500 Hz to 42 dB re. 1µPa/√Hz at 2.5 Hz.

The OADR can be configured for operation at frequencies up to 10 kHz (20 kHz sample rate). The field replaceable hydrophone allows changes of sensitivity as desired.

The OADR is designed for autonomous sea floor operation for missions extending from hours up to six month. Battery life and storage capacity is sufficient for up to 150 hours of data recording at 6554 samples/sec.

The OADR's deployment and recovery system includes a flotation collar, dual acoustic release mechanisms, a strobe, a RF beacon and an acoustic telemetry system for remote control at distances of up to 5 km.

Carefully integrated redundancy increases the availability and survivability of the system. The redundant systems include the dual release mechanisms, dual release and strobe / RF beacon control electronics, dual hard disks and a lithium backup battery serving as an alternate power source to the primary battery for system recovery functions. The software includes COP (CPU Operating Properly) functions to recover from any crash of the main processor or the various micro controllers in the system. A system self-test warns the operator of any failures just prior to deployment.

The OADR system includes a surface station, through which remote OADR activation, mission abort and ranging (distance measurement) functions can be exercised. The surface station is also available to program mission profiles and recover and inspect acoustic data. Exabyte tape is supported for bulk data storage.

The OADR is a software based system, and much processing power is available in its DSP chip and peripheral micro-controllers. The instrument is programmed in ‘C’, and can be easily adapted for task specific functions such as acoustic signal interpretation.

Despite its sophistication, the OADR is straightforward to operate. All information needed for standard operation is contained in this manual.

2. OADR System Components

OADR Instrument, Surface Station and Tape Drive

The principal components of the OADR system are the OADR instrument, the attached hydrophone and the surface station

OADR Instrument

The instrument acquires and records the acoustic data. Located inside is the VSON-1 acoustic data acquisition module, the VCPU-56 digital signal processor (DSP), the VMEM-1 FLASH memory module (128 Mbyte standard) for intermediate data storage, two Firewire hard disks (12 Gbyte standard) for final data storage, a main smart power management module (VPOW-1) a second smart power management module (VPOW-1) used as a backup trigger for the instrument recovery functions, two main battery packs, a backup battery pack for the recovery functions, a RF beacon and a strobe light.

The release mechanism pod is bolted to the OADR instrument, and electrically connected by two cables. This oil-filled, pressure-compensated pod contains two independent solenoid driven anchor weight release mechanisms, each housed in its own independently sealed compartment.

There are three connectors on the housing end-cap, two for establishing the link with the release mechanism pod, and one multi-function connector for data download, OADR programming, code installation, charging and debug functions.

A status LED indicates the OADR's mode of operation and signals errors. A rotary magnet-based power knob (without a feed through!) is used to switch the station OFF, ON or into AUTOMATIC mode.

The translucent end-cap houses the strobe light. Mounted on this end-cap are an oil-filled sonar transducer (8 kHz – 16 kHz) for acoustic telemetry (instrument control), an antenna connector for the RF beacon, and a 2–pin connector for the dual-gain hydrophone.

A syntactic foam flotation collar provides the OADR with about 10 kg (22 pounds) of flotation.

Hydrophone

The dual-gain hydrophone attached to the OADR acquires and amplifies the acoustic signal. The standard hydrophone is a High-Tech, Inc. model HTI-90-U/DS with an acceleration canceling assembly. The sensitivity settings and cut-off frequencies can be specified to meet a particular need. The hydrophone can be switched in the field.

Surface Station

The surface station is used to program the OADR in preparation for a mission. During deployment and recovery, it communicates with the OADR using acoustic telemetry. The distance to the OADR can be measured, and commands for mission activation and mission abort (return to surface) can be issued to the OADR.

After recovery, the surface station is used to retrieve data from the OADR, inspect the data and transfer the data to tape. The surface station also is used to charge the OADR.

The surface station consists of a model STM-10 acoustic tracking and command unit, a notebook PC and an Exabyte tape drive. The notebook computer can be placed on the instrument panel of the STM-10. It communicates with the STM-10 through a RS232 serial port. Communication between the PC and the OADR is through Firewire for programming and data retrieval, and RS232 for software installation and diagnostics. A SCSI interface links the PC to the Exabyte tape drive.

The following table lists the standard components of the OADR system and their Desert Star part numbers. Please verify that you have received these components.

Component	Function	Part #
OADR Instrument	Omnidirectional Acoustic Data Recorder, 4000 m depth rating, incl. accessories.	OADR-1D
Dual-Gain Hydrophone	Acquires & amplifies acoustic data, High-Tech Inc. model HTI-90-U/DS with acceleration canceling assembly and mounting rod. Standard gain is –155 dB and –220 dB, standard frequency range 2.5 Hz – 2.5 kHz	TDC00031
RF Beacon Antenna	Antenna, 17" for RF Beacon	TDC00030
Flotation Collar	Syntactic foam collar, provides 10 kg (22 lb)of flotation, 4000 m depth rating	FLOAT-3D
OADR Connector Adapter Cable	Link between OADR multi-function connector and accessories	MAID-SM8
OADR Charger Cable	For charging the batteries of the OADR. Connects between STM-10 PC-Power port and connector adapter.	CBL00011
OADR Firewire Cable	Firewire link between PC and OADR. Connects between Firewire port of PC and	LINK-FW6

	connector adapter. 6-pin Firewire connector. (Use LINK-FW4 for 4-pin Firewire connector)	
OADR RS232 Cable	Used for code download to OADR and diagnostic functions. Connects between COM port of PC and connector adapter.	LINK-V
Acoustic Release Module Cable	Connects between OADR main housing and acoustic release pod. Two cables are supplied, for the two independent mechanisms.	CBL00000
Surface Acoustic Tracking & Command Unit.	Used for remote control of the OADR. High-power and low-frequency options for extended range. Incl. accessories.	STM-10LH
Surface Station Transducer	8 kHz – 16 kHz ‘over the side’ sonar transducer for STM-10LH. Includes 15m cable.	TD-S10
Surface Station Transducer Cable	15m surface transducer cable.	CBL-S50
DiveBase Level 2	Surface Station software for acoustic remote control of the OADR	DB-L2
OADR Utility Software Pack	Includes OADR control software, and utilities for firmware installation.	OADR-SW
OADR Technical & Operator’s Manual	This manual.	OADR-TM

Standard (Desert Star Manufactured or Supplied) OADR Components

These components are third party items of a typical OADR system. This list is for guidance only. Components are purchased to meet your requirements.

Component	**Description**
Notebook PC	For control of the OADR system, data retrieval and data inspection. Typical computer is Rocky Jr. by Amrel, a ruggedized notebook computer. The OADR application requires at least 32 Mbyte of RAM (64 Mbyte recommended), and Windows 2000.
Firewire PCMCIA Card	Used if the notebook computer does not include a Firewire port.
SCSI PCMCIA Card	Used to link the notebook computer to the Exabyte tape drive.
Exabyte Tape Drive	Used for final data storage. Exabyte manufactured or compatible tape drives may be used.

Third-Party Components of The OADR System

3. OADR Connectors, Switches and Status LED

This chapter describes the connectors, switches and status LED of the OADR instrument only. Please refer to the STM-10 Technical Reference Manual for a description of the surface station.

3.1. Connectors

There are five connectors on the OADR main housing, and two connectors on the acoustic release mechanism pod.

Multi-Function Connector

The OADR is charged through this connector. The Firewire port for programming the instrument and retrieving acoustic data is available here. A RS232 serial data port is used to install software updates, or monitor the operation of the instrument. During deployment, this connector must be terminated with the 8-pin dummy plug.

Bulkhead Connector: Subconn MCBH8F
Cable Connector: Subconn MCIL8M

Pin	Function
1	Ground
2	TXD
3	RXD
4	FireWire TPA+
5	FireWire TPA-
6	FireWire TPB+
7	FireWire TPB-
8	Battery Charge Input

Acoustic Release Connectors

There are two acoustic release connectors on the OADR main housing, and two matching connectors on the release mechanism pod. These two sets of connectors control the two mechanisms in the pod. The connectors on the main housing and the release mechanism pod must be linked during deployment using Desert Star cable #CBL00000.

Bulkhead Connector: Subconn MCBH2F (main) MCBH2M (pod)
Cable Connector: Subconn MCIL2M (main) MCIL2F (pod)

Pin	Signal
1	Release Trigger (switched to ground)
2	30 V Supply Voltage

Hydrophone Connector

Located on the transparent end-cap of the OADR main housing, this connector establishes the connection to the hydrophone. The connector must be mated to the hydrophone during deployment.

Bulkhead Connector: Subconn MCBH2F

Pin	Signal
1	Hydrophone - / Signal Out

2	Hydrophone +

Antenna Connector

Located on the transparent end-cap of the OADR main housing, this connector establishes the connection to the RF antenna. The connector must be mated to the 17" antenna during deployment.

Bulkhead Connector: Subconn antenna connector

Pin	Signal
1	RF Output

3.2. The Power Switch

The OADR power knob is located on the metal end cap. It is based on a magnetic field, so there is no penetration of the OADR housing. The screw in the center of the knob can be adjusted to increase or decrease the friction of the knob. Use blue Loctite to lock the screw in the desired setting.

The knob has three valid settings.

- When turned to the OFF position, the OADR is off.

- When turned in the ON position, all OADR systems are activated (and consuming power). Use this setting to activate the OADR. After a successful self-test, the knob should be turned to the AUTOMATIC position discussed below.

- The AUTOMATIC position is selected by turning the knob half way between ON and OFF (90 degrees from both ON and OFF). In this mode, the internal software decides if the OADR should be active or sleeping. This setting must be selected before OADR deployment. Failure to do so (leaving the knob in the ON position) will quickly drain the OADR power.

3.3. The Status LED

A status LED is located on the metal end cap.

Several blink patterns indicate the current state of the OADR.

Blink Pattern	Meaning
LED off	OADR is switched off or is sleeping
½ second ON; ½ second OFF blink	OADR is initializing, power-up
7/8 second ON; 1/8 second OFF blink	OADR self-test in progress
Triple-blink, once per second	Self-test failed, diagnostic information available through RS232 port.
Single short blink, once per second	Self-test OK, OADR is ready for operation. The power knob should be turned to the AUTOMATIC position when this blink pattern is seen.
Rapid blinking	The OADR battery is NOT FULL. This blink pattern occurs when the battery is at about 75% capacity. Charge the battery before deployment.
1 second ON; 1 second OFF blink	The battery is charging. This pattern is seen when connecting the charger.
1 second ON; 3 second OFF blink	Battery charging is completed. The charger can be disconnected.

OADR Status LED Blink Patterns

4. Operating the OADR

This chapter describes operation of the OADR in the chronological order of a mission. The table summarizes the progress of a mission. Please note that this chapter describes operation of the STM-10 surface station only as it applies to the mission. For a more detailed description, refer to the STM-10 Technical Reference Manual.

Mission Phase	**Description**	**Section**
Charging the Batteries	The battery of the OADR is charged by connecting the OADR to the PC-Power port of the STM-10 using the charger cable.	4.1.
Programming a Mission Profile	The OADR is connected to the PC through the Firewire cable. The OADR control application is used to define a mission profile.	4.2.
OADR Self-Test	The OADR executes a basic self-test whenever activated; a more complete self-test can be done by running a short test mission.	4.3.
OADR Deployment	The OADR is lowered into the water. It is interrogated by the STM-10 surface station to see if acoustic communication works. A mission can be automatically aborted in case the OADR cannot communicate with the surface station.	4.4.
Acoustic Data Acquisition	The OADR automatically acquires acoustic data on the sea floor.	4.5.
OADR Recovery	Triggered by an acoustic command, or the expiration of the mission time, the OADR drops its anchor weight and returns to the surface.	4.6.
Data Retrieval and Inspection	Data is recovered from the OADR through the Firewire link. The data can be inspected and transferred to Exabyte tape.	4.7.
Storing the OADR	The OADR can be switched OFF and stored. Be aware however of the mission-abort trigger of the release mechanism, strobe and beacon. This will occur even if	4.8.

	the knob is in the OFF position, and can drain the battery.	

Phases of an OADR Mission

4.1. Charging the Batteries

The OADR instrument is powered by two rechargeable NiMH battery packs. To charge the packs, connect the OADR through the connector adapter and the charger cable to the PC-Power port of the STM-10. Plug the STM-10 into AC power, but leave the TRACK/OFF/CHARGE switch in the OFF position.

Now, rotate the OADR power knob to the ON position. Charging will start after a few seconds of initialization. Watch the OADR status LED for charge status information.

- A blink patter of one second ON, one second OFF indicates that charging is in progress.
- When charging is completed, the blink pattern will change to one second ON, three seconds OFF.

The OADR charge time from complete empty is about 12 hours. The OADR main battery voltage is displayed upon station activation in the control software. When fully charged, battery packs should be at about 18.2 Volts (1.3 Volt/cell). The OADR also displays a ‘battery not full’ blink pattern (rapid blinking) when the battery is down to about 75% of capacity.

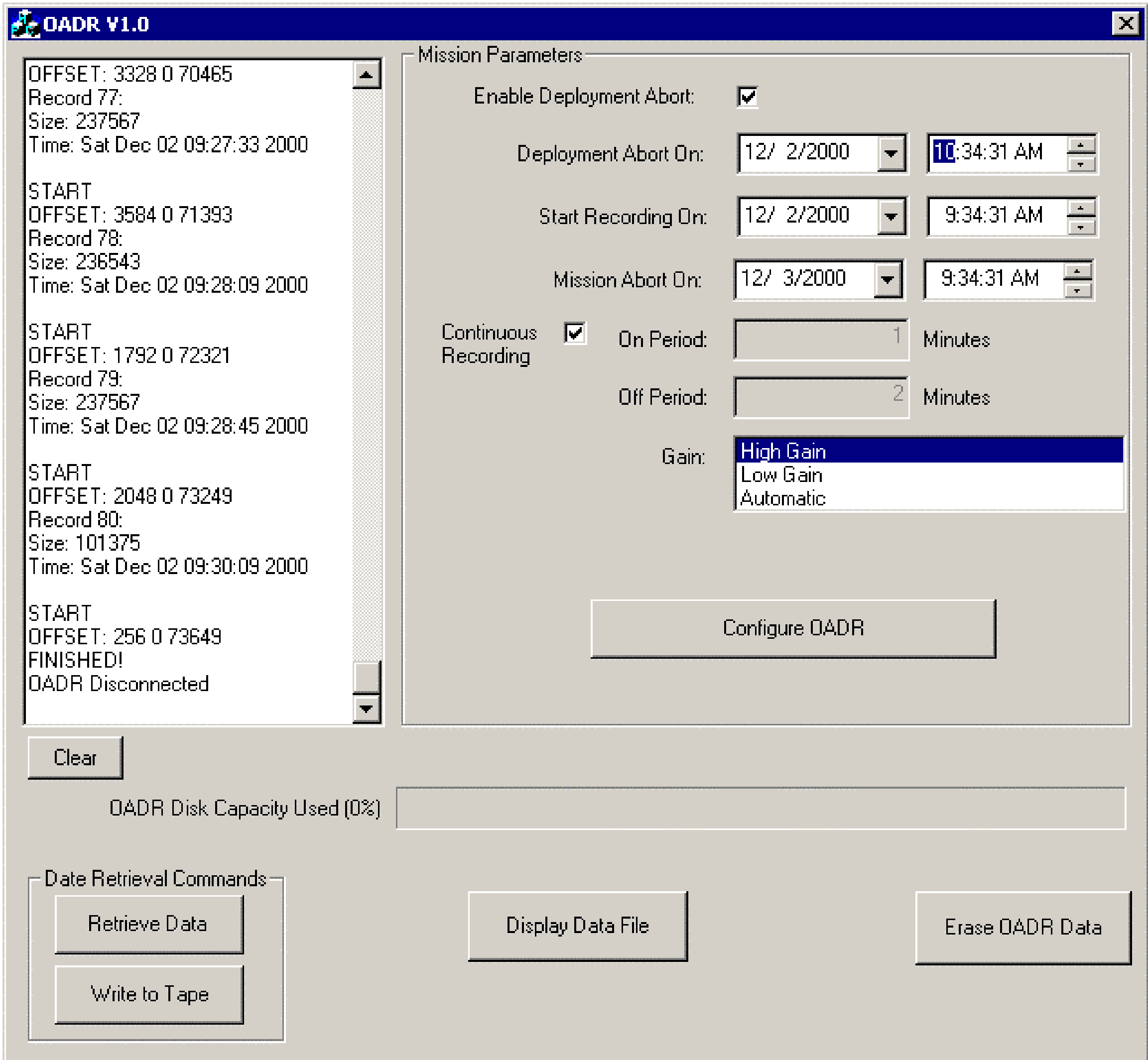
The OADR also contains a NiMH backup battery used to power the backup release electronics module, the release mechanisms and the strobe and beacons in case of main battery failure. The backup battery is trickle charged whenever the charger is inserted. If the OADR has not been used for an extended time (90 days or more), this battery will be discharged. A full trickle charge requires 24 hours. Keep the OADR on the charger for this duration if it has not been used in a while.

The STM-10 surface station can be powered by AC power, or its internal batteries. To charge the STM-10 batteries, plug the station into AC power and switch the TRACK/OFF/CHARGE switch to the CHARGE position. The same LED blink patterns as on the OADR apply. The STM-10 charge time is about 24 hours.

The OADR and STM-10 cannot be charged at the same time. However, the STM-10 batteries will last for about 40 hours of normal operation, which should be sufficient for many missions.

4.2. Programming a Mission Profile

A mission profile must be programmed into the OADR before each mission. The OADR is programmed through the Firewire link. Connect the OADR to the PC using the Firewire cable and the connector adapter. Launch the OADR control application on the PC by clicking on the OADR icon. Then, switch the OADR on. After a few seconds, a message should appear indicating that the OADR has been detected.



The OADR Control Screen

The OADR lists current system status and a log of activities in the window on the left. This includes OADR battery voltage, link status and the progress of data retrievals. The bar graph in the lower portions shows how much of the instrument's disk capacity is used.

The following paragraphs explain the control functions that are available through the buttons on the screen. The listing is in the typical chronological order of use.

Erase OADR Data

The OADR FLASH memory will be erased, and the disk write pointer set to zero when pressing this button. You will be prompted to verify your intent. The OADR data should be erased before each mission. Never erase the data on the OADR after a mission until after the data is recovered from the OADR, inspected and secured on tape or another backup device.

Configure OADR

The next step is the configuration of the OADR for the new mission. Do this by completing the mission parameters and clicking the *Configure OADR* button. The table below explains the parameters.

However, be aware that proper mission configuration is critical and success requires careful consideration of available battery power. Refer to chapter five 'OADR Power Management' for details on the matter.

Mission Parameter	**Explanation**
Enable Deployment Abort	The deployment abort function causes the OADR to drop its anchor weight and return to the surface when no mission activation command has been received from the surface by the time of the scheduled deployment abort. The deployment abort serves to recover the OADR in case it has landed in a spot where communication with the surface is not possible. Check this field to enable the deployment abort function. If the field is not checked, the OADR will enter the data acquisition phase of the mission as soon as the 'Start Recording' time is reached, without waiting for any commands from the surface.
Deployment Abort On	The time and date of the scheduled deployment abort. This would typically be set a few minutes or few hours after deployment, depending on deployment depth or other mission management considerations.
Start Recording On	The scheduled time and data to start recording of acoustic data. Delayed start of recording may be useful to record acoustic data from an experiment that does not start immediately upon deployment of the instrument. The OADR will sleep with all functions switched off once deployment is completed, until the scheduled recording start time. This complete sleep mode reduces power consumption to an absolute minimum (about 1.3 mA), but also means that the OADR cannot be interrogated during this period (the acoustic telemetry receiver is not running). If you are not using this function, and want to start recording immediately after completion of deployment, just leave the time and date unchanged.
Mission Abort On	The OADR will automatically abort the mission and return to the surface when this time is reached. The instrument recovery functions will be activated at this time by the primary control electronics, and five minutes later again by the backup control electronics. The mission abort time must be set. If the field is left unchanged, the mission abort functions will activate soon after you switch the OADR on.
Continuous Recording	When checked, the OADR will acquire acoustic data continuously throughout the data acquisition phase of a mission. Otherwise, the specified ON/OFF schedule will apply.
On Period	When **not** acquiring data continuously, this field specifies the duration of the ON period of a data acquisition cycle in minutes.
Off Period	When **not** acquiring data continuously, this field specifies the duration of the OFF period of a data acquisition cycle in minutes. During the OFF period, the OADR is asleep will all functions

	switched off. Power consumption is minimal (1.3 mA), but the OADR will also not listen for commands from the surface.
Gain	Sets the gain selection of the hydrophone for acoustic data acquisition. The high-gain mode of the standard hydrophone is –155 dB, the low-gain mode is –220 dB. Select AUTOMATIC to have the OADR set the gain automatically dependent on signal levels. The OADR will switch to low-gain as soon as a signal within 6 dB (one half) of the maximum discernable amplitude is detected. It will stay in low-gain for ??? seconds, then return to high-gain. Upon a return to high-gain, the OADR will wait for ??? seconds for the hydrophone to stabilize, then remain in high-gain until the next strong (-6 dB) signal is detected. Be aware that the hydrophone will require about one second to stabilize after a gain switch. You will see a big spike in the data.

Mission Parameters

After reviewing your settings, hit the *Configure OADR* button. The parameters will now be downloaded to the OADR, and the OADR clock will be set to the time of the PC clock. If you change your mind, you can change parameters as desired, then hit the button again. Upon hitting the button, you will be prompted for the name of the mission. A mission parameter file will be stored under that name. Read the file to check your mission settings. Here is an example.

```
Program OADR:
Start On: 12/02/00 10:03:22
Deploy Abort On: 12/02/00 11:03:22
Mission Abort On: 12/02/00 15:03:22
Continuous Recording
Gain: High Gain
Set Time: 12/02/00 10:06:44
```

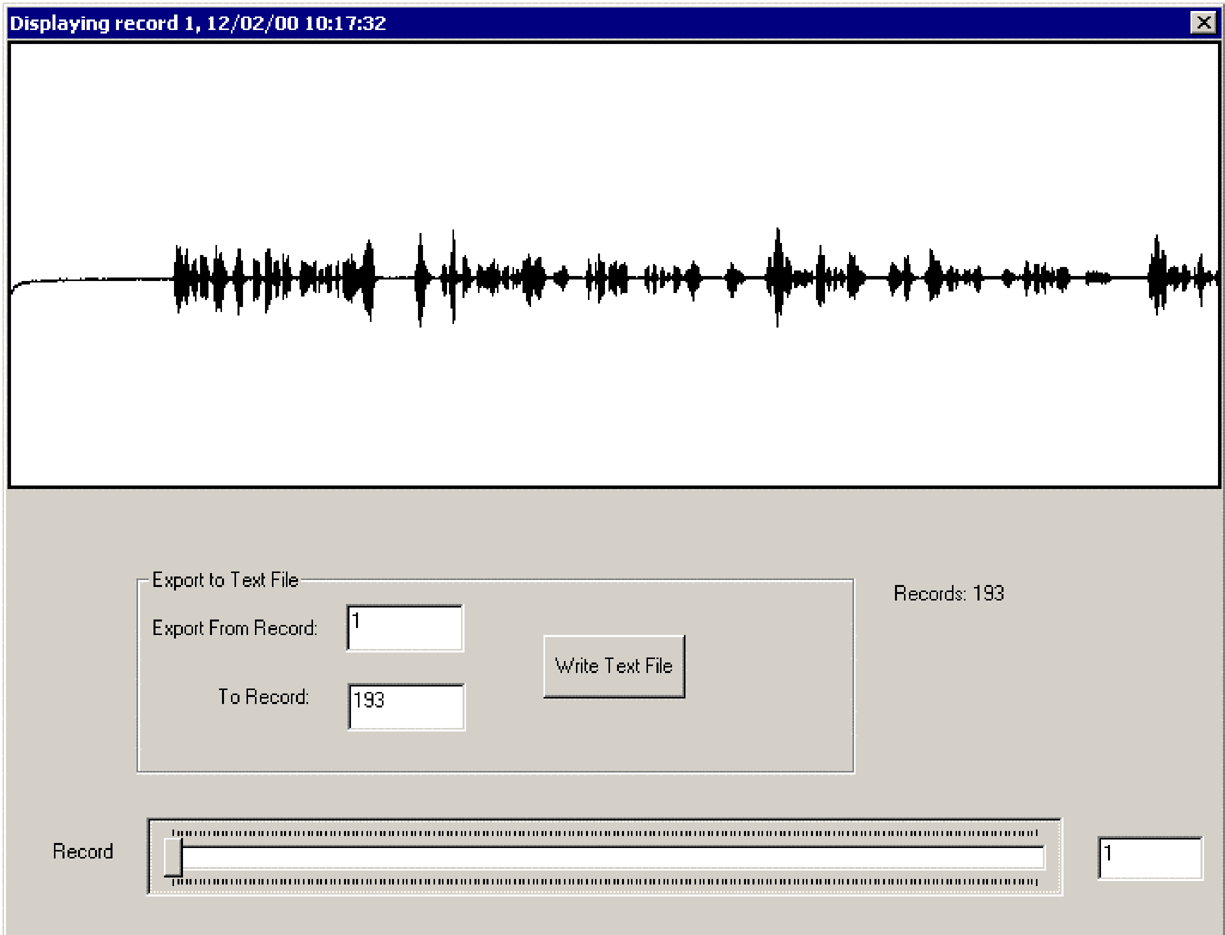
Now, switch the OADR off. The mission parameters will become valid upon the next activation of the OADR.

Retrieve Data

Use this function to retrieve data from the OADR after a mission. You will be prompted for a file name for the data. The progress of the data retrieval can be viewed in the status window. Data is recovered in blocks of about 40 seconds. The retrieval of each block takes about one second.

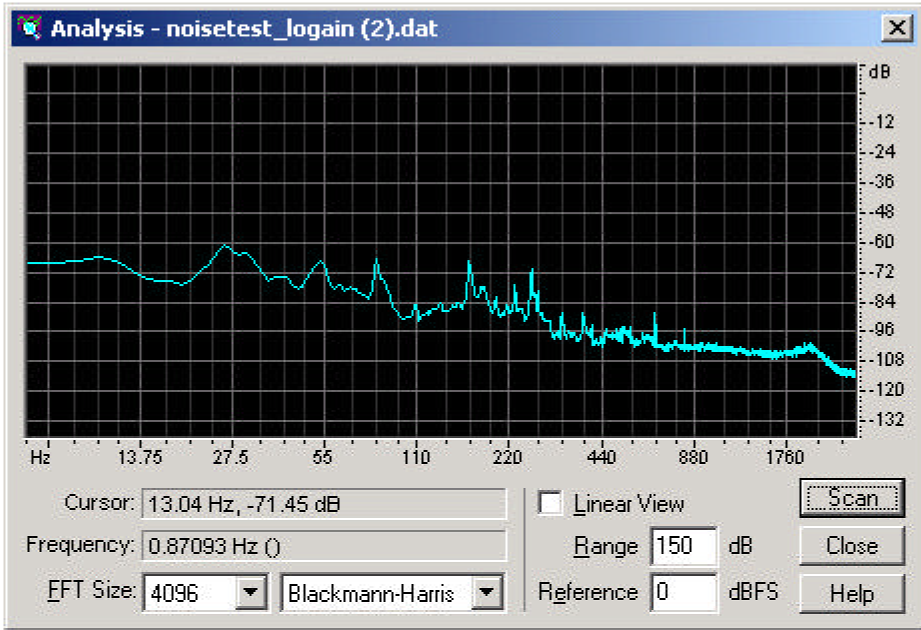
Display Data File

Use this function for a quick verification of the acoustic data following retrieval. You will be prompted for the name of the file to be displayed. A data window will then appear.



Data Display Window

The data window displays a time series of the data one 40-second record at a time. You can move among the records using the slider. You can also write some or all of the data to a text file by specifying the record range and clicking on the *Write Text File* field. The data is exported in a format that is compatible with Cool Edit 2000, an easy to use audio data analysis application. A feature-limited free version of that software is available on the web. Be aware that Cool Edit processes the data rather slow, so it is really only practical for snippets up to perhaps one hour.



Spectrum Analysis of OADR data with Cool Edit

Write To Tape

Click on this button to write a previously retrieved data set to tape. The data set must already reside on the PC hard disk, and the Exabyte tape drive must be connected to the PC using the SCSI interface card. You will be prompted for the name of the file to be transferred to the tape. The format of the data on tape is explained in chapter six.

4.3. OADR Self-Test

The OADR will execute a self-test, when it is manually activated by switching the knob to the ON position. After turning the knob to the ON position, observe the LED. After a few seconds, the self-test blink pattern should appear (7/8 second ON, 1/8 second OFF). Following the completion of the self test, the OADR will display one of three blink patterns:

Self-Test OK, Ready for Operation

One short blink per second indicates that the self-test succeeded, and the OADR is ready to be deployed. Look for this pattern, then turn the knob ¼ turn to the AUTOMATIC position. The OADR is now ready for deployment.

Note: If you turn the knob to the AUTOMATIC position before the self-test is completed, the self-test will fail. This is because a safety function allows the backup release control module to be programmed only when the knob is in the ON position. Programming this module is a part of the self-test.

Self-Test Failed

A fast triple-blinking of the LED indicates that the self-test failed. **Do not** deploy the OADR, but investigate the cause. A common cause of failure is the simple mistake of turning the knob to the AUTOMATIC position before the self-test is completed (see above). In this case, just return the OADR OFF, the ON again and repeat the self test.

If the self-test error persists, connect the OADR to the PC through the RS232 data cable. Run a terminal utility such as HyperTerm or Terraterm on the PC. Set the COM port to 4800 baud, 8 data bits, 1 stop bit, no parity (8N1). Make sure to select the proper COM port. Activate the OADR again and execute the self-test. Plain English statements will indicate the cause of the failure and instrument status.

Battery NOT Full

Rapid blinking of the LED indicates that the OADR battery is at 75% or less capacity, however the self-test otherwise completed without an error. We recommend charging of the battery fully before deployment.

The self-test verifies that all electronics modules and the two hard disks are active, operating normally and can communicate with each other. The backup release control module is also programmed to the mission abort time during the test. The self-test does NOT test these functions:

- Actual acoustic data acquisition
- Acoustic telemetry
- Firing of the release mechanisms, strobe and RF beacon
- Communication with the PC

Programming and exercising a mini data acquisition mission, lasting perhaps a few minutes can test these functions.

4.4. OADR Deployment

Prior to deployment, the flotation collar must be mounted on the OADR and an anchor weight must be attached to the release. The OADR is then activated, and lowered over the side. During free-fall to the bottom, you can interrogate the OADR. Once it has safely landed, activate the mission through an acoustic command.

Mounting the Flotation Collar

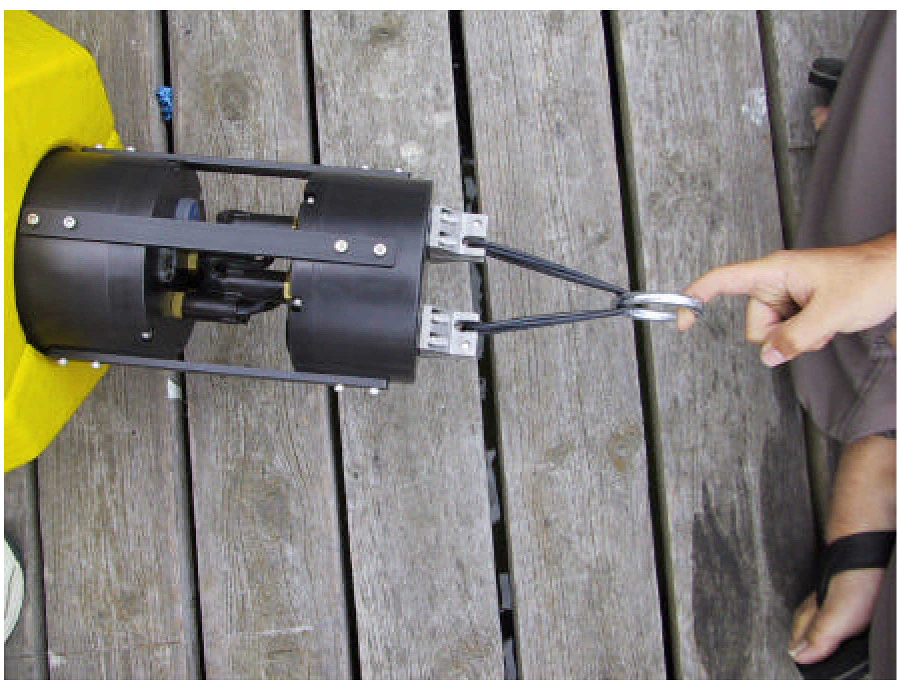
Bolt the flotation collar to the OADR such that the wide end is just below the translucent end-cap and the cone shaped end is pointed down. In this configuration, the instruments center of buoyancy will be well above the center of gravity, creating a righting moment that will cause the OADR to float straight at the surface. Install the flotation collar very tight to prevent the instrument from slipping out.

OADR with Flotation Collar

Arm The Release Mechanism

Next, secure an anchor weight to the acoustic release mechanism. The OADR exhibits a flotation of about 10 kg (22 lb). We recommend a weight from between 14 kg (30 lb) and 23 kg (50 lb). Do not use weights in excess of 23 kg (50 lb), as the increased friction in the release mechanism may cause the mechanism to jam, or bend under peak loads during deployment.

Each release mechanism operates by rotating a cam, which allows a lever to swing past. The barrier across a fork thus swings open, allowing a line to be released.



The Trigger Of Either Mechanism Will Release The Anchor

Rig the release by running a loop through both mechanisms, and securing the anchor via a stainless steel ring (see picture). Closing the for requires moving the cam to the open position so the lever can swing past. Do this by inserting a small screwdriver into the notch provided for this purpose on one side of the cam. You can also rotate the cam by pushing the screwdriver against the flat surface of the cam.

Here are a few more pointers:

- Check the pressure compensator (rubber membrane) before deployment. The compensator ensures that the mechanism will see no differential pressure. It will only work if the inside of the instrument is filled with oil. Under normal conditions, the membrane should neither stick all the way out, nor be able to be pressed in all the way or even most of the way (it should nominally be slightly in to slightly out). Press against the membrane with your finger but never with a sharp object or fingernail. If the oil level is low, the mechanism must be inspected and the oil needs to be topped off. Some loss of oil may be normal due to seepage past the dynamic O-ring of the shaft seal, however it may also indicate a problem (at the time of this writing, the mechanism was a new design – so no specific field data is available yet). We recommend you return the mechanism for service to Desert Star Systems. If that is not practical, use GE Silicone SF96-50 or a similar low-viscosity silicone fluid to top off the mechanism. Check carefully that no air bubbles remain.

- Use a short, smooth loop to run through the mechanism. Make sure there are no knots that could get jammed, preventing effective release. A strong O-ring does an excellent job, also providing shock absorption to prevent peak loads during deployment.

- Keep the anchor assembly short enough to prevent the OADR from getting caught in the anchor line itself. Yet, be aware that the sea floor is often very soft and a weight may sink deeply into the ground, dragging the OADR behind. The instrument may become stuck in the mud, or the mechanism jammed. We think that three feet of line may be about right.

- Round lead weights known as 'salmon weights' by fisherman make for excellent anchors. Try using a 30 lb or 50 lb weight.

- Don't use polypropylene line. This yellow line is lighter than water, floats up and may get caught around the instrument.

- Any mechanism can fail. While the OADR has two redundant mechanisms, that still cannot ensure 100% reliability. We recommend the use of a galvanic release (corrosion wire) between the OADR and the anchor weight as an additional safety.

Activate The OADR

Activate the OADR and perform a final self-test by following the procedure in section 4.3. In the process, check the friction of the power knob. Too tight a knob does no harm, but a loose knob may rotate accidentally to an unwanted position.

The knob is secured to certain level of friction by the center screw. You can unscrew this screw, apply some blue Loctite, (thread locking compound) then set it to the desired tension. Allow the Loctite to dry overnight. Alternatively, you can remove the knob altogether. Apply it only to switch the OADR ON or OFF, then remove the knob. If the OADR was last OFF, it will stay OFF. If it was last ON, it will enter automatic mode. Removal of the knob positively prevents undesired knob action. A magnet operates the power knob, and there is no feed-through. Thus, the knob can be safely removed.

Caution!
Never deploy the OADR with the knob in a position other than AUTOMATIC. If the knob is in the ON position, the OADR will not be able to fall asleep and the battery pack will be depleted in a few hours. If the knob is in the OFF position, the OADR will not acquire data or communicate with the surface. However, it will still trigger the release and activate the beacons five minutes after the mission abort time. This is a safety function.

Deploying and Tracking the Descent of the OADR

Prior to deployment of the OADR, activate the surface station. Lower the surface station transducer into the water at least beyond the keel level of the vessel. Acoustic conditions improve and vessel noise subsides as you gain depth. So, in deep water deployments it is a good idea to lower the transducer as deep as is practical. Back up the transducer cable with a strain relief line to take the weight. If currents are significant, attach a weight to the transducer cage so the transducer will sink straight down.

Boot the PC and switch the STM-10 TRACK/OFF/CHARGE switch to the TRACK position. Make sure the TRACK/CONFIGURE switch is set to TRACK as well. COM port 1 of the PC must be connected to the STM-10 PC-DATA connector using the supplied cable. The sonar transducer cable must be attached to SONAR #1.

Lower the OADR gently into the water. While the instrument has been vibration and shock tested, it is not designed for a hard splash-down. A drop of about one-foot however should not represent a problem. Be careful when handling the OADR. The weight of the instrument and flotation collar is about 59 kg (130 lb), more including an anchor weight. Attempt to not go flying across the deck holding the OADR only to be crushed by the instrument. It is a better idea to use lifting equipment.

To track the descent of the OADR, run DiveBase on your PC. Then, take these actions:

- DiveBase and the surface station can operate in many different modes. The mode of operation is defined in a configuration file. A configuration file for OADR tracking is provided with your system. Click on ***File->Select Active Configuration File***, then select OADR.PAR in the file browser. You can dismiss the download screen, which is normally used to configure the underwater stations. Since the OADR is factory configured, no further action is required. Selection of the configuration file is necessary only once, so you don't need to repeat this step unless your system configuration has been changed for another task.

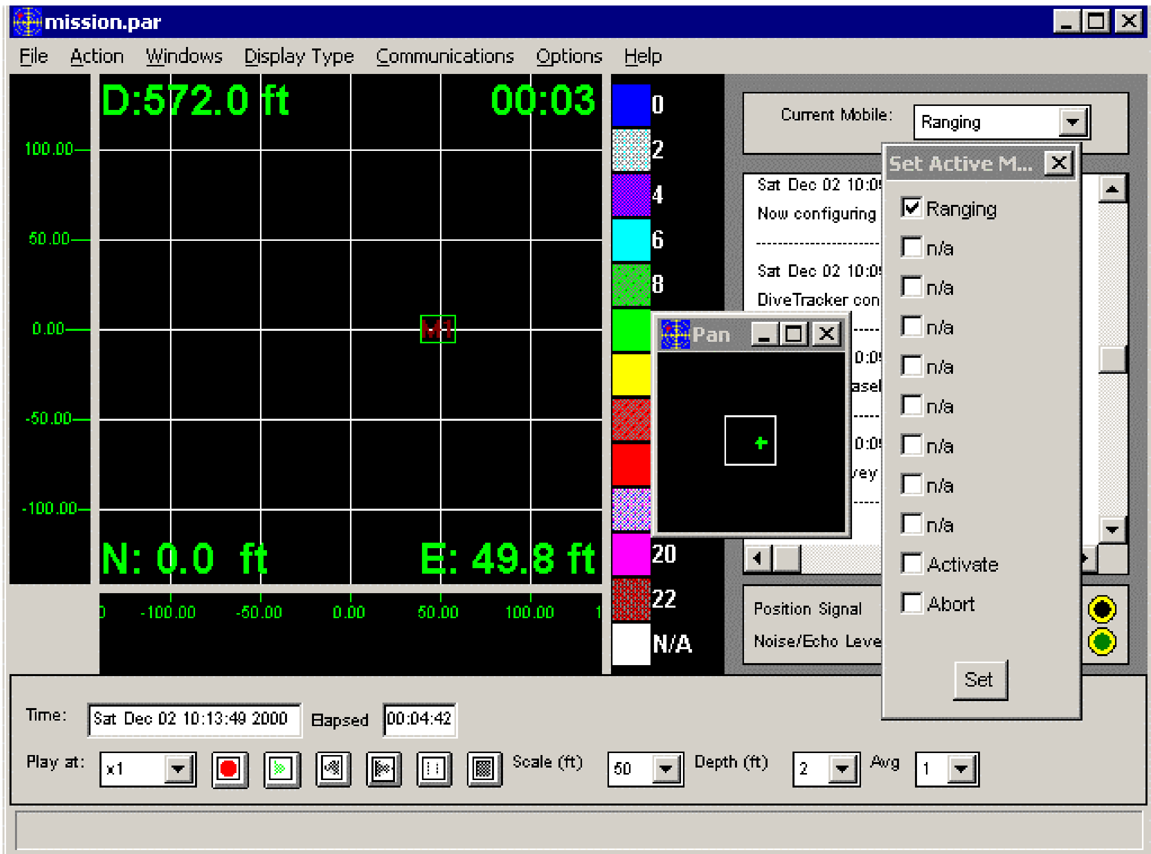
- To start tracking the OADR, select ***Action->Start Tracking Now***. The STM-10 will now be configured by DiveBase for the task, and a few seconds later it will start interrogating the OADR.

- DiveBase normally displays the depth of a station, which is relayed as acoustic telemetry to the surface. However, the OADR does not include a depth sensor, and the depth telemetry channel is instead used to transmit the mission state of the OADR. For this reason, select ***Options->Ignore Depth in Nav Calculations***.

- The OADR tracking configuration will show only the distance to the OADR, not its direction. The OADR is displayed as a small symbol 'M1'. The distance of the symbol from the center of the screen illustrates the actual distance of the OADR from the surface station transducer (slant range). Select the proper distance scale either from the list at the bottom of the screen, or by right-clicking on the tracking screen and selecting ***Distance Scale Factor***.

- DiveBase is used not just to track the OADR, but also to issue commands to the instrument. To enable that feature, click on ***Communications->Select Active Mobile Stations***. In standard tracking operations, this menu is used to select which of several underwater stations you would like to track. However, in the OADR mission it is used to issue commands.

After taking the above actions, the DiveBase tracking screen should look similar as the screen dump below.



Typical DiveBase Screen During OADR Tracking

The DiveBase screen elements are:

- Status information is displayed on the right. For example, if DiveBase cannot find the STM-10 (perhaps it is switched off, or not connected to the PC, or linked to a wrong COM port, or the TRACK/CONFIGURE switch is in the CONFIGURE setting), a message saying *'No Tracking Module Detected Yet'* will appear.
- The distance of the OADR from the surface station transducer is displayed on the main tracking screen.
- The number in the upper left corner show the time since the last ranging data was received from the OADR. At close distance, a fix should be received every three seconds. At a range of 5000 meters, the update time rises to about ten seconds. If no connection with the OADR can be established, or if issuing acoustic commands rather than ranging, the time will count up.
- The number in the upper right corner indicates the mission state of the OADR. This number is normally depth for DiveBase and is displayed as such. The table shows conversion from a 'depth' display to the corresponding state for operation in both American and metric units.

OADR State	Transmitted Value / (Valid Receive Range)	Display (feet)	Display (meters)
No Mission	30 (0-59)	0-239	0-72
Deployment Phase	90 (60-119)	240-479	73-145
Data Acquisition Phase	150 (120-179)	480-719	146-219
Recovery Phase	210 (180-239)	720-960	220-292

'Depth' Display to OADR Mission State Conversion Table

- The distance of the OADR from the surface station is indicated along the lower edge of the tracking window.
- Buttons resembling those on a tape drive are located along the bottom of the DiveBase window. These can be used to record tracking information for replay.
- Several screen settings can be selected through pull-down list along the bottom of the window.
- The ***Set Active Mobile Station*** window is used in the OADR configuration to select the control or ranging function to be performed. To select a function, check the corresponding box and uncheck all other boxes. Then, click on the **Set** button. (As windows sometimes does not accept a click, it is a good idea to click twice). The available control and ranging functions are listed in the table.

Function Name	Description
Ranging	The distance to the OADR will be measured and displayed. The OADR will switch acquisition of acoustic data off while ranging is in progress. The OADR will respond only once five Ranging commands have been received in a row.
Activate	This command switches the OADR to the data acquisition phase. We recommend to issue the command for two minutes to ensure it has been received. The OADR will only switch its state once five Activate commands have been received in a row.
Abort	This command initiates the return of the OADR to the surface. All remaining data is saved to disk. Then, the anchor weight is dropped. The OADR will keep responding to Ranging commands until none are received for two minutes. It will then activate the strobe and RF beacon and disable the acoustic telemetry receiver. We recommend to issue the command for two minutes to ensure it has been received. The OADR will only switch its state once five Abort commands have been received in a row.

OADR Acoustic Remote Control And Ranging Functions

Once the OADR has been dropped into the water, issue the *Ranging* command. It may also be a good idea to hold the OADR submerged near the surface until the first replies to the *Ranging* command have been received. You can now follow the fall of the OADR to the sea floor, seeing the distance to the instrument progressively growing.

When the OADR reaches the bottom, the distance should stabilize as long as you are not moving at the surface.

If you have enabled the deployment abort function in the mission profile definition, it is now time to issue the *Activate* command. Issue the command for about two minutes, then return to *Ranging*.

The OADR should now report that it is in the Data Acquisition Phase. If the deployment abort function is enabled and the OADR does not receive an *Activate* command by the specified deployment abort time, it will assume that a problem has occurred and automatically return to the surface.

Confused About Surface Station Operation?

This section describes the operation of the STM-10 and DiveBase only as far as you need to know for basic OADR control. The entire subject of acoustic telemetry and tracking exceeds the scope of this manual. We recommend this additional literature.

- The **PILOT Operator's Manual** describes operation of a surface station for tracking purposes in much greater detail. Subjects covered include STM-10 controls, transducer deployment, DiveBase features etc. Be aware that the manual concentrates on the use of DiveBase-R, not DiveBase-L2 which is used with the OADR. So, there are some differences.

- The **STM-1/STM-10 Technical Reference Manual** describes the features, operation and maintenance of the surface station.

- The **DiveBase Technical Reference Manual** explains the features of the surface control software.

4.5. Acoustic Data Acquisition

No interaction with the OADR is required during the data acquisition phase. However, you can abort the mission and instruct the OADR to return to the surface by issuing the *Abort* command.

The *Abort* command can be issued at any time, except:

- After deployment is completed and before the *Start Recording* time is reached. During this period, the OADR will sleep with all functions off to conserve power.
- When not recording continuously, during the *Off Period*. During these periods, the OADR will sleep with all functions off to conserve power.

4.6. OADR Recovery

OADR recovery is initiated automatically at the programmed mission abort time, or by issuing the *Abort* command (see previous section for details).

The OADR will save any acoustic data remaining in FLASH memory to the disk and then drop the anchor weight. It will keep listening for acoustic commands from the surface, until no such commands have been received for two minutes. The OADR will then activate the RF beacon and strobe light.

For deep ocean recoveries, issue the *Ranging* command after having run *Abort* for about two minutes. Watch the progress of the OADR (its distance) as it rises to the surface. By the time it breaks the surface, ranging will cease as the sonar transducer is no longer in the water. The last distance indicates how far you are from the OADR. Start looking for the strobe light or listen for the RF beacon. After recovering the OADR, switch the instrument OFF.

4.7. Data Recovery & Preparation For A New Mission

After a long mission with potentially a low battery, charge the battery for a while before recovering the data. A 30 minute charge period should suffice to supply enough energy.

Recover the data from the OADR following the instructions in section 4.2. After data recovery and inspection is completed, you can erase the OADR memory and program the instrument for a new mission (again, see section 4.2.). Put the OADR on charge and wait until charging is completed (see section 4.1.).

After completion of charging, run a power-on self-test and perhaps a mini-mission to verify proper operation of the instrument. Switch the OADR off and store it until the start of the next mission.

4.8. Storing the OADR

The OADR batteries should be charged before storage, to prevent deep discharge of the batteries and prevent unnecessary discharging of the Lithium backup battery.

For storage, switch the OADR power knob to the OFF position.

5. OADR Power Management

The available battery power must be considered when defining an OADR mission. Failure to do so may result in the OADR running out of battery power before the mission is completed. In the best case, this will result in early termination of data acquisition, and thus loss of data for the remainder of the mission. In the worst case, all OADR energy reserves may be run down, preventing a trigger of the OADR release mechanisms and failure of the instrument to return to the surface.

Mechanisms are built into the OADR, to provide warnings and safeguards against such a worst case event. These are:

OADR Low Battery Safeguards

- When the main battery voltage is 1.25 volts per cell or less, the OADR status LED will blink rapidly, indicating that the battery is not full. The battery has at this point about 75% of its capacity in reserve. It should be charged before deployment.
- If the main battery pack voltage falls to 1.15 volts per cell, the OADR will stop data acquisition, thus reducing current draw to about 30 mA. It will still listen for acoustic commands from the surface. The remaining battery capacity is about 20%, sufficient for operating the OADR in this mode for about 100 hours.
- When the main battery finally dies completely, the backup release control electronics module will be the only function remaining active. It will drop the anchor weight and activate the strobe and RF beacon five minutes after the scheduled mission abort time. After the main battery has been depleted, this module will draw power from a small backup NiMH battery. It has a capacity of about 1500 mAh, and the power draw is about 1.3 mA. Thus, the OADR can wait

up to about 48 days for the scheduled mission end time. Beyond that, the OADR will not be able to return to the surface. **(CAUTION: OADR Control Software V1.00 DOES NOT report the charge state of the Lithium battery during self-test. There is thus a chance that the Lithium battery might be depleted. No power is drawn from the Lithium battery, as long as the main battery is not entirely depleted to 0.7 volt per cell or less).**

Missions should be programmed with the intent of the last two safeguards mechanisms not getting invoked. They should serve as your margin of safety.

To determine the safe length and profile of a mission, compute the expected power requirement. The requirement should be 80% or less of the available battery capacity. Power consumption of the OADR depends on the mode of operation:

Mode of Operation	**Power Consumption**
OADR sleeping during deployment, prior to start of recording time or during 'off' periods	1.3 mA
OADR is acquiring acoustic data (average consumption)	118 mA
While Ranging commands are sent to OADR	360 mA
While Activate or Abort commands are sent to OADR	776 mA
While the power knob is in the ON position	776 mA

The available battery capacity is 16000 milli-ampere hours (mAh).

Let's look at the consumption of a sample mission:

Activity	**Duration**	**Power draw**	**Energy Consumed**
OADR power knob is in ON position prior to deployment for programming and test purposes	0.5 hours	776 mA	388 mAh
OADR is tracked during descent to sea-floor	1 hour	360 mA	360 mAh
OADR is waiting for 'start of recording' time	7 days	1.3 mA	218 mAh
OADR is acquiring data using a 50% ON 50% schedule for four days. This number is for the ON period.	2 days	118 mA	5664 mAh
OADR is acquiring data using a 50% OFF 50% schedule for four days. This number is for the OFF period.	2 days	1.3 mA	62 mAh
OADR is tracked on way back to surface	1 hour	360 mA	360 mAh
Total Consumption For Mission:			**7052 mAh**

This mission will consume an estimated 44% of the battery capacity, so it should be safe.

Finally, some advise on what may cause a battery to have less than the rated capacity.

- New NiMH batteries must be conditioned by running through about five charge / discharge cycles to obtain their rated capacity. Run these cycles, and use them as an opportunity to test the OADR.
- The battery will slowly loose capacity over time. The effect is more pronounced when stored at higher temperatures. Replace the batteries once per year, and don't store the OADR at temperatures higher than room temperature.

- The battery will also loose capacity with each charge cycle. Replace the battery after 200 charge cycles.

- An early charge cut-off will leave you with a less than full battery. Verify the battery voltage after charging. It is displayed after a link is established in the OADR control application. The battery voltage should be at least 18.2 Volts right after charging.

Advise

It is a good idea to test the actual battery capacity prior to a long mission. Charge the battery fully, and define a continuos data acquisition mission. Hook up the RS232 cable to the OADR, and record the diagnostic information on a terminal screen. The OADR will display a message when it is entering low battery mission cut-off. Multiply the elapsed mission time in hours by 118 mA. This is the energy available to discharge the battery to 20% of capacity.

6. Tape File Format Specification

The data recorded by the OADR is stored as a time series of 16-bit numbers. The most significant 15-bits of that number reflect the most significant 15-bit of the 16-bit A/D converter. The least significant bit indicates the gain of the OADR. A ‘1’ bit means high-gain, a ‘0’ bit low-gain. The A/D values range from 0x0000 (negative peak) to 0xffff (positive peak), with the zero point being at a nominal 0x8000. A slight negative or positive DC offset in the data is to be expected.

Data is acquired at a rate of 6554 samples per second. It is amplified by the hydrophone, and again by an anti-aliasing band-pass filter in the receiver-input section of the OADR. The band-pass filter is designed for operation from about 2.5 Hz to 2.5 kHz. The frequency dependent gain of the OADR input stage is given below.

Freq.	2.5 Hz	10 Hz	100 Hz	300 Hz	600 Hz	1000 Hz	2000 Hz	2500 Hz	3000 Hz	5000 Hz
Gain	15 dB	16 dB	16 dB	17 dB	18 dB	20 dB	19 dB	18 dB	4 dB	-23 dB

Note: numbers include –3 dB adjustment to compensate for 1.414 Vrms full scale at ADC input

The equivalent acoustic power of an input signal (Sin) producing a digital signal with a given RMS amplitude (ADCrms) at the output of the ADC is as follows.

Sin (dB) = 0 – At – Ai – 87.3 dB + 20 log (ADCrms)

where:

Sin:	Acoustic input signal (dB)
At:	Hydrophone Sensitivity (dB)
Ai:	Gain of OADR input stage
ADCrms:	RMS amplitude at ADC output (ADC steps)

The standard sensitivity settings of the dual-gain hydrophone are –155 dB (high-gain) and –220 dB (low gain). All sound level dB numbers are referenced to 1µPa.

The data on tape is organized as a Record Set. A header defines the Record Set, which is made up of multiple data records. Individual headers define each record. The format is described below, with sample C code for reading the tape under the WIN32 API.

```
// OADR_read_tape.cpp : Defines the entry point for the console application.
//

#include "stdafx.h"
#include "stdio.h"
#include "windows.h"
#include <io.h>
#include <fcntl.h>
#include <time.h>


/* OADR DATA FORMAT ON TAPE:
	OADR_RECORD_SET_HEADER {
		unsigned long record_count;
		unsigned long sync;
		unsigned long time;
	}
	FILE_MARK
	//for number of records in set...{
		OADR_RECORD_HEADER; {
			unsigned long sample_count;
			unsigned long sync;
			unsigned long time;
			unsigned long tag;
		}
		FILE_MARK
		DATA {
			unsigned short data[sample_count]
		}
		FILE_MARK
	}

NOTE:  unsigned long  is 4 bytes (32 bits)
	  unsigned short is 2 byte  (16 bits)
	  all data is MSB first
	  all data is written in whole sectors, sector size is the
		default sector size for the tape device (1024 bytes for Exabyte Eliant-820
*/



typedef struct {
	unsigned long record_count;
	unsigned long sync;
	unsigned long time;
} OADR_RECORD_SET_HEADER;

typedef struct {
	unsigned long sample_count;
	unsigned long sync;
	unsigned long time;
	unsigned long tag;
} OADR_RECORD_HEADER;


typedef struct {
	OADR_RECORD_HEADER header;
	unsigned short *data;
} OADR_RECORD;
```

```
void printtime(unsigned long time);

void read_tape(HANDLE tape, unsigned long sect_size, char *filename, unsigned long rec_to_write) {
	unsigned long numread;
	unsigned char *buf = new unsigned char[sect_size];
	unsigned int rval;

	OADR_RECORD_SET_HEADER record_set_header;
	OADR_RECORD_HEADER record_header;

	if (!ReadFile(tape,buf,sect_size, &numread,NULL)) {
		printf("Error Reading Record Set Header From Tape\n");
	} else {

		// First Read the Record Set Header (it is on the 1'st tape sector
		unsigned char *p=buf;

		record_set_header.sync=*p++;
		record_set_header.sync=(record_set_header.sync<<8) + *p++;
		record_set_header.sync=(record_set_header.sync<<8) + *p++;
		record_set_header.sync=(record_set_header.sync<<8) + *p++;

		if (record_set_header.sync!=0xfeeddeed) {
			printf("Could not find sync in record set header.\n");
			return;
		}

		record_set_header.time=*p++;
		record_set_header.time=(record_set_header.time<<8) + *p++;
		record_set_header.time=(record_set_header.time<<8) + *p++;
		record_set_header.time=(record_set_header.time<<8) + *p++;

		record_set_header.record_count=*p++;
		record_set_header.record_count=(record_set_header.record_count<<8) + *p++;
		record_set_header.record_count=(record_set_header.record_count<<8) + *p++;
		record_set_header.record_count=(record_set_header.record_count<<8) + *p++;

		//print out record set header
		printf("Record Set:\n");
		printtime(record_set_header.time);
		printf("%ld records\n\n",record_set_header.record_count);

		//Seek past filemark
		SetTapePosition(
			tape,       // handle to device
			TAPE_SPACE_FILEMARKS,  // positioning type
			0,      // new tape partition
			1,      // low-order bits of position
			0,     // high-order bits of position
			FALSE        // return after operation begins
			);

		for (unsigned int i=0;i<record_set_header.record_count;i++) {
			/* now read the records */

			printf("Trying to Read Record %d\n",i+1);

			/* First Read Record Header */
			if (!(rval=ReadFile(tape,buf,sect_size, &numread,NULL))) {
```

```
                              printf("Error Reading Record Header From Tape: %d\n",
GetLastError());
                    } else {

                              p=buf;

                              record_header.sync= *p++;
                              record_header.sync=(record_header.sync<<8) +  *p++;
                              record_header.sync=(record_header.sync<<8) +  *p++;
                              record_header.sync=(record_header.sync<<8) +  *p++;

                              if (record_header.sync!=0xbeeffeed) {
                                        printf("Could not find sync in record.\n");
                                        return;
                              }

                              record_header.time= *p++;;
                              record_header.time=(record_header.time<<8) +  *p++;
                              record_header.time=(record_header.time<<8) +  *p++;
                              record_header.time=(record_header.time<<8) +  *p++;


                              record_header.tag= *p++;
                              record_header.tag=(record_header.tag<<8) +  *p++;
                              record_header.tag=(record_header.tag<<8) +  *p++;
                              record_header.tag=(record_header.tag<<8) +  *p++;


                              record_header.sample_count=*p++;
                              record_header.sample_count=(record_header.sample_count<<8)     +
*p++;
                              record_header.sample_count=(record_header.sample_count<<8)     +
*p++;
                              record_header.sample_count=(record_header.sample_count<<8)     +
*p++;

                              // now print out record header
                              printf("Record %d:\n",record_header.tag);
                              printtime(record_header.time);
                              printf("Samples: %ld\n\n",record_header.sample_count);

                              //Seek past filemark
                              SetTapePosition(
                                        tape,        // handle to device
                                        TAPE_SPACE_FILEMARKS,  // positioning type
                                        0,      // new tape partition
                                        1,      // low-order bits of position
                                        0,     // high-order bits of position
                                        FALSE        // return after operation begins
                                        );

                              //Now read the samples
                              unsigned long bytes = record_header.sample_count * 2; //two bytes
per sample

                              // calculate the number of whole tape sectors required for the data
record.
                              unsigned long tape_sectors = bytes/sect_size;
                              if ((tape_sectors * sect_size) < bytes)
                                        tape_sectors++;
                              // allocate a buffer large enough to hold all the tape sectors that
```

```
                                        // will be read
                                        unsigned char *data = new unsigned char[tape_sectors * sect_size];

                                        if      (!(rval=ReadFile(tape,data,tape_sectors        *         sect_size,
&numread,NULL))) {
                                                printf("Error Reading Data From Tape!: %d\n",GetLastError());
                                        }
                                        if (record_header.tag==rec_to_write) {
                                                //write the desired record to the data file
                                                printf("Writing record to %s\n",filename);
                                                FILE *of=fopen(filename,"wt");
                                                p=data;
                                                while(bytes) {
                                                        //write data to file, data is 16-bit MSB first
                                                        //the subraction is to format the data for COOLEDIT
2000

                                                        unsigned short val;
                                                        val=(*p++<<8);
                                                        val+=(*p++);
                                                        bytes-=2;
                                                        fprintf(of,"%d\n",val-32768);
                                                }
                                                fclose(of);
                                        }

                                        delete [] data;


                                        //Seek past filemark
                                        SetTapePosition(
                                                tape,        // handle to device
                                                TAPE_SPACE_FILEMARKS,  // positioning type
                                                0,      // new tape partition
                                                1,      // low-order bits of position
                                                0,     // high-order bits of position
                                                FALSE        // return after operation begins
                                                );
                                }

                        }
                }
                delete [] buf;
}



int main(int argc, char* argv[])
{


        char *filename;
        unsigned long rec_to_write=0;

        if (argc==3) {
                rec_to_write=atoi(argv[1]);
                filename = argv[2];
                printf("Gonna write record %d to %s\n",rec_to_write, filename);
        }

        HANDLE hTape;   // handle to tape device
```

```
        hTape = CreateFile(
    "\\\\.\\TAPE0",          // name of tape device to open
    GENERIC_READ | GENERIC_WRITE, // read/write access
    0,                      // not used
    0,                      // not used
    OPEN_EXISTING,          // required for tape devices
    0,                      // not used
    NULL);                  // not used

        if (hTape==INVALID_HANDLE_VALUE) {
                printf("Could not open tape device.");
        }


        DWORD rval;
        PrepareTape(hTape,
                        TAPE_LOAD,
                        TRUE);   //may indicate a media change, but we dont care for now...


        unsigned long size;
        TAPE_GET_MEDIA_PARAMETERS tape_params;
        TAPE_GET_DRIVE_PARAMETERS drive_params;


        rval=GetTapeParameters(hTape,
                                GET_TAPE_DRIVE_INFORMATION,
                                &size,
                                &drive_params
                                );
        switch (rval) {
        case NO_ERROR: {


                unsigned long td1=drive_params.ECC;
                unsigned long td2=drive_params.Compression;
                unsigned long td3=drive_params.DataPadding;
                unsigned long td4=drive_params.ReportSetmarks;
                unsigned long td5=drive_params.DefaultBlockSize;
                unsigned long td6=drive_params.MaximumBlockSize;
                unsigned long td7=drive_params.MinimumBlockSize;
                unsigned long td8=drive_params.MaximumPartitionCount;
                unsigned long td9=drive_params.FeaturesLow;
                unsigned long tda=drive_params.FeaturesHigh;
                unsigned long tdb=drive_params.EOTWarningZoneSize;

/*
         printf("ECC: %ld\nCompression: %ld\nData Pad: %ld\nReportSetMarks: %ld\nDef Block Size:
%ld\nMax Block Size: %ld\nMin Block Size %ld\n",
                        td1,
                        td2,
                        td3,
                        td4,
                        td5,
                        td6,
                        td7);
*/

         if (!(tda & TAPE_DRIVE_FILEMARKS)) {
                printf("Tape Error: No TAPE_DRIVE_FILEMARKS");
         }
```

```
  if (!(tda & TAPE_DRIVE_WRITE_LONG_FMKS)) {
          printf("Tape Error: No TAPE_DRIVE_WRITE_LONG_FMKS");
  }

  break;
 }
 case ERROR_NO_MEDIA_IN_DRIVE: {
  printf("No media in drive.");
  return 1;
  break;
 }
 default: {
         printf("Could not get tape parameters: %d",rval);
         return 1;
 }
 };



 rval=GetTapeParameters(hTape,
                                GET_TAPE_MEDIA_INFORMATION,
                                &size,
                                &tape_params
                                );
 switch (rval) {
 case NO_ERROR: {
  __int64 remaining=tape_params.Remaining.QuadPart;
  __int64 cap=tape_params.Capacity.QuadPart;
  double d1=(float) cap/1073741824.0;
  double d2=(float) remaining/1073741824.0;
  unsigned long d3=tape_params.BlockSize;
  unsigned long d4=tape_params.PartitionCount;
  unsigned long d5=tape_params.WriteProtected;
/*
        printf("Capacity:    %3.2fGb\nRemaining:    %3.2fGb\nBlock    Size:    %ld\nPartition
Count:%ld\nWP:%ld\n",
                d1,
                d2,
                d3,
                d4,
                d5);
*/
  break;
 }
 case ERROR_NO_MEDIA_IN_DRIVE: {
  printf("No media in drive.");
  return 1;
  break;
 }
 default: {
         printf("Could not get tape parameters: %d",rval);
         return 1;
 }
 };


 printf("Rewinding Tape: Please Wait...\n");

 //rewind tape
 SetTapePosition(
```

```
                    hTape,        // handle to device
                    TAPE_REWIND,  // positioning type
                    0,      // new tape partition
                    0,      // low-order bits of position
                    0,     // high-order bits of position
                    FALSE);


          printf("Reading Tape\n");
          read_tape(hTape, drive_params.DefaultBlockSize, filename, rec_to_write);

          CloseHandle(hTape);

          return 0;
}
/* Helper function to print times */
void
printtime(unsigned long time) {
          time_t thistime=time;
          struct tm *newtime;

          newtime = localtime( &thistime );  /* Convert time to struct */
                                                                   /* tm form */
          printf("Time: %s",asctime( newtime ));
}
```

7. OADR Specifications

Size:	1140 mm L x 152 mm D overall (914 mm L x 152 mm D without hydrophone)
Weight:	23 kg
Depth Rating:	4000 meters
Floatation Collar:	Syntactic foam collar, 4000 m rating, instrument is 10 kg positive buoyant in sea water.
Operating temperature:	0 to 50 degrees Celsius
Storage Temperature:	-20 to 70 degrees Celsius
Data Interfaces:	Firewire interface for data retrieval & configuration RS-232 interface for software installation & diagnostics
Status Indicator:	Status LED
Microprocessor:	Multi-processor system, DSP56301 DSP chip, three MC68HC908 microcontrollers
Data Recording:	Two 10 Gbyte Firewire hard disks, used in parallel operation for data redundancy 128 Mbyte FLASH memory used for intermediate data storage Sufficient for 200 hours of data recording at 6554 samples per second.
Battery:	Main: Two NiMH packs, 8 Ah @ 16.8 V each (14 ‘D’ cells in series) Backup: NiMH, 2Ah @ 9.6V, for operation of recovery functions only
Battery Life:	About 135 hours of continuos recording. Sleep modes for extended missions.
Acoustic Receiver:	2.5 Hz to 2500 Hz pass band 44 dB to 200 dB dynamic range self-noise 24 dB re. 1 µPa/√Hz at 2500 Hz to 42 dB re. 1µPa/√Hz at 2.5 Hz.
Mission Control:	Pre-programmed mission profiles and remote control from surface
Telemetry:	Remote control through STM-10LH surface station, max. distance 5000 m
Release:	Two independent release mechanisms drop a weight Two independent control electronics, each can operate both release mechanisms