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San Clemente Island Undersea Range Acoustic Experiment, July 2002

by

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13. ABSTRACT *(maximum 200 words)*

An at-sea data collection effort was conducted July 24-28, 2002 in support of the Naval Postgraduate School's Tactical Oceanography Course (OC-4270) off the San Clemente Island Undersea Range (SCIUR). The experiment configuration was designed to provide acoustic propagation measurements for transmission loss, detection range limitation, and acoustic variability in the 1-8 kHz frequency band. This report is provided to document contacts, experiment configuration, execution and collected data sets.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 Introduction

An at-sea data collection effort was conducted July 24-28, 2002 in support of the Naval Postgraduate School's Tactical Oceanography Course (OC-4270) off the San Clemente Island Undersea Range (SCIUR). The experiment configuration was designed to provide acoustic propagation measurements for transmission loss, detection range limitation, and acoustic variability in the 1-8 kHz frequency band. Marine mammal signals were transmitted to develop a statistical data set to evaluate the performance of omni-directional receivers to detect the vocalizations of Odontocete (toothed) whales. This report is provided to the document contacts and procedures; experiment configuration and execution; as well as the data collected.

2.0 Personnel

The San Clemente Island data collection effort was conducted during the at-sea laboratory segment for the NPS Oceanography Department's Tactical Oceanography course, OC-4270. The Research Vessel (R/V) POINT SUR (Fig 1), out of Moss Landing, CA, was our primary platform for deploying all equipment and conducting the experiment. Table 1 lists the personnel aboard the R/V POINT SUR who were responsible for the equipment and data collected for this report. Table 2 lists the personnel that were stationed on San Clemente Island to monitor the SCIUR array data collection.

Figure 1. R/V POINT SUR

Name	Responsibilities
Arthur Parsons	**Chief Scientist, course instructor**
Curt Collins	**Principal Investigator**
John Joseph	**Faculty (next OC4270 instructor)**
Chris Miller	**Engineer, acoustic data collection**
Anu Kumar	**Science technician, acoustics**
Jim Stockell	**Engineer, CTD support**
John Okon	**Student (1st leg)**
John Daziens	**Student (1st leg)**
David Kuehn	**Student (1st leg)**
Michael Weltmer	**Student (1st leg)**
Adam Newton	**Student (1st leg)**
Erica Museler	**Student (2nd leg)**
Robyn Phillips	**Student (2nd leg)**
Claude Gahard	**Student (2nd leg)**
Jeff Dixon	**Student (2nd leg)**

Table 1. Personnel aboard the R/V POINT SUR

Name	Responsibilities
Ching-Sang Chiu	**Principal Investigator**
Jorge Garcia	**Student 1st & 2nd leg**
Jody Beattie	**Student 1st leg**

Table 2. Personnel at the San Clemente Island Undersea Range

3.0 Experiment Overview

The SCIUR Acoustics Experiment was conducted from 24-28 July 2002. The purpose of this experiment was to utilize a calibrated cabled receiver for the purpose of measuring transmission loss, and acoustic detection and range limits. With the failure of the NPS Ocean Acoustic Observatory array at Point Sur, NPS lost the ability to perform this experiment off the central California coast. The Naval Undersea Warfare Center was contacted to use a cabled array operated off southern California (sec 4). Acoustic signals were transmitted at twelve acoustic stations, from 1-12 km at 1 km intervals, to measure propagation loss. Broadband whale signals (Sec. 5.3) were also used to measure detection and classification characteristics of the receivers.

The cruise schedule was coordinated when the R/V POINT SUR would be operating out of the Santa Barbara harbor (UCSB cruise). The NPS Operational Oceanography (OC3570) cruise was scheduled the week prior to this cruise, and they returned to the Santa Barbara harbor at the end of their cruise. After the Tactical Oceanography (OC4270) cruise, the University of California, Santa Barbara, had a cruise scheduled on the POINT SUR. This coordination allowed NPS to minimize transit time to get on station as well as operating costs. With UCSB using the POINT SUR after this cruise, NPS didn't pay for the ship's return transit to Moss Landing. Having back-to-back NPS cruises also allowed the heavy equipment to be loaded on board the POINT SUR prior to their Moss Landing departure, but required additional coordination for the remote off-load of all equipment in Santa Barbara at the end of both cruises.

With the cruise divided into two legs, there was an additional transportation requirement for the student swap on 26 July. A Navy C-12 NALO (Navy Air Logistics Office) aircraft was coordinated for 26 July to pick up the students for the 2nd leg of the cruise from the Monterey Airport and fly them down to the San Clemente Island airstrip. The POINT SUR held station off Wilson Cove (North-East side of San Clemente Island) and the SCI small boat operations assisted with the crew transfer to shore. NUWC provided a van that was used to transport the students to/from the SCI airstrip. After the crew transfer, the NALO flight returned the students from the 1st leg of the cruise to the Monterey Airport.

The Experiment Operations Schedule and the Cruise Plan are listed in the Appendix (Sec 12.1 and 12.2, respectively).

4.0 San Clemente Island Undersea Range (SCIUR)

The primary receiver for this experiment was the Naval Undersea Warfare Center's (NUWC) Ship Self-Radiated Noise Measurement (SSRNM) array located South of Wilson Cove on San Clemente Island (SCI). NUWC operates the vertical line array (VLA) to measure radiated ship noise. The array location and information is listed in Table 3, while the NUWC personnel contact information is found in Table 4. The manufacturer's hydrophone response curves for the SCIUR phones are shown in Figure 3. The VLA was originally installed with 4 hydrophones, but only 3 are currently operational (listed in Table 3) and were used in this experiment.

Location	33 00' 35.1" N	118 31' 49.8" W
Hydrophone depths	75.2856 m	247 ft
	136.5504 m	448 ft
	165.8112 m	544 ft
Manufacturer	International Transducer Corporation (ITC)	
Hydrophone model	ITC 6050N	
Hydrophone Frequency Range	20 Hz – 75 kHz	
Hydrophone Sensitivity	-157 dB V/uPa (minimum)	
Preamplifier gain (at hydrophone)	20 dB	
Precision Filters 6201-1 amplifier gain at SCUIR building	42 dB fixed (see data log)	

Table 3. SCIUR range location and specifications

Figure 2. San Clemente Island. SCI airstrip is clearly shown along the northern tip of the island (forground).

Personnel access to San Clemente Island is done via contracted flights from Naval Air Station North Island (NAS-NI), San Diego. Flights are available Monday-Friday, from 0730-1600 every half hour. Craig Walker coordinated all travel to/from SCI, and covered the $75 flight cost under his NUWC contract, so travel arrangements were relatively easy for the NPS personnel working at the NUWC SSRNM facility. All NAS-NI flights departed from the North Island air terminal (Bldg 700), and travelers are required to be at the terminal 1 hour prior to their reservation time, as the plane will leave as soon as all travelers have arrived (most flights depart 30 minutes earlier than their published times). The contracted flights are performed in small aircraft (Figure 5) and weight limits are a factor for carry-on baggage and equipment (limited to 30 lbs). Larger cargo service to San Clemente Island is done weekly by barge service from San Diego. The barge departs from San Diego every Tuesday arriving at SCI on Wednesday under their normal schedule. The NPS data acquisition system was shipped to Craig Walker several weeks before the cruise, and barged to the island. Additional time should be allowed to collect any equipment sent over by barge if you are not present when the barge arrives. The NPS rack case was tracked to a flatbed trailer near the SCI airstrip, rather than at the barge warehouse where it was expected to be.

Mr. Craig Walker walkerca@kpt.nuwc.navy.mil	(619) 524-6617 DSN 524-6617	Site Manager, NUWC San Diego 9284 Balboa Ave. San Diego, CA 92123
Mr. Jerry McCue mccuejt@kpt.nuwc.navy.mil	(619) 553-7062 (619)553-0586 FAX	

Table 4. NUWC Site San Diego points of contact for the SCIUR range.

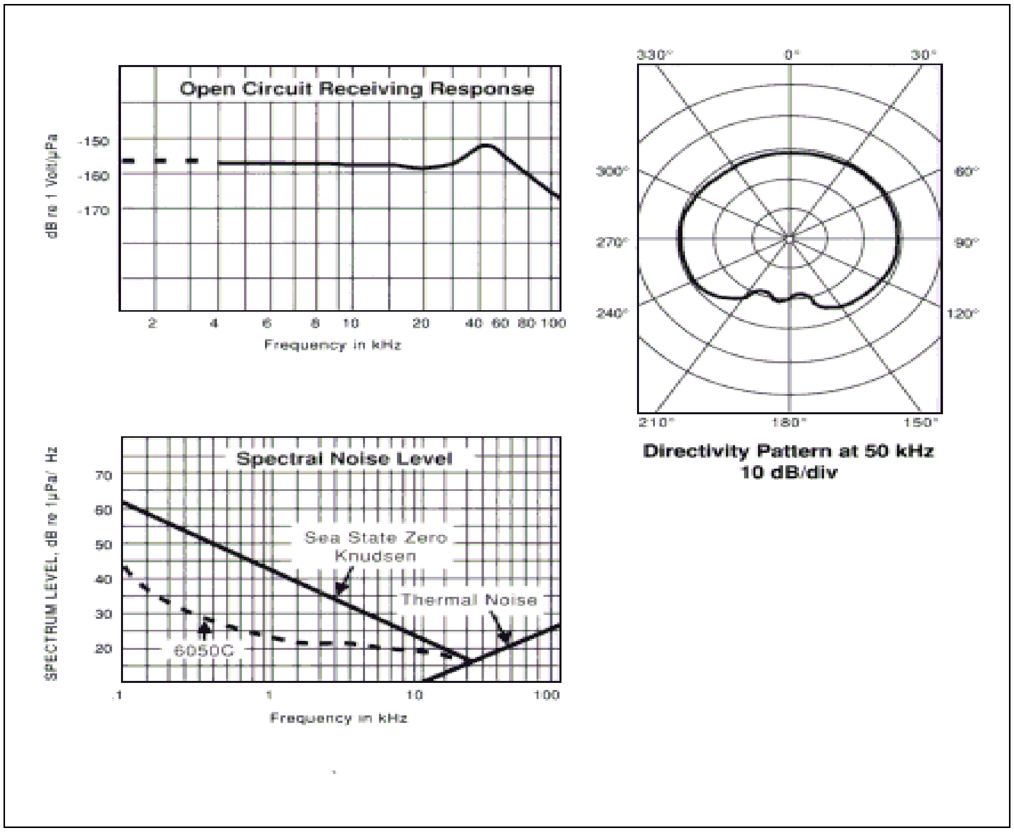


Figure 3. SCIUR VLA (ITC-6050N) hydrophone response and beam pattern curves (courtesy of International Transducers, Inc., http://www.itc-transducers.com/168-0044.htm).

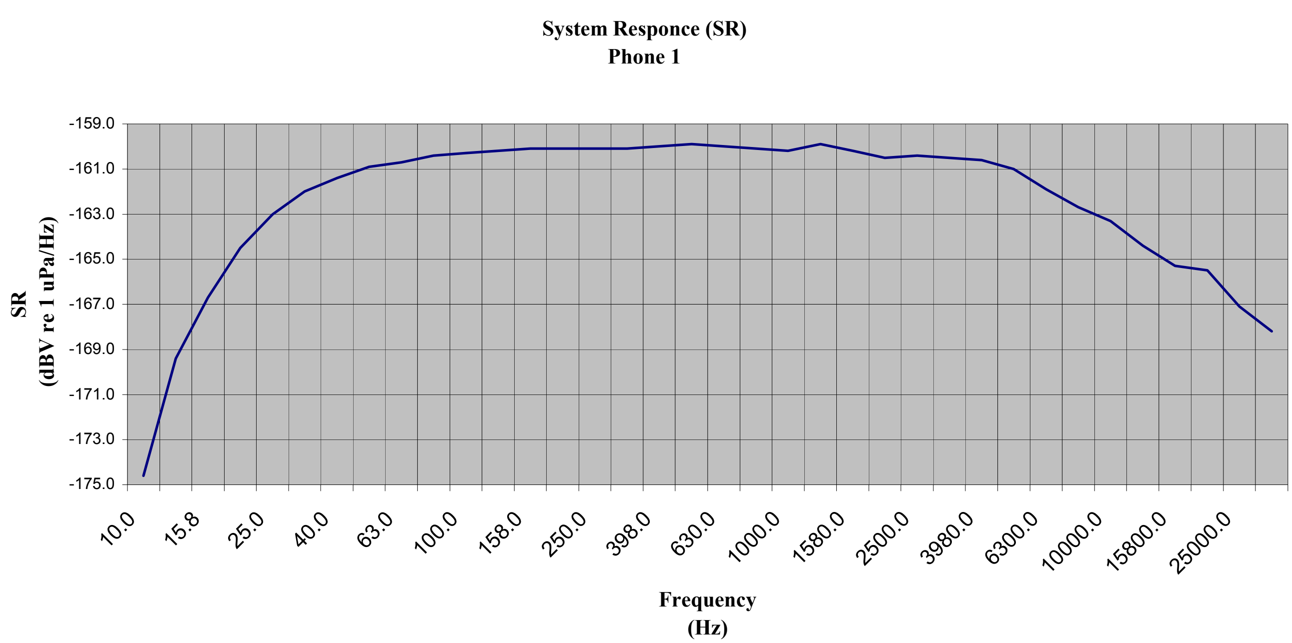


Figure 4. Measured system response for the SCIUR array hydrophone #1. Self-calibration test, measured in 1 Hz bins.

Figure 5. San Clemete Island military charter at the North Island Naval Air Station.

The SCIUR data was accessed via single-ended BNC connectors on the front panel of the NUWC equipment rack (Figure 6). The only signal conditioning applied to the data at the access point was from the Precision Filters 6201-1 unit, which was used as a high gain amplifier. Normally this unit is configured in “Auto-Master” mode, where it is allowed to auto-range (in 6 dB steps) to prevent data clipping. Where this would have been acceptable for our application, there was no way to automatically log and track the gain setting from our data collection system, so a constant gain was used throughout. A primary goal during this experiment was to determine the detection range limits for the transmitted whale calls. Continually increasing the amplifier gain (as the source-receiver range increased) would have extended the required track lengths and increased ship costs. Since the standard operating mode for the NUWC equipment is to let the computer control the auto-ranging amplifiers, the instructions to set the Precision filter unit to a constant gain is provided in Table 5.

It should be noted that due to the minimal support required from the NUWC personnel, NPS was able to reduce the costs normally associated with accessing the SCIUR facility. Total cost for NUWC personnel and facility access was $5,500 for this experiment.

Figure 6. SCIUR array termination and equipment rack.

SYS, NEXT	Should now be in the "ARM" menu
SEL, →, SEL, →	Cursor should be under "AUTO"
SEL, up arrow	Cursor should be under "PROGRAM"
ENT, SYS, SYS	Display should show "PROGRAM-MASTER"
Place the cursor under the gain setting using the up/down arrow and hit SEL to make the arrow adjust the gain	
With the cursor under the gain setting, up/down arrows will change the gain. Set to desired level and hit ENT.	

Table 5. Proceedure to slave the Precision Filter amplifiers to a constain gain setting.

The SCIUR terminal building (shown in Figure 7) is located on the North-East side of San Clemente Island, just South of Wilson Cove (Figure 8). The building's seaward side has unobstructed windows looking out towards the Outer Santa Barbara Passage and the Catalina Basin (Figure 9). The SCIUR terminal building is equipped with its own RADAR and transmits a DGPS signal over a dedicated UHF frequency for accurate ship tracking. These assets were not utilized during this experiment, but are available if necessary during future work. NUWC did provide handheld UHF radios for communication between ship and shore during the experiments.

San Clemente Island is operated by the U.S. Navy, and is a restricted operating area. An OPAREA request form (Appendix, Sec 12.3) must be submitted for approval and scheduling for all activities in/around the island. This also includes all acoustic transmissions, as there are several Navy labs (NUWC, SPAWAR, NRL) that work along the island. OPAREA 3802 and OPAREA 3803 were requested for the NPS effort. Craig Walker submitted the OPAREA requests for this experiment. Figure

10 shows the boundaries for OPAREA 3803 and the approximate 15 km acoustic track that was used for the transmissions during this experiment.

Figure 7. SCIUR terminal building (center, at the shoreline) on San Clemente Island. Small boat operations from SCI (foreground) supported personnel and equipment transfer to/from The R/V POINT SUR from the Wilson Cove dock.

Figure 8. Wilson Cove concrete pier and small boat operations. SCIUR building is located ~0.25 miles to the left.

Figure 9. View from the SCIUR building, looking west. Windows line the seaward side of the building for unobstructed observation.

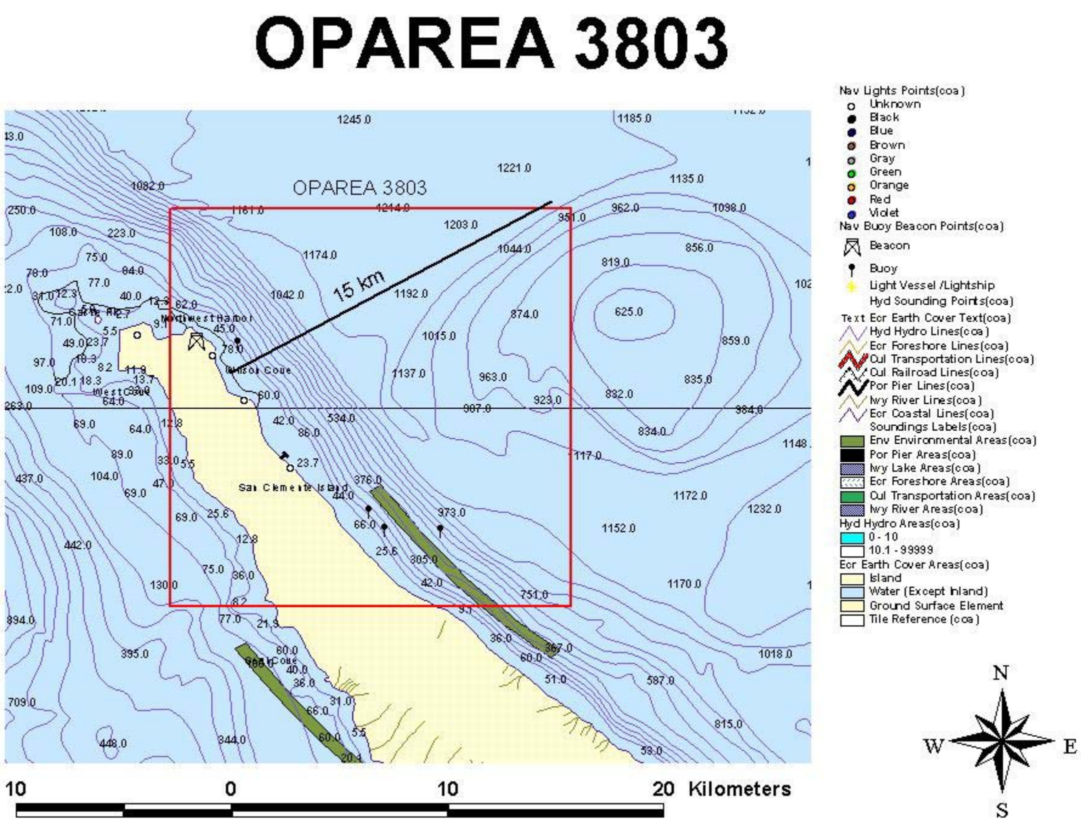


Figure 10. San Clemente Island OPAREA 3803 and the approximate acoustic track used for the July 2002 cruise.

5.0 Source-to-Receiver Equipment Descriptions

5.1 G-34 Sound Source

A G-34 transducer was rented from the Underwater Sound Reference Division of the Naval Undersea Warfare Center to provide a calibrated projector for at-sea experiments. The G34 transducer has an advertised frequency range of 200 Hz – 5 kHz, and is constructed of 7 tuned ceramic transducers that have been compressed side-by-side in a bronze housing. The individual responses of each ceramic plate add together to provide the larger bandwidth of the source, however this also results in a variable (not flat) transmit voltage response curve shown in Figure 11. The propagation frequencies of interest for this effort were 1-10 kHz. Previous tests with the G34 noted that the source was capable of generating higher frequencies (up to 20 kHz) however several lower (1-5 kHz) frequency harmonics were observed in this out-of-band range. Tests were performed, and it was determined that we could stretch the usable range of the G34 to 1-8 kHz to transmit the various signals for this experiment.

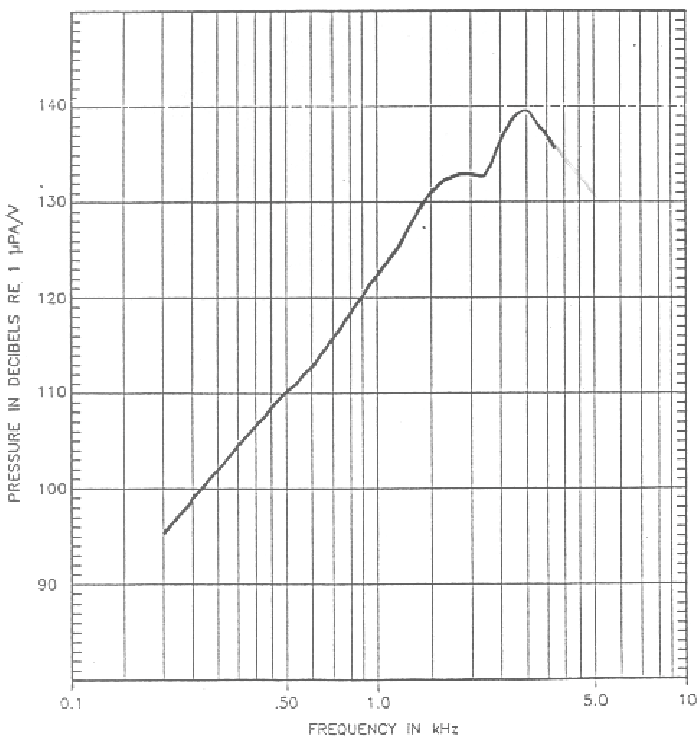


Figure 11. Transmit Voltage Response (TVR) curve for G34 projector

The G34 transducer was connected physically and electrically to the R/V POINT SUR's oceanographic winch, and lowered over the side via the gallows frame (Figure 12). The source was equipped with a jacketed wire rope harness, which was shackled to the winch wire. The winch wire has a steel outer jacket, with 4 copper center conductors, two of which were used to send the amplified signal to the transducer. An adapter was purchased to provide a seawater connection from the winch wire's Mecca connectors to the 2-conductor SeaCon connector on the G34.

The advantage of wiring the transducer directly to the winch wire was the ease of deployment and depth setting. Initial CW measurements through the wire suggest that there is a frequency dependent gain that is associated with the winch (inductive due to the windings?) that must be taken into account when calculating a projected source level from the amplified signal voltages. The initial voltage measurements through the winch wire were done using the Techron 7560 amplifier, at max gain on March 4, 2002. The winch wire 'transfer function' results are shown in Table 6. Note, this winch wire was replaced in September 2002, so this measurement must be repeated in the future. It should also be noted that this characteristic is likely to be "wire out" dependent, and may change significantly as the percentage of the winch wire is spooled out and the number of windings on the drum are reduced.

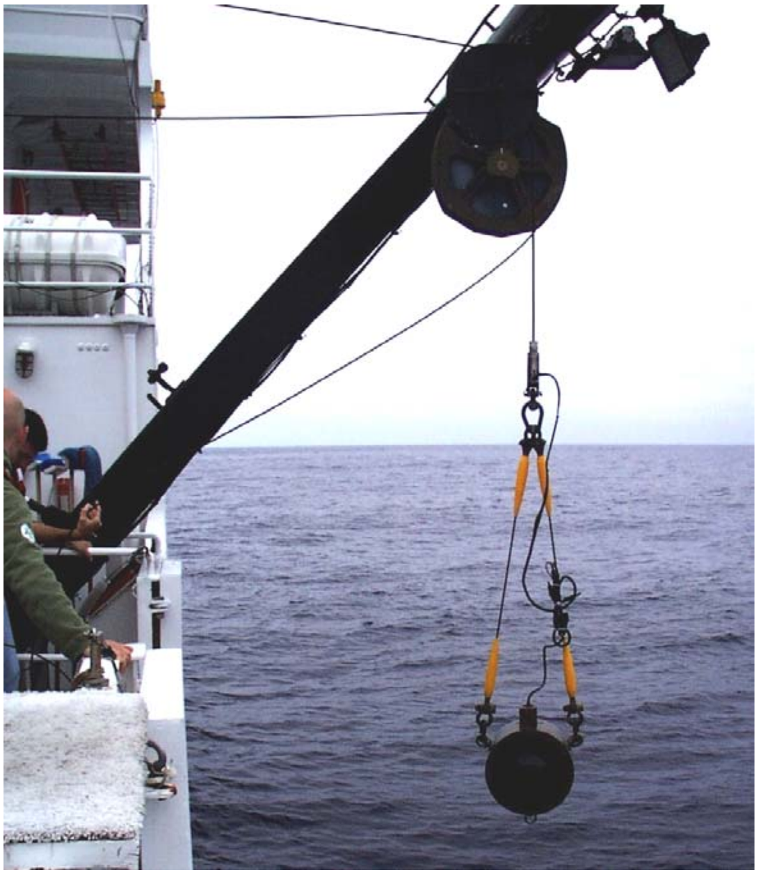


Figure 12. G34 projector suspended from the gallows frame of the R/V POINT SUR.

Frequency (Hz)	Input Voltage (Vrms)	Output Voltage (Vrms)	gain
500	20.5	20.51	1.000
1000	20.44	20.50	1.003
3000	20.43	21.08	1.032
5000	21.19	23.45	1.107
8000	23.06	29.45	1.277
10000	24.18	34.84	1.441

Table 6. Oceanography winch wire frequency response curve (under "no load" condition)

5.2 Techron Voltage Amplifier

Line-level input signals were amplified to provide enough voltage to drive the G-34 projector using a Techron model 7560 power supply amplifier (Figure 14), which was borrowed from Moss Landing Marine Labs (S/N 015142). This voltage amplifier has a 4 V_{rms} maximum input signal before clipping, and 3.45 V_{rms} to produce 600 Watt output on an 8 ohm load. The Techron amplifier power supply requires 110V, 20A service at full power. The R/V POINT SUR only had 15A service in the science lab, so an extension cord with appropriate 10 & 20 amp connectors was used to power the amplifier, and the full power capabilities of the amplifier were not possible due to supply power limitations.

Figure 13. Techron model 7560 power amplifier

The amplified output signal was connected to the source through the ship's hydro-wire from the aft winch. This connection was made inside the electronics lab.

5.3 Signal Selection and Generation

There were 2 signal sets that were used for this experiment, one set of odontocete (toothed whale) signals and another set of CW (continuous wave) & LFM (linear frequency modulated) signals. Due to the 1-8 kHz frequency limitations of the G34 source, all signals were filtered to ensure that the transmitted signal energy was contained in this pass band. Signals were filtered in MATLAB® using 4th order Butterworth filter coefficients, with passband frequencies of 1-8 kHz, applied with the 'filtfilt' function for an effective 8th order bandpass filter without the phase delays normally associated with the butterworth series filters.

An Internet survey was performed to search for high quality digital samples of Odontocete whale vocalizations. Researchers were contacted from the Acoustical Society of America's bioacoustics e-mail contacts list, and an internet survey of available marine mammal sounds was conducted. Of the vocalizations that were collected, only those signals with significantly rich content in the 1-8 kHz frequency band and contained a single animal's vocalization were considered for this study. Of these remaining signals, six signals were selected that provided the widest signal variability (various clicks and whistles) as well as the widest species representation. We limited this experiment to seven signals to guarantee that sufficient statistics could be generated for each signal during the time-on-station that was scheduled. The selected signals for this experiment are listed in Table 7, and their spectrograms are shown in Figure 14.

Table 7. Transmission signal source file and references.

Filename	Description	Signal Source (reference)
risso_ck_01.mat	Risso's dolphin click (*G. griseus*)	Watkins, 2001
pilot_wh_01.mat	Pilot whale click (*G. sp.*)	Watkins, 2001
pilot_wh_02.mat	Pilot whale whistle (*G. sp.*)	Watkins, 2001
sperm_ck_01.mat	Sperm whale click (*P. macrocephasus*)	Watkins, 2001
Orca__wh_01.mat	Orca whistle (*O. orca*)	Vancouver Aquarium
Orca__wh_02.mat	Orca whistle #2 (*O. orca*)	Vancouver Aquarium
Cw_sweep_01.mat	3s CW tones (1, 3, 5, 7, 10 kHz) plus LFM, 5s up-down sweep (1-10-1kHz)	NPS generated

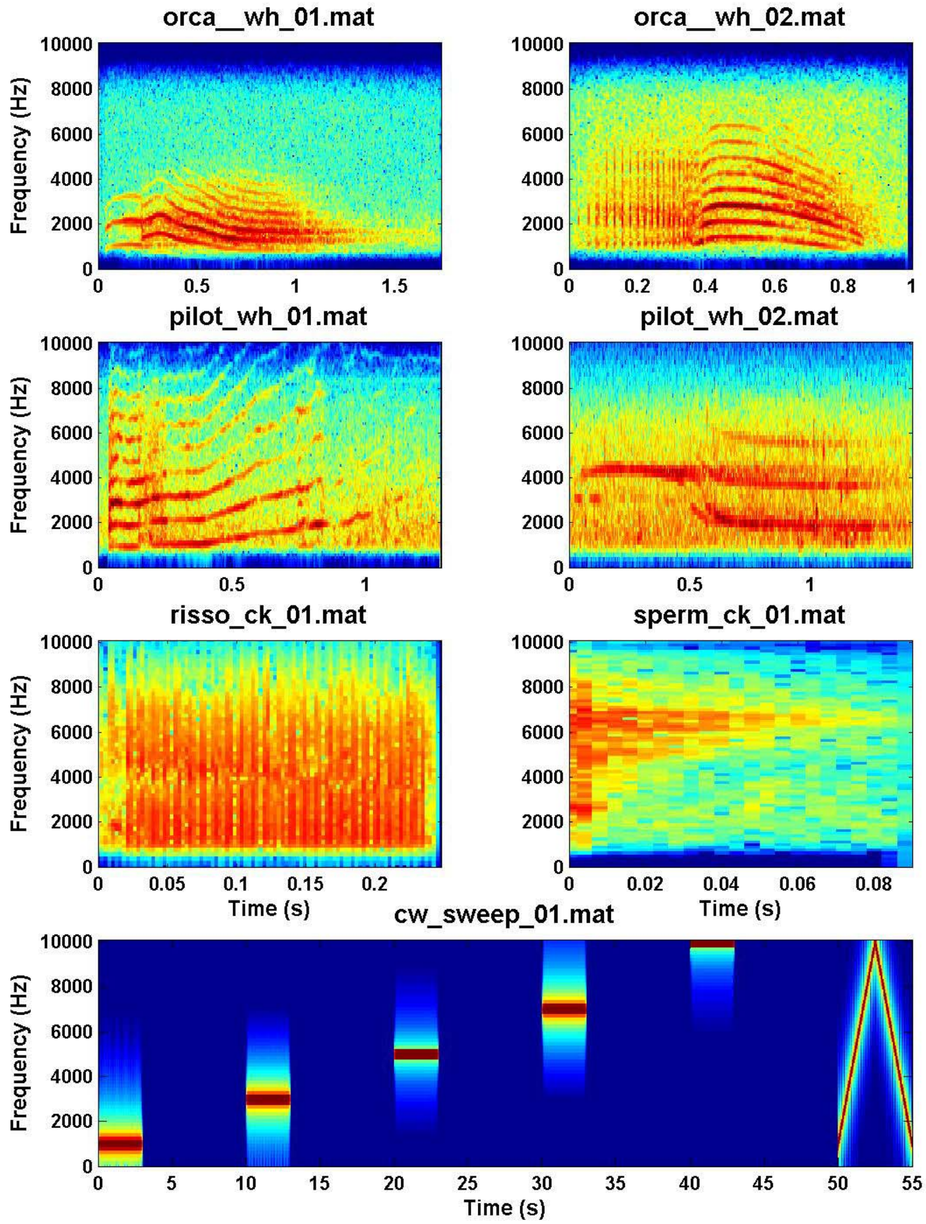


Figure 14. Frequency spectra for transmitted signals during the July 2002 cruise. Signal length varied for each signal.

Once these signals were selected, they were further edited to contain a single 'phrase': either a single click of a click train, or a dominant whistle in a series. Each signal was repeated 50 times during each transmission cycle to provide the statistical redundancy necessary to develop probability of detection curves for the receiver platforms. This information will be used to help determine the maximum detection ranges for each of these animals from these receivers.

A two (2) second, 3 kHz CW tonal was transmitted prior to each signal (LFM and whale calls) to provide a clearly audible signal index that could be seen in the receiver data (since the G34 source response is optimal at 3 kHz). This was very useful to properly identify the calls in the received data, as the received signal levels were below the noise level at maximum ranges.

Playback was done using the MATLAB® 'sound' function and a personal computer's SoundBlaster® soundcard. The sound card was tested over the frequency band using continuous wave

(CW) signals to verify it's ability to accurately reproduce the signals in both amplitude and frequency. Initially a generic sound card was tested which had a frequency dependence to its amplitude response. The SoundBlaster® card was tested and found to faithfully reproduce the signal, but had a maximum amplitude output of ±1V before clipping occurred. Each transmission signal was normalized to ±1V ensure that the transmitted signals from the G34 were faithful reproductions of the source signal.

The MATLAB® program 'timerwhale.m' (Appendix, Sec. 12.7) was used to automatically load and play all transmission signals, as well as automatically log each transmission time (Appendix, Sec 12.6). Both receive and transmit computers were networked, and GPS timing was provided to both (via SNTP protocol) to ensure that accurate timing was maintained during the experiment.

The CW and LFM signals were transmitted to study vertical and horizontal coherence, as well as transmission loss (TL) of narrowband signals. The odontocete signals were transmitted to provide contrasting wideband signals for comparison. The odontocete signals will also be used to develop receiver operating characteristic curves for the detection and classification of marine mammal signals using Navy receivers, a thesis research project supported by the Office of the Chief of Naval Operations Environmental Readiness Division, OPNAV N45.

5.4 AN/SSQ-57B Omni-directional Receivers

In addition to the NUWC SSRNM array, omni-directional sonobuoys were also deployed from the R/V POINT SUR as alternate receivers for this experiment. The AN/SSQ-57B is a passive, calibrated omni-directional sonobuoy used by the Navy from 1988-2002 as their calibrated LOFAR buoy. The applicable technical data is shown in Table 8.

Table 8. AN/SSQ-57B Technical specifications.

Description	Passive, Omni-directional, calibrated LOFAR
Average Weight	18 lb (8.16 kg)
Activation time (after splash)	Nominal < 1min. Maximum 3 min.
Transmitter	RF Channels 1-31, fixed
RF Power	1.0 watt
Power Source	Sea-Water battery
Operating Depth	90 or 400 feet
Decent time	60 sec shallow, 100 sec deep
Sensor Type	Piezoelectric, single element
Freq Range	5-40,000 Hertz (Calibrated)
Sensitivity	116 ± 2 dB re 1µPa @ 100 Hz = ± 19 kHz FM deviation
Directivity	Omnidirectional in horizontal and vertical planes
Operating Life	1, 3, or 8 hours (preselected)
Operating Environment	0-35°C sea water temp, sea state 5 max. (Sec 12.9)

The 57B is an "A" size sonobuoy with a fixed radio frequency transmitter, preset during construction to one of 31 RF frequencies between 162.250 – 173.500 MHz. Section 12.8 contains a complete list of the sonobuoy channel frequency allocations. The 57B sonobuoy contains six electronics sub-assemblies: the hydrophone, preamplifier, sonic amplifier, FM modulator, VHF transmitter, and antenna (see Figure 15). Ocean acoustic pressure waves create movement in the sonobuoy hydrophone. The hydrophone creates a resultant voltage out, the preamp amplifies the hydrophone voltage, the sonic amplifier shapes and pre-whitens the response, the modulator converts voltage to frequency (FM deviation) and the transmitter provides the high frequency FM carrier and drives the output at 1 watt. A 3 dB change in the level into the hydrophone results in a corresponding deviation in the RF carrier. For a typical sonobuoy hydrophone, an incident pressure of ~80 dB re 1 μPa results in an output voltage of ~10^{-5} volts. The preamplifier in the 57B amplifies this signal by 40 dB (gain of 100), for an output level on the order of 10^{-3} volts.

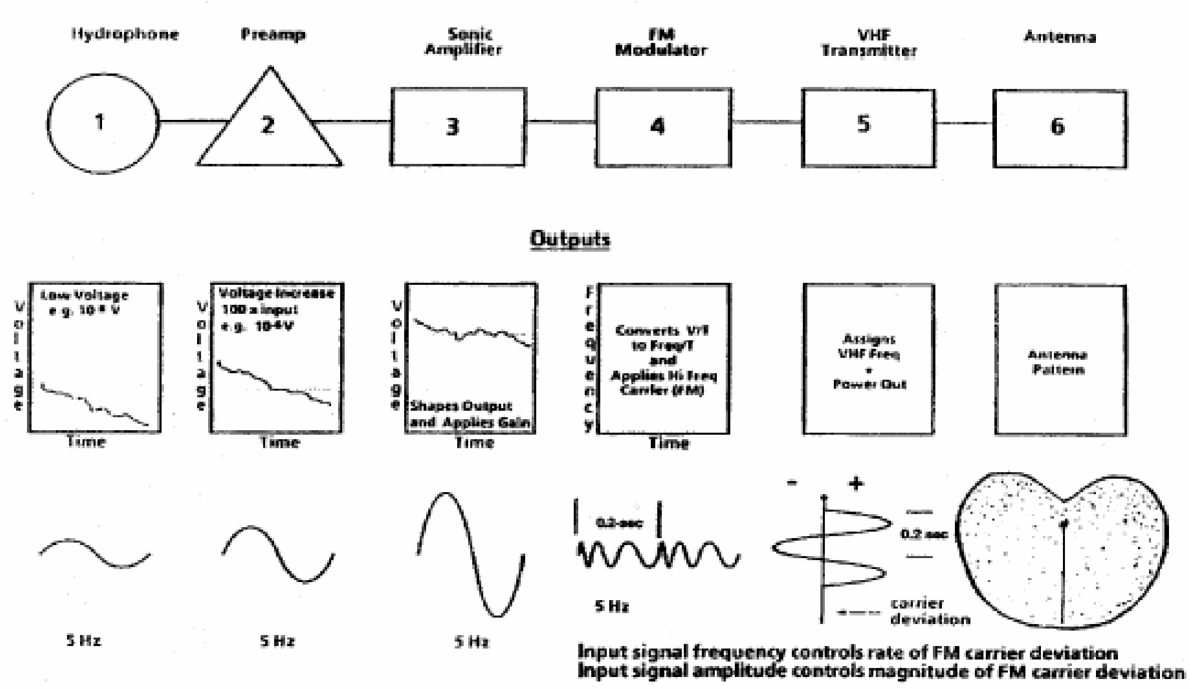


Figure 15. SSQ-57B sonobuoy system sub-assembly overview.

After the preamplifier, the signal is passed through a sonic amplifier. The sonic amp is used to: set the low and high end frequency response; control and set the sensitivity of the sensor; and shapes the output of the sensor for RF transmission (pre-whitens the signal). For any FM receiver, the maximum deviation that is allowed is based upon the width of the IF (intermediate frequency) amplifier. Deviations above this frequency will create distorted signals, or a non-linear output. The FM bandwidth approximations are determined by:

- 2 x peak deviation + 2 x highest modulated frequency
- 2 x 75 kHz deviation + 2 x 20kHz
- 150 kHz deviation + 40 kHz

for a total FM bandwidth of 190 kHz for this example.

The acoustic sensitivity of the 57B sonobuoy is specified (end-to-end) as: "An RMS SPL input of 116 ±2 db // μPa at 100 Hz will result in a ±19 kHz VHF carrier frequency deviation." The sonic frequency response of the 57B sonobuoy is shown in Figure 16.

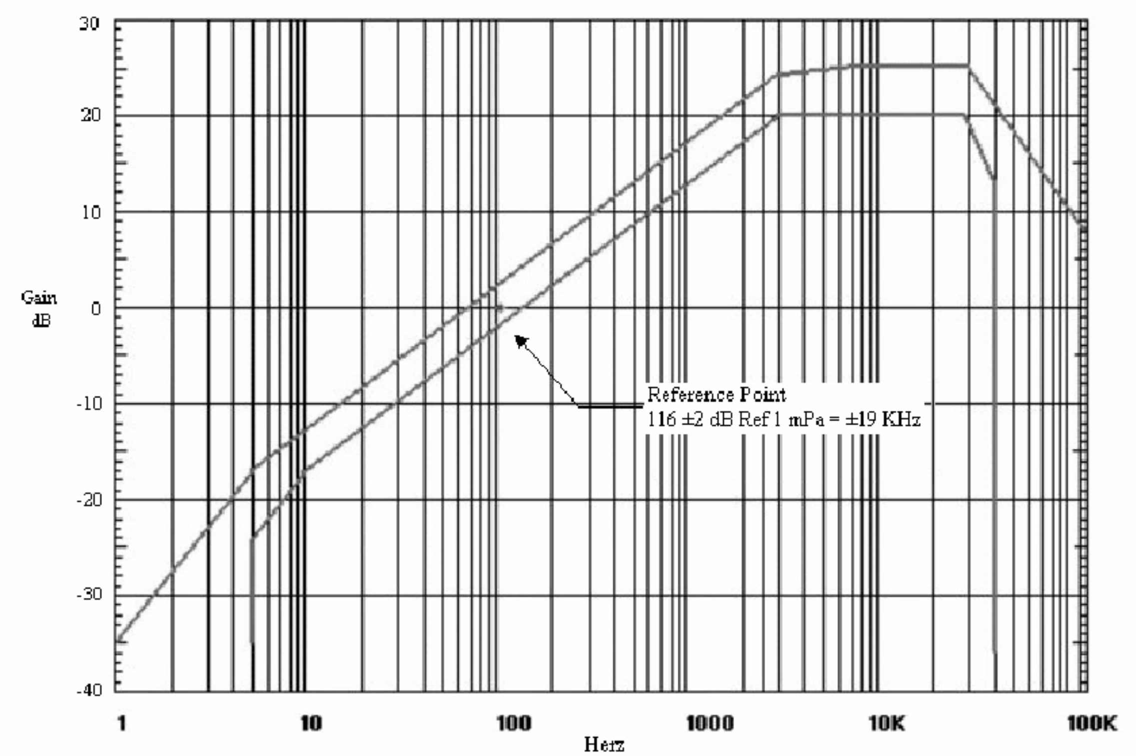


Figure 16. Sonic frequency response of the SSQ-57B sonobuoy

The sonobuoy signal cable is a 28 gauge dual conductor copper strand cable with a 30 lb break strength. The cable feeds the positive supply voltage from the seawater battery down to the hydrophone, and the signal from the hydrophone up to the transmitter section. The sonobuoy uses a seawater ground to reduce the need for a third conductor along the cable assembly.

The sonobuoy hardware assembly also includes a kite/disk drogue assembly to reduce vertical wave motion at the hydrophone, to prevent low frequency (<50 Hz) noise adding to the receiver. The change in hydrostatic pressure for 1 inch of vertical movement of the hydrophone (at any depth in the ocean) results in 168 dB // µPa output level. An ambient noise reading of 80 dB // µPa would be caused by a change in pressure equivalent to the difference in hydrostatic pressure between two points in the water column separated vertically by 1/10,000th inch. The sonobuoy drogue assembly shown in Figure 17 is used to reduce this vertical motion.

The sonobuoy configuration required for this experiment called for vertical measurements of the received sound field. Multiple sonobuoys, deployed to different depths, were tied to a single spar buoy to provide a Vertical Line Array (VLA) of elements for each receiver location. The VLA configuration information is listed in Table 9.

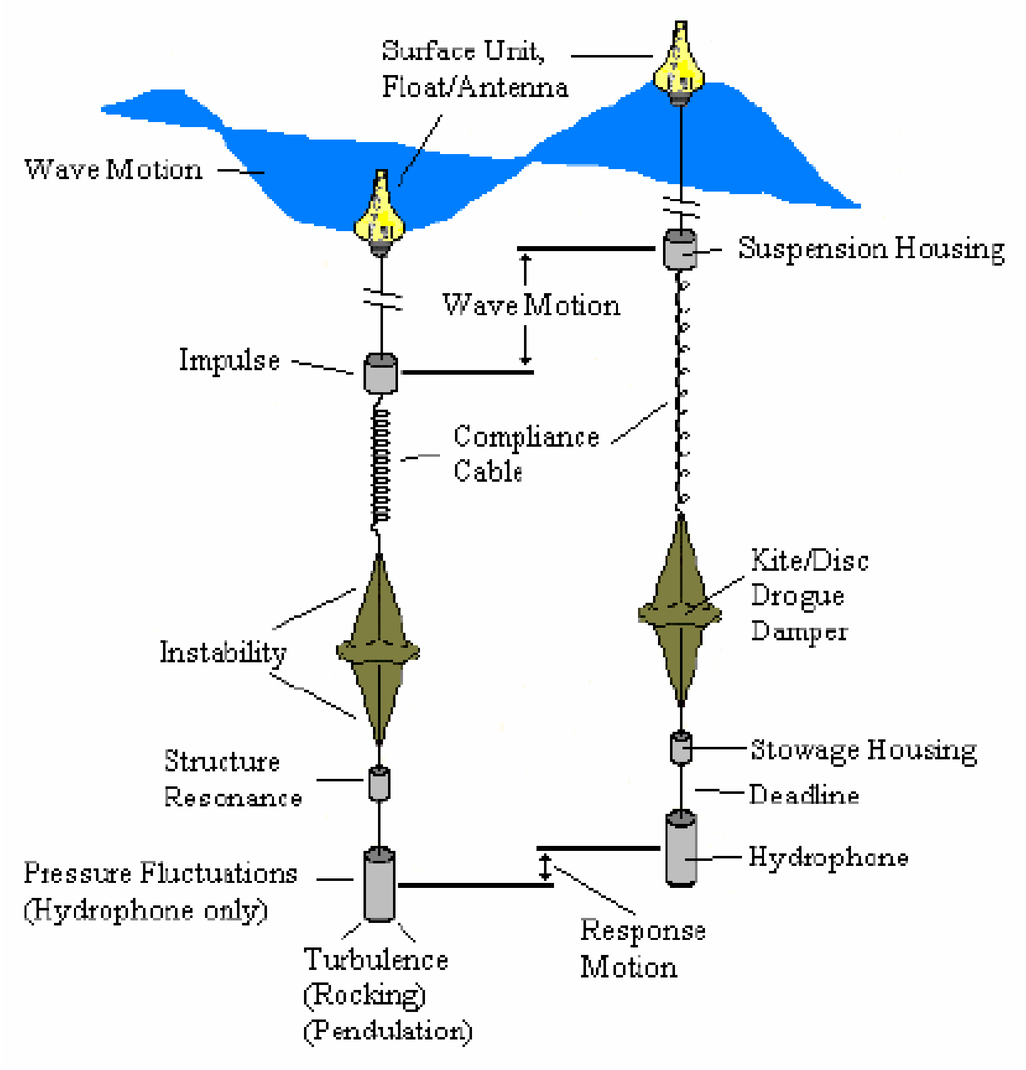


Figure 17. SSQ-57B Kite & Drogue damper assembly.

Accurate receiver locations are necessary for TL calculations and detection range estimation. All sonobuoys deployed for this experiment were tied off to spar buoys (Fig. 18). The spar buoy allowed for GPS positioning as well as radio, visual and radar tracking from the ship. The deployment times and sonobuoy setup for each spar buoy are listed in Table 9. Positioning the buoys was done using a handheld GPS unit (Garmin International, model eTrex VISTA). This GPS unit (Fig. 19) has a 12 hour operating life (reported) from 2 AA batteries. Our experiments have shown 5-8 hours typical during experiments with 'average' batteries of unknown shelf-life. Additional testing with high-end batteries will be conducted as we have had units turn off during deployment due to low power. These units are ideal for a simple GPS track, as they store 3000 track points (programmable by distance or time intervals), and follow the IEC 529 IPX7 European waterproof standard (waterproof up to 1 meter for 30 minutes).

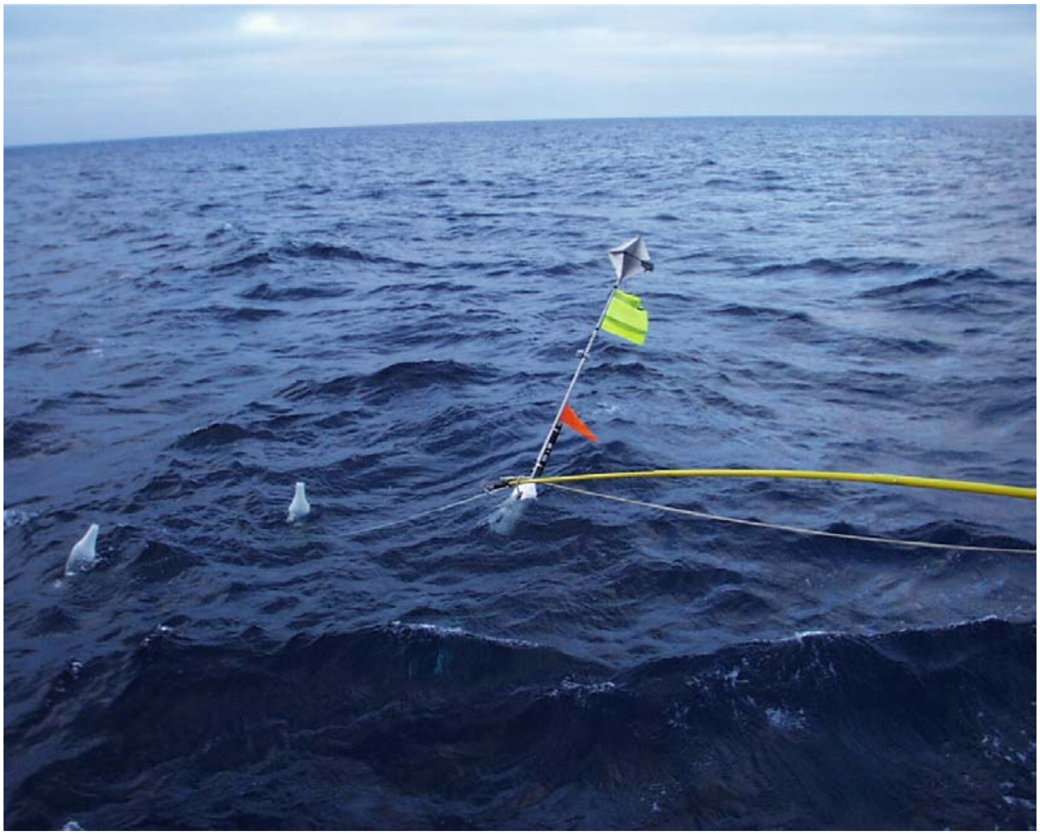


Figure 18. Spar buoy (center) with two sonobuoy antennas visible (left). Radio beacon is attached above the buoy flotation, and GPS handheld unit below the radar reflector/flag.

Table 9. VLA/Spar buoy deployment times and configurations (Appendix, Sec 12.4).

	Acoustic Run #1	**Acoustic Run #3**	**Acoustic Run #4**
VLA/Spar 1 (red flag)	GPS #3	GPS #3	GPS #1
Deployment time	7/25/02, 20:35 UTC	7/26/02, 13:50 UTC	7/26/02, 23:45 UTC
Recovery time	7/26/02, ~00:30 UTC	7/26/02, 16:00? UTC	7/27/02, 02:25 UTC
Novatech Freq	159.480 MHz		159.480 MHz
FM channel allocation & depth setting	Channel 2 – 90’	Channel 3 – 90’	Channel 5 – 90’
	Channel 3 – 200’	Channel 5 – 200’	Channel 3 – 200’
	Channel 4 – 400’	Channel 4 – 400’	Channel 19 – 400’
VLA/Spar 2 (green flag)	GPS #1	N/A	GPS #3
Deployment time	7/25/02, 21:09 UTC	N/A	7/26/02, 23:43 UTC
Recovery time	7/26/02, ~01:00 UTC	N/A	7/27/02, 02:34 UTC
Novatech Freq	154.580 MHz		160.725 MHz
FM channel allocation & depth setting	Channel 25 – 90’	N/A	Channel 25 - 90’
	N/A	N/A	Channel 24 – 200’*
	Channel 15 – 400’	N/A	Channel 2 – 400’

Figure 19. Garmin International eTrex VISTA handheld GPS unit. (photo courtesy of Garmin Intl.)

Each spar buoy was equipped with a radar reflector so they could be tracked from the ship's bridge while deployed. Novatech RF-700C Radio beacons and SP-400A xenon flashers (for night deployments) were also added to aid spar buoy tracking. Tracking was necessary to enable the ship to locate the buoys for rapid recovery.

5.5 ICOM PCR-1000 Radio Receivers

The radio selected to receive the sonobuoy acoustic signal was the ICOM America, Inc. model PCR-1000 (Fig 20). The PCR-1000 is software controlled AM/FM/SSB/CW radio receiver that provides full spectrum reception from 0.01-1300.00 MHz. Since each radio is software controlled, an 8-port serial, PCI board was added to the shipboard receiving computer (Sec. 5.6). The PCR-1000 is delivered with a software control application, but it would only support one radio/computer. A multiple-use license for the TalkPCR software package was purchased to enable one computer to set & control all six radio receivers. The standard TalkPCR program does not allow multiple copies to run on the same machine, but the programmer was contacted and was helpful in recompiling a special executable that didn't have this limitation.

Figure 20. ICOM PCR-1000 radio receiver, showing (left-to-right) the 1/8" mini-plug audio output, 9-pin serial computer control connector, DC-power connector, ground screw, and the 50Ω BNC antenna connection. (Photo courtesy of ICOM America)

The TalkPCR software was set up to receive Wideband FM (WBFM) signals, with the 230 kHz filter setting. The 230 kHz filter allowed us to receive the full 190 kHz frequency deviation signal from the sonobuoy (Sec. 5.4, p. 17).

The volume settings for the ICOM radio also had to be calibrated to ensure any signal gains in the receiver system were known. An FM signal generator (Racal-Dana, Model 9082) was used to modulate 1

Volt, CW tonal signals, which were input to the ICOM radios. The volume settings on the TalkPCR software were set so that these 1 Volt inputs resulted in a 1 Volt output from the ICOM radio (i.e. no gain caused by the radio receiver system). At this volume setting, the voltages that are present at the input to the sonobuoy transmitter will be identical to the radio receiver output. By applying the sonobuoy gains and hydrophone sensitivity, we can back out the absolute pressure levels, in Pascals, received at the sonobuoy hydrophones.

5.6 Calibrated Monitoring Hydrophone

A calibrated monitoring hydrophone was lowered from the ship's stern to measure the near-field source signals. The hydrophone was manufactured by High Tech, Inc., model 316/1/1, (S/N:316002) with a flat sensitivity of -164.7 dB re 1V/μPa from 10 Hz - .

The monitoring hydrophone was suspended from the ship's starboard stern quarter, and the hydrophone cable was run back into the dry lab to the amplifier & data collection rack. The monitoring hydrophone used a Stanford Research Systems, low-noise voltage amplifier, model SR560, to amplify the signal prior to digitization. This amplifier has a built in low-pass and high-pass filters, that were useful to provide anti-alias filtering on the high-end, as well as remove the very-low frequency signals caused by the ship's motion, swells, etc. Table 9 lists the gain settings used during the experiment.

Table 10. Monitoring hydrophone amplifier gain settings.

Date/time (UTC)	Preamp gain setting
24 July 02, 2035	10
25 July 02, 0426	5

5.7 NPS Data Acquisition Systems

The data acquisition systems assembled for collecting the NPS acoustic data (Fig. 21) are built around the National Instruments' PCI-6052E Multifunction Data Acquisition (DAQ) board. This DAQ card provides 16-bit sampling of 8 differential (16 single-ended) analog inputs for a total throughput of 333 kSamples/second. The National Instruments series was selected for quality, capabilities, and compatibility with the MATLAB® Data Acquisition Toolbox.

Received acoustic data was first passed through Ithaco, model 4120A, dual low-pass filters. These filters provided the anti-aliasing necessary to prevent higher frequencies from contaminating the digital data collected by the NI-DAQ cards. The 4120A series filters provide 0.1 Hz – 1MHz adjustable, 4-poleButterworth low pass filters with an attenuation slope of 80 dB/decade above the cutoff frequency. For this experiment, all filters from the shipboard system were set at 10kHz.

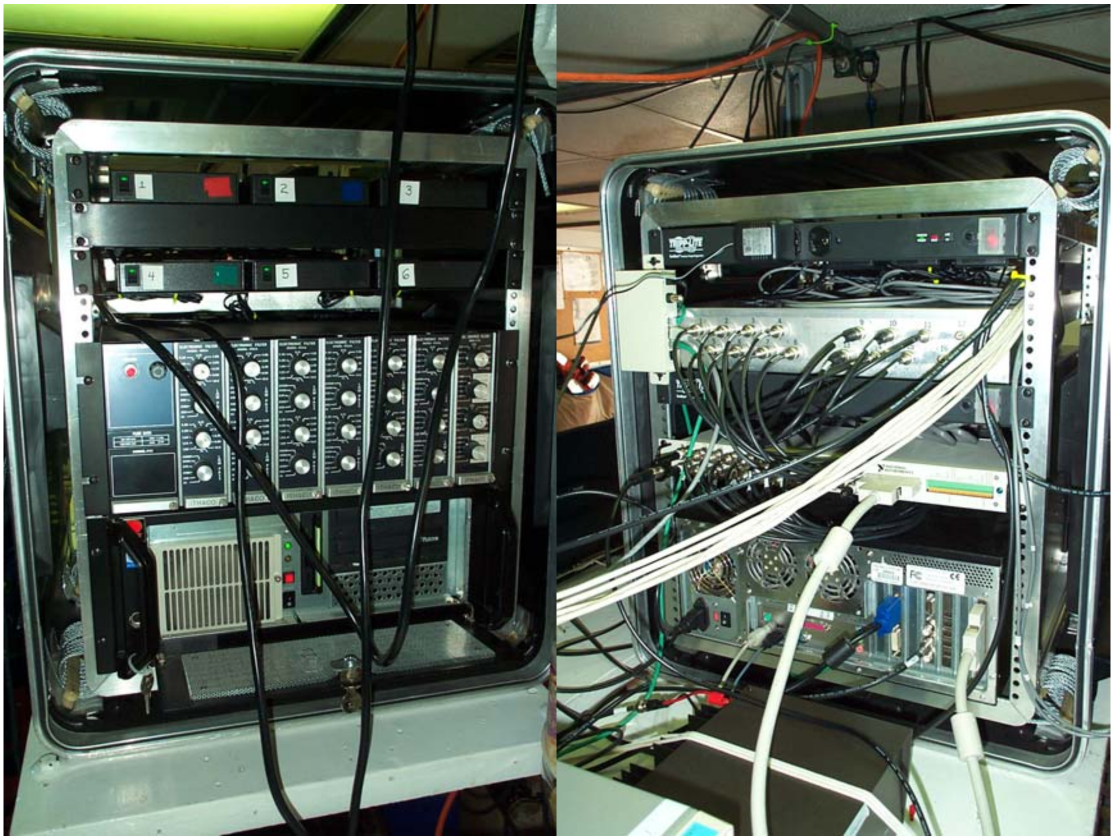


Figure 21. NPS portable data acquisition system front (left) on board the R/V POINT SUR. The data acquisition computer is mounted at the bottom of the rack, Ithaco low pass filters above it, and the six ICOM radio receivers (sonobuoy reception) are mounted at the top. The back of the rack (right) shows additional breakout boxes and wiring necessary to connect data, GPS, and RF antennas to the rack.

5.7 Lightweight Implosive Glass Hand-deployed Target Bulb

Lightweight Implosive Glass Hand-deployed Target (LIGHT) bulbs were also deployed from the POINT SUR to provide broadband impulsive signals used for receiver positioning. LIGHT bulbs are manufactured by several companies, are available commercially (General Electric, Sylvania, etc.) and come in several sizes and shapes. The LIGHT bulbs deployed during this cruise were 6 cm glass evacuated spheres, with an elongated end (pear shaped) and terminated in a thin metal casing which was used to attach anchor weights (Fig 22). The LIGHT bulbs can also be deployed in a linear array of elements (Fig 23). Due to the implosive nature of the bulbs, adequate supervision was maintained during the assembly process (Fig 24). We are still trying to determine the manpower requirement to prepare a LIGHT bulb for deployment (Fig 25).

Figure 22. LT Jorge Garcia readying a LIGHT bulb for deployment.

Figure 23. LIGHT bulb linear array elements ready for deployment.

Figure 24. LIGHT bulb assembly process with proper safety, supervision and gray tape.

Figure 25. LIGHT bulb assembly process. How many students does it take…?

Received signals from three of the LIGHT bulb sources are shown in figure 26, each showing three distinct signals from each of the bulbs. These bulbs were attached to the ship's CTD frame, and lowered. The approximate depths of each implosion were 66, 82, and 90m (216, 270, and 295 feet).

These depths were estimated from the CTD winch wire-out length at the time that each of the implosions was heard on the monitoring hydrophone audio.

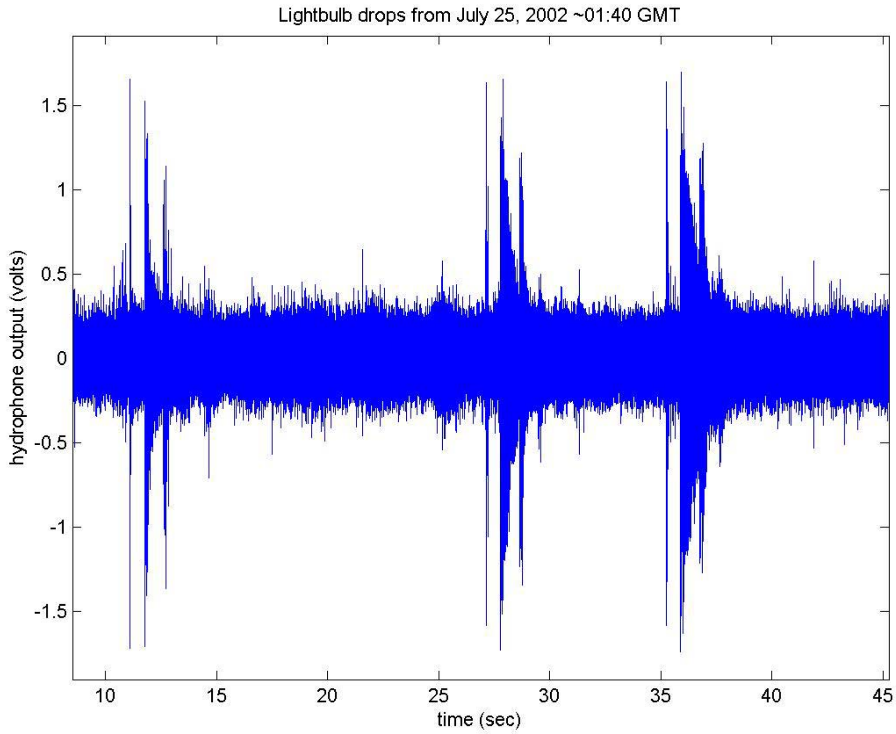


Figure 26. Three LIGHT bulb source implosions received at the monitoring hydrophone on July 25, 2002.

An expanded view of the first LIGHT implosion is shown in Figure 27. The direct path arrival arrives first, but since we don't know the exact time of implosion (only when the signal was received at the monitoring hydrophone), we can't derive a range estimate from the hydrophone to the LIGHT without additional receivers. With the approximate depth of the monitoring hydrophone of ~110 feet (33.5 m), we can estimate the LIGHT implosion depth by looking at the time-difference of arrivals between the direct path and surface reflected signals (Figure 28). Given the time difference of 32 ms, and a sound speed of 1500 m/s, the difference in path lengths is 48 m. Since we know the hydrophone position and depth, and know the bulb drop position, we can determine the approximate implosion depth from the equipment geometry.

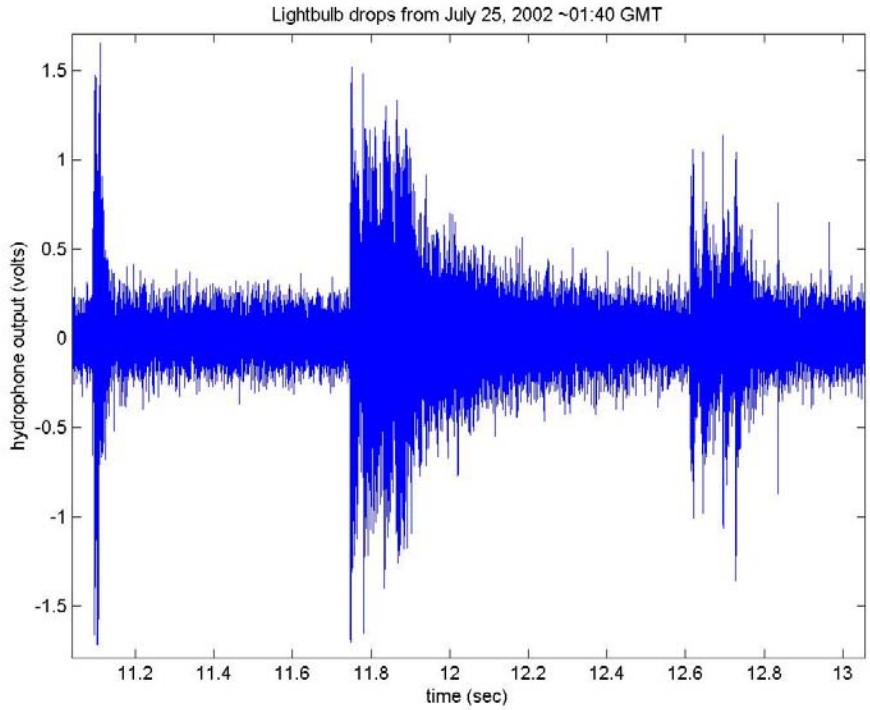


Figure 27. Single LIGHT bulb implosion impulse and echoes. Evident multipath spreading exists.

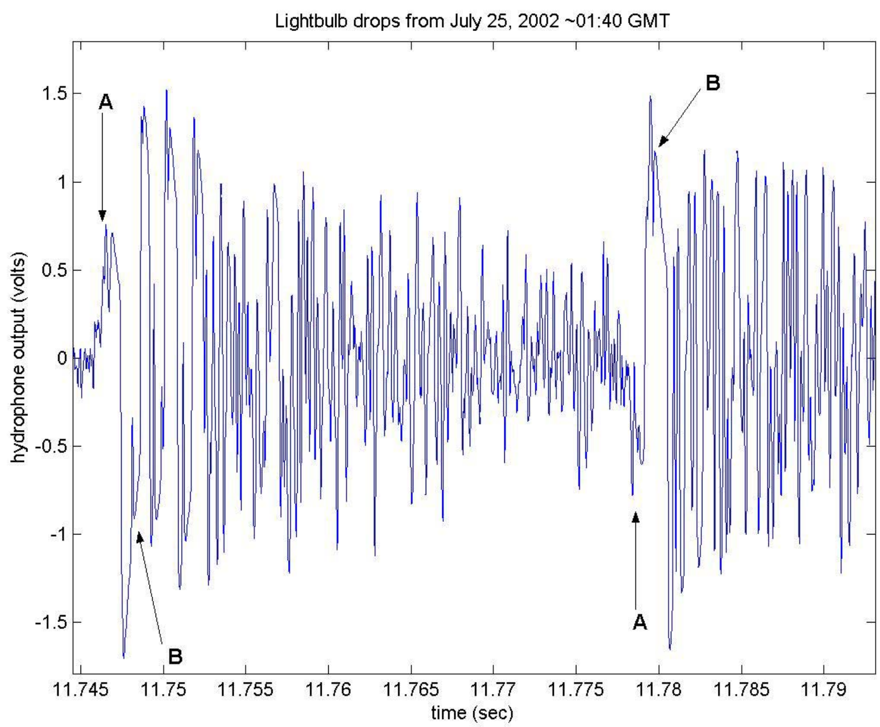


Figure 28. Expanded view of the first echo from the LIGHT source. Note the 180 phase change at points A and B. This is consistent with a reflection from a pressure release boundary (ocean surface).

6.0 Acoustic Data Format

Data acquisition control and storage was performed using the MathWorks DAQ file format created by MATLAB®'s Data Acquisition Toolbox. The acquisition program, digitize.m, used to collect all data for this experiment is listed in the Appendix (sec 12.7). The sample rate for both acquisition systems (shipboard and on the island) was 33.333 kHz, and each binary output DAQ file contains one minute of data.

The exact header, file structure, and format for the DAQ files are not specified, but MATLAB® provides the function DAQREAD.M to access to the data and as well as relevant software and hardware configuration information stored during collection. Some of the key items that can be obtained from each DAQ file's object information are: number of data channels, single or differential input, acquisition device, channel skew (time delay between channel observations), trigger time, sample rate, number of samples acquired to the current data file, and the data file name. MATLAB® logs absolute timing information (time of day) using the computer's internal time. The computer timing was corrected to GPS accuracy from the ship's NEMA (National Electrical Manufacturers Association) provided signal in the electronics lab of the Point Sur. On San Clemente Island, GPS timing was provided by a TrueTime NTS-90 Network Time Server, which provided NTP time corrections over a local Ethernet connection to the data acquisition computer.

For further information on how to access and read in the DAQ files and format, the reader is referred to the Data Acquisition Toolbox Users Guide (vol. 2).

7.0 CTD Measurements

Conductivity, Temperature and Depth (CTD) casts were taken throughout the cruise to provide environmental data measurements. CTD casts were taken at the beginning (1km from SCIUR array), middle (5km from array), and end of each acoustic transmission leg. CTD times and locations are provided in Table 11.

Table 11. Time and location of CTD casts

CTD #	Date	Time (UTC)	Latitude (start)	Longitude (start)
1	25 July 02	15:46	33 00.958' N	118 31.375' W
2		19:24	33 02.704' N	118 29.652' W
3		23:55	33 05.271' N	118 26.624' W
4	26 July 02	02:16	33 01.038' N	118 31.479' W
5		07:24	33 04.417' N	118 27.500' W
6		13:00	33 02.664' N	118 29.637' W
7		16:39		
8		19:15	33 01.040' N	118 31.481' W
9		22:24	33 02.632' N	118 29.706' W
10	27 July 02	06:07	33 05.391' N	118 26.720' W
11		13:03	33 03.411' N	118 28.866' W
12		16:59	33 01.106' N	118 31.490' W
XBT		17:36	33 00.949' N	118 13.381' W
14	28 July 02	12:47	34 09.113' N	120 03.142' W
15		13:44	34 13.628' N	120 00.328' W
16		14:35	34 19.017' N	120 59.801' W
17		15:??	34 ??' N	120 ??' W

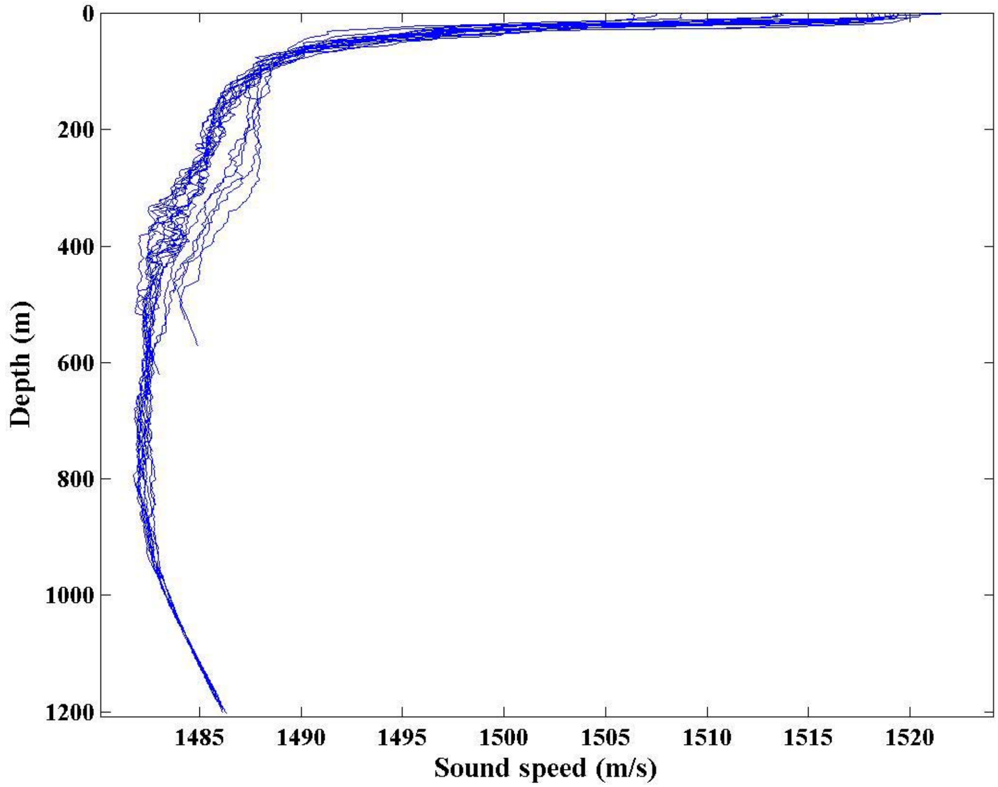


Figure 29. Sound speed profiles from the San Clemente cruise.

8.0 G-34 Source Test

During the transit from Santa Barbara to San Clemente Island, the G-34 source was deployed over deep water to perform a calibration test of all equipment. Continuous wave (CW) tonals were transmitted from the G-34 source, and data was collected from the HighTech, Inc. "monitoring" hydrophone, a RESON, Inc. calibrated hydrophone, and a SSQ-57B sonobuoy deployed over the side and shore powered by a 12V power supply.

The goal of this test was to provide accurate source level measurements as well as provide calibration curves for the different hydrophone systems to ensure that absolute pressures could be calculated from each receiver system.

Table 12. G-34 calibration test hydrophone setup.

	Data channel #	Amplifier gain
HighTech, Inc. hydrophone	1	10
57B sonobuoy, (Ch13)	2	1 (ICOM radio gain = 1)
Reson	3	200

The G-34 source was deployed from the gallows frame of the POINT SUR, and all three hydrophones were deployed from the aft starboard quarter. During this test, the Techron amplifier blew several fuses, so the output power was reduced to half power. The source signal generation code (MATLAB®) was also producing errors, and the computer was reset several times. During the hydrophone recovery after the test, it was noted that the sonobuoy hydrophone had not deployed from the cardboard tube, so the test was performed again (from 2221) with 5 second CW signals (1 second gap) stepping through the bandwidth. The calibration transmissions were secured at 2305.

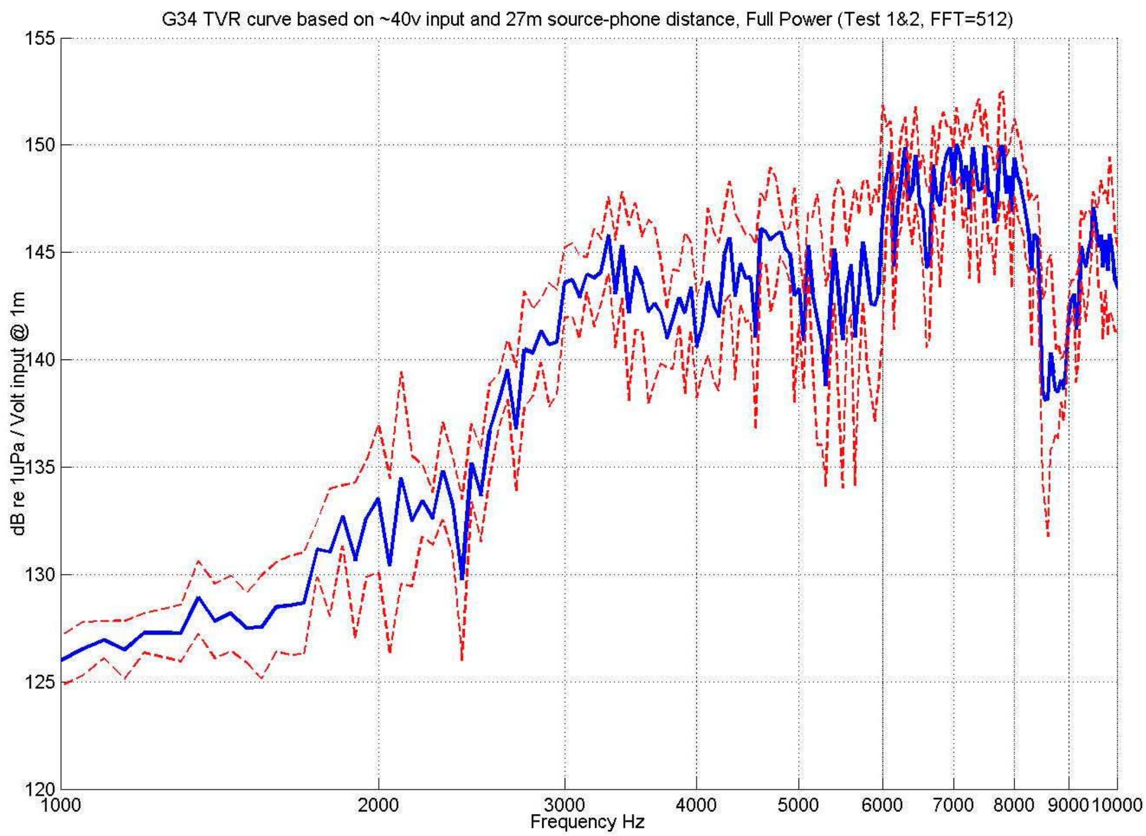


Figure 30. G34 mean calibration curve calculated from received data from the High Tech hydrophone (blue) with one standard deviation shown in red.

9.0 Acknowledgments

The SCIUR Acoustic Experiment was financially supported by the Chief of Naval Operations, Environmental Readiness Division (OPNAV N45), and the Naval Postgraduate School. We would like to acknowledge both organizations for making this effort possible.

We would like to thank the captain and crew of the R/V POINT SUR. Their professionalism, knowledge, flexibility and cooperation contribute so much to our efforts, and the quality of this data set is made possible with their assistance.

10.0 Appendix

10.1 Experiment Operations Schedule

OC4270 – Tactical Oceanography
Summer Cruise 2002
R/V PT SUR
23-28 July 2002

All times Pacific Daylight Time (PDT)

Friday, 12 July 02

1000: On load Moss Landing Harbor. On load 1 pallet (basket) of SSQ-57B sonobuoys, G34 Acoustic Source, and cruise boxes. Install VHF sonobuoy antenna on mast.

Tuesday, 23 July 02 [Sunrise, 0603; Sunset 2008; Moonrise 2007 (Waxing Gibbous 99% Illumination)]

1300: Staff/Faculty Arrive Santa Barbara and embark R/V PT SUR. Onload of 1 electronic half-rack and 1 PC. Equipment set-up and testing. *Note: Prof Collins and 5 students will remain aboard PT SUR from 22 July. No meals requested.*

Wednesday, 24 July 02 [Sunrise, 0604; Sunset 2005; Moonrise 2048 (Full Moon, 100% Illumination)]

0700: Breakfast
1000: Underway from Santa Barbara to Santa Catalina Island (OPAREA 3803)
1130: Lunch
1300: Acoustic Calibration Trials. PT SUR requested to position in lee of islands with sufficient sea room to declutch shaft. G34 acoustic source will be lowered and three (3) monitoring hydrophones will be deployed off stern for calibration testing. Approximately 20 minutes of signals will be transmitted. Request to repeat trials at least 2 times (hopefully sufficient). Monitoring hydrophones can be recovered and PT SUR may reposition between trials.
1600: Resume transit
1700: Dinner
1800: Ambient Noise and Broadband Acoustic Signal Experiment. Drop single sonobuoy from PT SUR (not recovered). PT SUR can move away from buoy approximately 1 km. Students will collect ambient noise data for approximately 30 minutes then drop weight light bulbs for broadband source. Additionally to bring ship DIW, lower monitoring and hydrophone and lower Rosette cage with light bulb attached to determine approximate depth bulbs implode and their source level.
2000: Resume transit to Santa Clemente Island (OPAREA 3803)

Thursday, 25 July 02: [Sunrise, 0603; Sunset 1959; Moonrise 2120 (Waning Gibbous, 98% Illumination)]

0700: Breakfast

0800 R/V PT SUR arrives in OPAREA 3803, Wilson Cove, San Clemente Island (vicinity 33° 00N 118° 33W). Conducts Comm Checks with NUWC Range and CTD Station 1

0900: Commence Acoustic Experiment #1 . PT SUR will be running a transect from about 1 km from NUWC SSRNM Vertical Array to 11-15 km offshore (when signal is lost by NUWC Range). NUWC SSRNM Vertical Array approximate position 33° 01.8'N 118° 33'W. Exact position will be provided by NUWC Range. Acoustic Stations will occur every 1 km proceeding offshore from NUWC Array. At each station, PT SUR is requested to stop and declutch shaft; G34 source will be lowered and monitoring hydrophone deployed. Source will transmit about 16 min at each station (1-8 kHz; max 145 dB SL). Science party will deploy two sonobuoy vertical arrays at 5 km from seaward from NUWC Array (5th Acoustc Station). Sonobuoys will be attached to instrumented spar buoys (light/reflector/RF beacon). CTD Station 2 will be taken when sonobuoy deployed. CTD Station 3 will be taken at end of transect. XBT conducted at completion of CTD Station 3.

1100: - Lunch

1700: (approx) at completion of acoustic transect, End Acoustic Experiment #1

1700: Dinner (During Dinner PT SUR reposition to 1km from vertical array to run the same acoustic transect as Experiment #1

1800: Commence Acoustic Experiment # 2. PT SUR requested to conduct same transect of acoustic stations as Experiment 1. CTD Station 4 conducted at first acoustic station; CTD Station 5 conducted mid-transect. CTD Station 6 conducted at end of transect. No sonobuoys will be deployed.

Friday, 26 July 02 [Sunrise, 0604; Sunset 1958; Moonrise 2153 (Waning Gibbous, 94% Illumination)]

0200: (approx) at completion of acoustic transect, End Acoustic Experiment #2

0600: Commence Acoustic Experiment #3 We will run the opposite transect from Experiment 1 (offshore to inshore) starting at intermediate station (~10 km from array). Conduct CTD Station 7 and beginning of transect and CTD Station 8 at end of transect. A single sonobuoy vertical array will be deployed approximately 4 km from NUWC Vertical Array.

1100: End Acoustic Experiment #3

1115 – 1230: Conduct Student Group Swap. NALO Flight requested to arrive at SCI between 0900 - 1100 carrying 6 students. R/V PT SUR will located vicinity of Wilson Cove for transfer/small boat operations. NUWC small boat will be used to transfer students to/from PT SUR. (NALO flight scheduled to depart at 1200).

1130: Lunch

1300: Commence Acoustic Experiment #4. PT SUR requested to run same transect as Experiment #1. CTD Station 9 conducted at first acoustic station; CTD Station 10 conducted mid-transect. CTD Station 11 conducted at end of transect. Science party will deploy two sonobuoy vertical arrays at 5 km from NUWC Array attached to instrumented spar buoys (light/reflector/RF beacon).

1700: Dinner

1900: End Acoustic Experiment #4

1900: R/V PT SUR reposition for Experiment #5 approximately 1 km from NUWC Array.

2000: Commence Acoustic Experiment # 5. PT SUR requested to conduct same transect of acoustic stations as Experiment 1 except ending approximately 10 km offshore from NUWC Array. CTD Station 12 conducted at first acoustic station; CTD Station 13 conducted mid-transect

<u>Saturday, 27 July 02</u> [Sunrise, 0605; Sunset 1957; Moonrise 2233 (Waning Gibbous, 89% Illumination)]

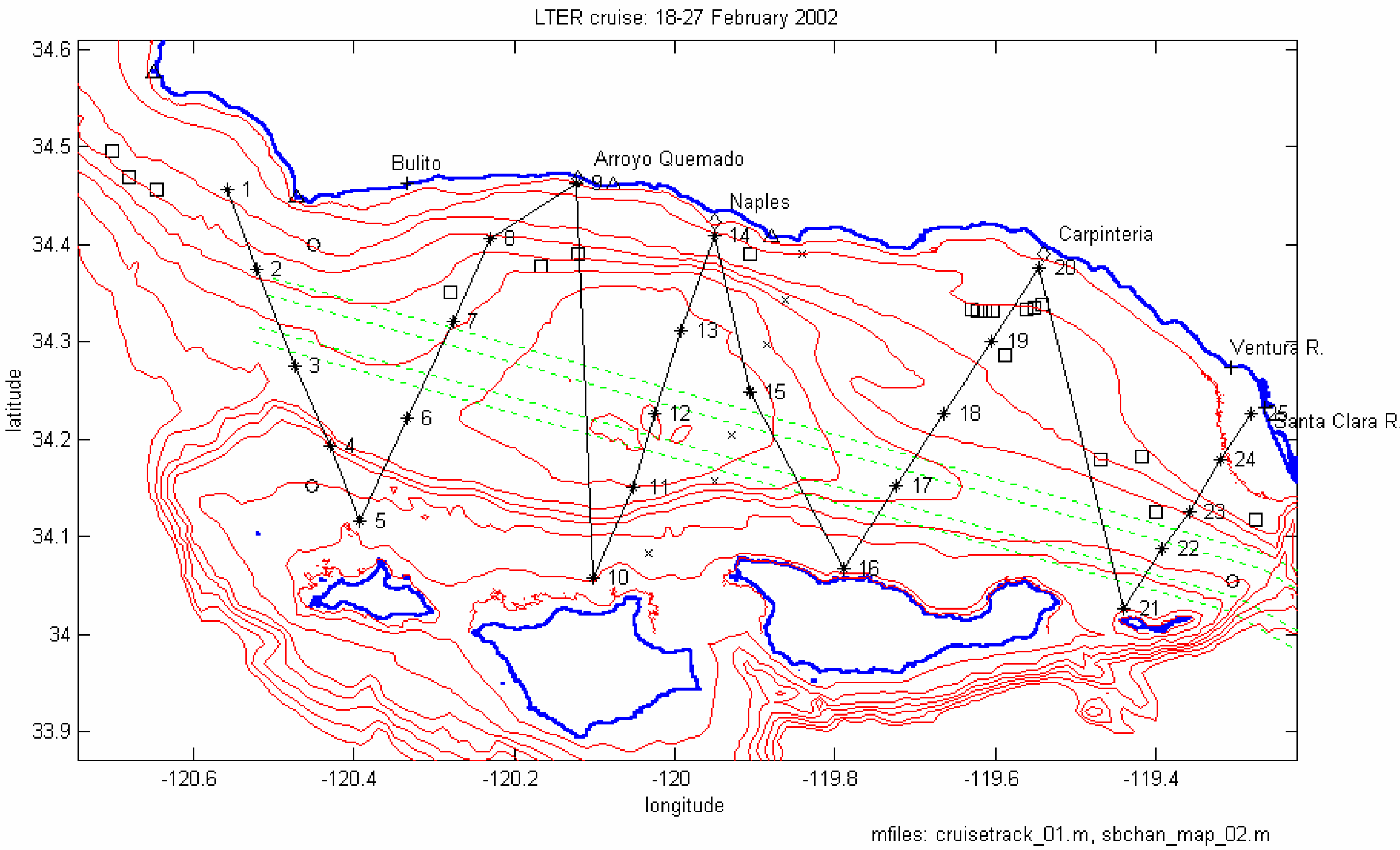
0200: (approx) at completion of acoustic transect, <u>End Acoustic Experiment #5</u>
0600: <u>Commence Acoustic Experiment #6</u> We will run the opposite transect from Experiment 1 (offshore to inshore) starting at intermediate station (~10 km from array). Conduct CTD Station 14 and beginning of transect and CTD Station 15 at end of transect. A single sonobuoy vertical array will be deployed approximately 4 km from NUWC Vertical Array
0700: Breakfast
1100: End Acoustic Experiment #4 (NPS completed with range use).
1130: Lunch
1200: R/V PT SUR position in Wilson Cove for recovery of Digital Collection System and 2 NPS personnel. Request use of PT SUR RHIB for recovery of personnel and equipment
1330: R/V PT SUR clears OPAREA 3803 and begins transit to Santa Barbara
1700: Dinner
1900: Ambient Noise and Broadband Acoustic Signal Experiment II. Drop single sonobuoy from PT SUR (not recovered). PT SUR can move away from buoy approximately 1 km. Students will collect ambient noise data for approximately 30 minutes then drop weight light bulbs for broadband source. Additionally to bring ship DIW, lower monitoring and hydrophone and lower Rosette cage with light bulb attached to determine approximate depth bulbs implode and their source level.

<u>Sunday, 28 July 02</u> [Sunrise, 0607; Sunset 2004; Moonrise 2256 (Waning Gibbous, 82% Illumination)]

0600: Commence LTER D CTD Stations across Santa Barbara Channel. CTD Casts will be taken to near bottom.

CTD STATION	Latitude	Longitude
10	34^{o} 3.50'N	120^{o} 6.02'W
11	34^{o}9.04'N	120^{o} 3.07'W
12	34^{o} 13.53'N	120^{o} 1.50'W

13	34° 18.73'N	119° 59.48'W
14	34° 24.58'N	119° 57.06'W



1000: Conduct Shallow Water Dive in vicinity of LTER D Station 14. LT Erica Mueseler, student, will conduct underwater visibility experiment.

1130: Lunch

1600: Arrive Santa Barbara. Request use of aft crane to offload NPS Equipment.

10.2 R/V Point Sur Cruise Plan (condensed)

R/V POINT SUR **CRUISE PLAN 1**

Moss Landing Marine Operations

Please complete these cruise planning forms and send as an email attachment to marineops@mlml.calstate.edu. These forms are MS Word documents formatted as tables. You can tab through the cells and fill in text where appropriate. If you need more space refer to additional pages on the form and create new pages with your information.

Chief Scientist:	**Arthur R. Parsons**	Cruise Dates	**23-28 July 2002**
Institution:	**Naval Postgraduate School**	Phone Number	**(831) 656-3270**
Address:	**833 Dyer Road, Dept of Oceanography, Rm 342A, Monterey, CA 93943**		
Email Address:	**parsons@oc.nps.navy.mil**	Fax Number	**(831) 656-2712**

Date and Time to Start Loading	**12 and 23 Jul 02**	How Much Time is Needed?	**6-8 Hours**
Special Requirements for Loading or in port logistics?	**Use of Aft crane to load acoustic source, sonobuoys, & boxes on 12 July. 23 July onload minimal: 1 half-rack electronics, 1 PC, and misc small gear.**		

Departure Time (Normally 0830)	**1000, 24 July**	Return Time (Normally NLT 1600)	**1600, 28 July**
Intermediate Stops (Include loading in ports other than Moss Landing)			
Date & Time of Arrival	Port	Departure Date/Time	Purpose
26 July, 1100	San Clemente Island	1200	Not pierside, small boat pax trf
27 July, 1200	San Clemente Island	1300	Not pierside, small boat pax trf
Give a brief description of the area of operations and type of work to be done:			
Conducts a series of instructional shallow water acoustic experiments on the San Clemente Island Underwater Range. Area of operations is Navy OPAREA 3803 on the eastern side of San Clemente Island near Wilson Cove. An acoustic source and monitoring hydrophone will operated from the PT SUR and remote sonobuoys and range instruments will record transmissions. CTD casts will be used to calculate SVPs.			

The maximum number of people in the science party is twelve (12) for trips over 12 hours and forty (40) for trips lasting 12 hours or less. THE MLML MARINE TECHNICIAN IS COUNTED IN THIS NUMBER.

12	Total Number of People Including Marine Technician

If your cruise involves any of the following **please check** (**X**) below and complete the appropriate forms			
X	Shared Use Equipment		Radio Active Materials
X	Diving		Hazardous Materials
	Deployment or Recovery of Moorings		Multiple PI or Institution Cruise

Number for Proposal being supported or Account paying Ship Costs	ONR/CNMOC

R/V POINT SUR **CRUISE PLAN 2**

Moss Landing Marine Laboratories

Chief Scientist	Parsons	Cruise	OC4270 23-28 July 2002

Area of Operation: Cruise Tracks and Station Locations. Please provide as complete a description as possible. Include with this plan or separately a complete list of stations with ID#, Latitude and Longitude and other information such as type of sampling as appropriate. Use additional pages or separate documents to provide this information. Use the section below to generally describe the area of operations.

PT SUR will begin and start the cruise in Santa Barbara, CA. One series of acoustic source calibration experiments will be conducted enroute to and return from San Clemente Island Underwater Range (SCIUR) in area recommended by the Master of PT SUR to provide sufficient lee and space to declutch shaft for approximately 20 minute periods. Area for main acoustic experiments is Fleet OPAREA 3803 off Wilson Cove, San Clemente Island. Additionally, plan to take the LTER D CTD Stations 10-14 across the Santa Barbara Channel on the return leg back to Santa Barbara. On 28 July in the vicinity of Station 14, intend to conduct 30 ft shallow water dive for optical clarity measurements immediately prior to return Santa Barbara.

Description of Operations: Provide as much detail as possible about the type of operations and sampling to be conducted, daily schedule and hours of operation, type of equipment to be used and any other information that will help us prepare for this cruise. Use additional pages or send corrected drafts as necessary.

(See attached Cruise Scheduled for detailed plan). Note students are divided into two groups (**A** and **B**). Note that 5 of the 6 students in Group A along with Prof Collins remain onboard from previous NPS OC3570 cruise ending 22 July. Intend to allow Prof Collins and students to remain on board and berth the night of 22 July following cruise. In conjunction, request that the evening meal on 22 July be provided. No meals are requested for 23 July; request that the faculty/staff/students be allowed to berth onboard the night of 23 July and work will proceed onboard 23 July preparing for cruise. The students groups will be swapped out on the morning of 26 July at Wilson Cove, San Clemente Island via small boat sea conditions permitting.

Moss Landing Marine Operations

Please list all scientific personnel sailing on your cruise. Include the MLML Marine Technician if requested. If you do not know the names of some of the participants list them as TBD (To Be Determined). The maximum number of persons in the scientific party including the marine technician is twelve except for day trips when the maximum is forty. Indicate under position, if the person is a Scientist, Technician, Graduate Student, Undergraduate, or Observer. Please indicate if anyone has special dietary needs. If the person will only be on board for part of the trip show the dates on board in the dates column. Use additional sheets if required. For other than day trips have each person complete the Personnel Information Form (1B).

	Name	Institution	Position	Dates on Board
1	A. Rost Parsons	Naval Postgraduate School	Chief Scientist (Faculty)	23-28 July
2	Curt Collins	Naval Postgraduate School	Scientist (Faculty)	22-28 July
3	Chris Miller	Naval Postgraduate School	Scientist (Staff)	23-28 July
4	Jim Stockell	Naval Postgraduate School	Scientist (Staff)	23-28 July
5	Anurag Kumar	Naval Postgraduate School	Scientist (Staff)	23-28 July
6	Stewart Lamerdin	Moss Landing Marine Lab	Marine Technician	23-28 July
7	John Joseph	Naval Postgraduate School	Scientist (Faculty)	23-26 July **(A)**
8	John Okon	Naval Postgraduate School	Student	22-26 July **(A)**
9	John Daziens	Naval Postgraduate School	Student	22-26 July **(A)**
10	David Kuehn	Naval Postgraduate School	Student	22-26 July **(A)**
11	Michael Weltmer	Naval Postgraduate School	Student	22-26 July **(A)**
12	Adam Newton	Naval Postgraduate School	Student	22-26 July **(A)**
13	Erica Museler	Naval Postgraduate School	Student	26-28 July **(B)**
14	Robyn Phillips	Naval Postgraduate School	Student	26-28 July **(B)**
15	Claude Gahard	Naval Postgraduate School	Student	26-28 July **(B)**
16	Jeff Dixon	Naval Postgraduate School	Student	26-28 July **(B)**
17	Ching-Sang Chiu	Naval Postgraduate School	Scientist (Faculty)	27-28 July **(B)**
18	Jorge Garcia	Naval Postgraduate School	Student	27-28 July **(B)**
19				
20				

RV POINT SUR	CRUISE PLAN DECK CONFIGURATION 4
Chief Scientist: Parsons	Cruise Dates: 23-28 July 2002

Please check (**X**) equipment needed. If you have questions, or need assistance, please call or email Richard Muller or Stewart Lamerdin at 408-633-3534
rmuller@mlml.calstate.edu or lamerdin@mlml.calstate.edu

	Winches	Use			
	Trawl Winch (8000 meters 1/2" 3x19 wire)				
X	CTD Winch (5000 meters 0.322" conducting cable)				
X	Hydro Winch (3000 meters 0.25" conducting cable)				
	Orientation for Hydro Winch	**X**	Stbd		Aft
	Pengo Mooring winch (Bare drum with 3 partitions)				
	Sea Mac winch with 1/4" Kevlar cable				
	User supplied winch (describe use, size & power requirements below				

	Other Deck Equipment	Equip. will be used for:
X	Aft Crane (Safe Working Load 6,000 lbs.)	**Onload of transducer/sonobuoys**
	Fwd Crane (Safe Working Load 3,000 lbs.)	
	Capstan, Hydraulic, either side of aft deck	
X	Work Boat and Motor	

Describe needs here:

	Other needs for Deck Space	Size/Use/Location
	Van	
	Van	
	Moorings	
	Incubators	
X	Storage	**Sonobuoys (area of one pallet cage), 3 spar buoys**
	Other (Describe below)	

Elaboration on any of the above needs

Chief Scientist	Parsons	Cruise Dates	5-6 March

Please check (X) equipment needed!

CTD			
X	Sea Bird CTD/Rosette (12 position)	**100 m**	Deepest Depth Planned (m)
X	Redundant Temperature Sensors	**X**	Redundant Conductivity Sensors
X	O_2 Sensor	**X**	Sea-Tech Transmissometer
	PAR Sensor	**X**	Chelsea Fluorometer
	Altimeter		Pinger
X	10 L Nisken Bottles	**12**	Number needed (max 12)
	5 L Nisken Bottles		Number needed (max 12)
ADCP			
X	RDI 150 kHz NB VM-ADCP		
X	DAS (Data Acquisition Software)		Transect (Data Acquisition Software)
XBT			
X	Sippican XBT	**X**	User supplied probes
Data Acquisition System (SAIL)			
X	Science Data Acquisition System	**X**	External Navagation Output (NMEA)
	Flow-thru Turner Fluorometer		
Bathymetery			
X	Knudsen Echosounder (recommended)		Raytheon PDR
X	12 kHz		EPC 4800 Paper Chart Recorder
	3.5 kHz		
Lab Equipment			
	DI Water (1 Mega Ohm)		Milli-Q Water (18.2 Mega Ohm) (user fee)
	Fume Hood		Beckman 8301 Scintillation Counter
	Sea water in Lab		Sea water on deck
	Upright Freezer		Chest Freezer
	Refrigerator	**X**	Clean/UPS Power (7.5 KVA 120V)
Miscellaneous			
X	Cell Phone	**X**	Data/Email/Fax
	12 kHz pinger	**X**	Radio Beacons
X	Strobe Lights	**X**	Radio Direction finder
X	Copy Machine		TDR
Coring			
	Multi-Core System		Box Core
	Smith Mac Grab		Gravity Core
	Other Geological		Rock Dredge
Nets			
	2m Tucker Trawl		Beam Trawl
	25 ft Otter Trawl		Phytoplankton Net
			Zooplankton Net

Please describe your equipment and lab set up needs below. Please include any special requirements for setting up any of the equipment marked above. Also describe special needs for electrical connections, fresh or salt water usage or air. Also describe any plans to mount equipment to the vessel or for the deployment of equipment you will be bringing. Use extra pages as necessary and if you have questions about any of the equipment above or equipment not listed please contact Richard Muller rmuller@mlml.calstate.edu or Stewart Lamerdin lamerdin@mlml.calstate.edu or at 408-633-3534.

10.3 San Clemente Island OPAREARrequest (example)

FORMAT FOR REQUESTS OF FLEET OPAREA SERVICES, SAN CLEMENTE ISLAND USE - Request for Fleet OPAREAs and exercise services should generally be UNCLASSIFIED and shall be in the format described below. Information should be furnished using item designators listed in this article. OMIT NON-APPLICABLE ITEMS.:

1. Item A. Unit(s) to utilize the area/target give ship/unit name or squadron number and number of participants.
   Item B. Type exercise.
   Item C. Exclusive or co-use (EXCLUSIVE FOR HAZARDOUS OPERATIONS).
   Item D. Area/target requested, including desired altitudes as applicable.
   Item E. Date and COMEX/FINEX of each period desired.
   Item F. Weapon Information: ((1)//(2)//(3)//(4))
   Item G. Acceptable alternate area(s), date(s), or time(s) and amplifying remarks.
   Item H. Priority
   Item I. TACP/TAC (A) requirements
   Item J. Remarks and/or services requested. Include point of contact and phone number, if applicable.
   Item K. Any special requirements.
   Item L. Pre-exercise briefing. Provide date, time and location of briefing by range personnel.
   Item M. Schedule of events.
   Item N. Number of personnel (officer, enlisted, Civilian, denote gender)
   Item O. Berthing requirements
   Item P. Messing requirements.
   Item Q. Amount of potable water required in the field.
   Item R. Type and number of vehicles, heavy equipment, aircraft, or watercraft requirements.
   Item S. Amount and type of fuel required.
   Item T. Job order and/or applicable accounting information.
   Item U. Number, type and frequency range of electronic equipment to be used.
   Item V. Proposed mode of transportation to and from SCI.
   Item W. Proposed mode of transportation to and from area of operations.
   Item X Proposed mode of transportation/entry point / type of hazardous material (cargo) as per CFR 49
   Item Y. Name/rank/branch of service, of individual in charge of operation on SCI.
   Item Z. Any special request or additional information.

OPAREA/SERVICE/SCI USE REQUEST EXAMPLE

FROM: CG FIRST MARDIV
TO: FACSFAC DET SCORE SAN DIEGO CA//215//
INFO: NALF SAN CLEMENTE ISLAND
UNCLASS//N03120//
MSG/GENADMIN/1MARDIV//
SUBJ: OPAREA/SERVICE/SCI USE REQUEST//
REF/A/DOC/FACSFACSDINST 3120.1E/-//
AMPN/REF A IS MANUAL OF EASTPAC AND MIDPAC FLEET OPERATING AREAS
POC/J.C. JONES/CAPT/FIRST MARINE DIVISION/760-725-1234/DSN 361-1234

1. FOLLOWING REQUEST SUBMITTED IAW REF A.
2. A FIRST MARINE DIVISION
   B. SPOTTER SERVICES
   C. EXCLUSIVE
   D. SHOBA
   E. 061200 - 061800, 071200 - 071200-071800 NOV 99
   F. 5"/54//35K//25KYD
   G. NONE
   H. 3A1
   I. NONE
   J. NONE
   K. NONE
   L. 021200 NOV 99, LOCATION TBD
   M. SCHEDULE OF EVENTS
      1. 1106 0800 AIRLIFT TO OP3 VIA CH53E
      2. 1106 PREP OP3 FOR NGF AFTER CH53E DEPARTS
      3. 1106 0800 LCU DEPARTS CAMP PEND FOR SCI TO DESIGNATED BEACHING SITE FOR OFFLOAD ONE HMMWV W/SAFETY RHIB/TRAILER
      4. 1106 0800 NAVAL SHIPPING DEPARTS NAVSTA SAN DIEGO FOR SCI TO DESIGNATED FIRING POSITION
      5. 1106 AND 07 1200-1800 NAVAL GUNFIRE TRNG. OP3
      6. 1106 AND 07 NAVAL SHIP/LCU LAUNCH AND RECOVER CRRC VIC SCI AS DESIGNATED BY SCI RANGE CONTROL FOR BEACH LANDING SITE TRAINING FROM CRRC'S
      7. 1108 RECOVER CRRC'S ABOARD NAVAL SHIPPING
      8. 1109 1000-1400 CH53E RECOVER PERSONNEL FROM OP3
      9. 1109 LAUNCH CRRC'S FROM NAVAL SHIPPING TO CAMP PEND.
      10. 1110 RECOVER CRRC'S ON NAVAL SHIPING FROM CAMP PEND.
   N. PERSONNEL 1 OFFICER/25 ENLISTED/20 MALE/6 FEMALE
   O. BERTHING NOT REQUIRED
   P. MESSING NOT REQUIRED
   Q. POTABLE WATER REQUIRED ENOUGH FOR 26 PERSONNEL FOR

4 DAYS
R. ONE SIX PASSENGER 4WD TRUCK
S. FUEL FOR ONE HMMWV FOR 4 DAYS
T. XXXYYY
U. COMM. VHF AND HF FREQ. FROM CAMP PEND. FREQ. CONTROL
V. HMMWV
W. HELO/LCU
X. AC/NALF/ ORDNANCE or BARGE/WILSON COVE/MOGAS or LCM/PYRAMID COVE/EXPLOSIVES or OTB/NORTHWEST HARBOUR /SMALL ARMS
Y. CAPT JONES, USMC
Z. NONE

3. PRE-EX MSG WILL FOLLOW UPON APPROVAL OF AREAS AND SERVICES.

10.4 OC4270 Cruise Log, 23-28 July 2002

LOG for OC4270 Cruise Summer 2002
23-28 July 2002
R/V PT SUR
All TIME GMT (PDT+7 hours)

Log Procedures: Time (GMT) and Ship's position at each event

Ocean Observation Events: CTD Casts and XBTs

Acoustic Events: Beginning of Acoustic Station
-- Start and end of actual Transmissions
End of Acoustic Station
Sonobuoy Deployment
-- GPS Number on each Spar Buoy
-- Sonobuoy Channel Number on each buoy and depth
-- RF Beacon Frequency
--
Sonobuoy Recovery
Ambient Noise Test (Start and End)
Broadband Noise (light bulb drop)

<u>Tuesday, 23 Jul 02</u>
Inport Santa Barbara, CA

<u>Wednesday, 24 Jul 02</u>

1600 - Underway

2035 - Commence Calibration Trial
34 00.85N 119.20.664W

Hi Tech Monitoring Hyrdophone -- Pre-amp gain 10
Reison Hydrophone -- Pre-amp gain 20
Sonobuoy Channel - Radio 1 - Unity gain

2035 - 7-sec cw test (max 20 volts rms out of amp)

(in between test mammal signals)

2102 15-sec cw test commenced (cut volume toward end)

--blown fuse in amp; matlab problem

2135 - 15 sec cw test commenced at half power (10 volts rms)

Matlab errors -- going to restart source computer

2140 -- 15 sec cw test commenced at half power (10 volts rms)

2140 -- Matlab error

2144 - 5 sec cw test commenced at half power (10 volts rms) (1 sec gap)

2202 - 5 sec cw test complete (collect some ambient noise for a couple of files)

-- recovered hydrophones. noted sonobuoy hydrophone remained in cardboard tube. Redoing calibration.

2221 - 5 sec cw test commenced at full power (20 volts rms) (1 sec gap)

-- Ambient noise in between test

2250 - Repeating 5 sec cw test commenced at full power (20 volts rms) (1 sec gap)

2305 -- Completed 5 sec cw test -- secure calibration trials

0100 - Commenced Ambient Noise and broadband tests

0141-0142 - Light bulb crush depth tests w/CTD -- 65.9m, 82.4m, 90.0m

0224 -- Secured Ambient noise and Broadband tests -- continue transit to San Clemente Island

Thursday, 25 Jul 02

1546 CTD Station 1 at Acoustic Station 1 (33 00.958N 118 31.375W)

1634 Acoustic Station 1 -- Started CW (33 01.111N 118 31.501W)

1652 -- Started Acoustic Mammal Signals (33 01.191N 118 31.538W)

1706 -- Started Acoustic Mammal Signals with different gain settings for SCIUR array (33 01.264N 118 31.525W)

1733 -- Acoustic Station 2 -- (33 01.444N 118 30.937W)
1734 Started Transmissions

1803 -- Acoustic Station 3 -- (33 01.890N 118 30.532W)

1803 -- Started transmission

1817 - Secured Station 3

1826 -- Acoustic Station 4 (33 02.218N 118 30.086W)

1903 -- Acoustic Station 5 (33 02.609 118 29.602W)

1924 -- CTD Station 2 (33 02.704N 118 29.652W)

2035 -- Deploy VLA Spar 1 (Red Flag, GPS#3)
Radio freq: 159.480 (CH B)
90 ft: CH2
200 ft: CH3
400 ft: CH4

2008 -- CTD Station 2 complete

2047 -- Acoustic Station 6 (33 02.925N 118 29.041W

2109 Deploy Spar 2 (Green Flag, GPS#1) (33 02.859N 118 26.908W)
Radio freq: 154.580
90 ft: CH25
400 ft: CH15

2117 Acoustic Station 7 (33 03.376N 118 28.606W)
Repeat Mammal signals twice -- small boats observed by SCIUR Array)

2140 Complete Acoustic Station 7

2152 Acoustic Station 8 (33 03.387N 118 28.341W)

2221 Acoustic Station 9 (33 04.198N 118 27.941W)

2244 Acoustic Station 10 (33 04.534 118 27.493W)

2312 Acoustic Station 11 (33 04.975 118 27.046W)

2338 Acoustic Station 12 (33 05.248 118 26.624W)

2350 Finished Station 12, repositioning for CTD Station 3

2355 -- CTD Station 3 (33 05.271N 118 26.374W)

0030 - 0130 -- Recovered SPAR Buoys 1 and 2

0200 -- Small Boat ops to transfer C.Miller and C-S Chiu

0216 -- CTD Station 4 at Acoustic Station 1 (33 01.038N 118 31.479W)

0245 -- Complete CDT Station 4 (33 00.812N 118 31.767W)

0252 -- Acoustic Station 1 (33 00.746N 118 31.778W)

0300 -- Completed Acoustic Station 1

0315 -- Acoustic Station 2 (33 01.406N 118 30.988W)

0332 -- Completed Acoustic Station 2

0344 -- Acoustic Station 3 (33 01.834N 118 30.532W)

0358 -- Completed Acoustic Station 3

0413 -- Acoustic Station 4 (33 02.190N 118 30.119W)

0426 -- Completed Acoustic Station 4; Adjusting monitoring hydrophone gain to 5x from 10x -- noticed overload light as ship rolled.

0439 -- Acoustic Station 5 (33 02.604N 118 29.737W) (0442 started transmissions)

0454 -- Completed Acoustic Station 5

0505 -- Acoustic Station 6 (33 02.984N 118 29.281W)

0518 -- Completed Acoustic Station 6

0538 -- Acoustic Station 7 (33 03.387N 118 28.816W)

0552 - Completed Acoustic Station 7. SCIUR Range personnel secured for evening … digital recording system left running

0604 -- Acoustic Station 8 (33 03.890 118 28.043)

0618 -- Completed Acoustic Station 8

0632 -- Acoustic Station 9 (33 04.166 118.28.021)

0649 -- Completed Acoustic Station 9

0701 -- Acoustic Station 10 (33 04.624N 118.27.562W)

0714 - Completed Acoustic Station 10

0724 -- CTD Station 5 at Acoustic Station 10 (33 04.417N 118 27.500W)

0815 -- Completed CTD Station 5

0815 -- 1300 Night break

1300 -- CTD Station 6 at Acoustic Station 5

1348 -- Completed CTD Station 6

1350 Deployed Spar Buoy 1 (GPS#3):

90 ft:	CH3
200 ft:	CH5
400 ft:	CH4

1425 -- Acoustic Station 5 (33 02.664N 118 29.637W) - No monitoring hydrophone (off)

1440 -- Completed Acoustic Station 5

1455 -- Acoustic Station 4 (33 02.172n 118 30.008W)

1506 -- Completed Acoustic Station 4

1521 -- Acoustic Station 3 (33 01.786N 118 30.501W)

1532 -- Completed Acoustic Station 3

1545 -- Acoustic Station 2 (33 01.386N 118.30.915W)

1601 -- Completed Acoustic Station 2

1618 -- Recovered Spar Buoy 1 (33.043186N 118.50499W)

1639 -- CTD Station 7 at Acoustic Station 1

1718 -- Completed CTD Station 7

1725 -- Acoustic Station 1 (33 00.993N 118 31.398W)

1740 -- Complete Acoustic Station 1

1915 -- CTD Station 8 at Acoustic Station 1 (33 01.040N 118 31.481N)

2003 -- Acoustic Station 1 (33 01.011N 118 31.624W)

2019 -- Complete Acoustic Station 1 - Retrieving gear

2022 -- Departing Acoustic Station 1 (33 00.812 119 31.168)

2029 -- Arriving at Acoustic Station 2 (33 01.514 118 31.185)

2040 -- Abandoned Station 2 experiment due to fouled range.
(Civilian motorboat interference.)

2109 -- Complete Acoustic Station 2 - Retrieving gear

2114 -- Departing Acoustic Station 2 (33 01.173 118 30.370)

2123 -- Arriving at Acoustic Station 3 (33 01.869 118 30.666)

2138 -- Complete Acoustic Station 3 - Retrieving gear

2142 -- Departing Acoustic Station 3 (33 01.645 118 30.328)

2151 -- Arriving at Acoustic Station 4 (33 02.300N 118 30.270W)

2207 -- Complete Acoustic Station 4 - Retrieving gear

2212 -- Departing Acoustic Station 4

2220 -- Arriving at Acoustic Station 5

2224 -- CTD Station 9 at Acoustic Station 5 (33 02.632N 118 29.706W)

2312 -- Finished CTD and repositioning to Station 5 (33 02.568N 118 30.470W)

2319 -- Arriving at Acoustic Station 5 (33 02.658N 118 29.689W) (2325 started transmission)

2338 -- Complete Acoustic Station 5 - Retrieving gear

2343 -- Released Buoy (33 02.422N 118 29.948W) (yellow)

2345 -- Released Buoy (33 02.451N 118 29.976W) -- only two sonobuoys deployed (Red)

Spar Buoy 1 (Red)
RDF Freq: 159.480 MHz
Etrek GPS #1
Top -- 90 ft -- Channel 5
Middle -- ~200ft -- Channel 3
Bottom -- 400 ft -- Channel 19

Spar Buoy 2 (Green Flag and Orange Pennant)
RDF Freq: 160.725 MHz
Etrek GPS #3
Top -- 90 ft -- Channel 25
Middle -- ~200ft -- Channel 24
Bottom -- 400 ft -- Channel 2

2356 -- Arrive at Acoustic Station 6 (33 03.081 118 29.342)

2415 -- Complete Acoustic Station 6 - Retrieving gear

2416 -- Depart Acoustic Station 6 (~33 02.982 ~118 29.254)

0050 - Arrive at Acoustic Station 7 (33 03.485N 118 28.832W) - 0054 Started transmissions

0110 -- Complete Acoustic Station 7 - Retrieving gear

0111 -- Depart Acoustic Station 7 (33 03.361 118 29.282)

0118 -- Arrive Acoustic Station 8 (33 03.872N 118 28.398W)

0134 -- Complete Acoustic Station 8 - Retrieving gear

0136 -- Depart Acoustic Station 8 (33 03.809 118 28.737)

0148 -- Arrive Acoustic Station 9 (33 04.293 118 27.984)

0202 -- Complete Acoustic Station 9 - Retrieving gear

0204 -- Depart Acoustic Station 9 (33 04.090 118 28.440)

0218 -- Coming alongside buoy (33 02.291 118 29.951)

0225 -- Retrieve (red) buoy (~33 02.327 ~118 29.643)
(Underway posits, 2 minutes past retrieval)

0234 -- Retrieve (yellow) buoy (33 01.392 118 29.389)
(Underway posits, several minutes past retrieval)

Note: Channel 24 sonobuoy came loose and is still transmitting

0301 -- Arrive Acoustic Station 10 (33 04.549 118 27.507)

0320 -- Lowered sound source 100 m and re-transmitted

0334 -- Complete Acoustic Station 10 - Retrieving gear

0340 -- Depart Acoustic Station 10 (33 04.018 118 28.259)

0355 -- Arrive Acoustic Station 11 (33 04.961 118 27.129)

0426 -- Complete Acoustic Station 11 - Retrieving gear

0434 -- Depart Acoustic Station 11 (33 04.424 118 28.066)

0451 -- Arrive Acoustic Station 12 (33 05.443 118 26.688)

0525 -- Main computer shut down, rebooting in progress.
(Foreign sonar transmitting body at large, suspect SQS-53C; computer crashed coincidentally with the time the 3KHz noise was heard.)

0546 -- Complete Acoustic Station 12 - Retrieving gear

0550 -- Depart Acoustic Station 12 (33 04.710 118 28.296)

0607 -- CTD Station 10 at Acoustic Station 12 (33 05.391   118 26.720)

0653 -- Complete CTD Station 10 at Acoustic Station 12 (33 64.839 118 27.662)

0654 -- Conclude operations for evening

Saturday, 27 Jul 02 (Local Time)

1303 -- CTD station 11 at Acoustic Station 7 (33 03.411   118 28.866)

1345 -- Complete CTD station 11 at Acoustic Station 7 (33 03.666 118 29.248)

1346 -- Reposition for acoustic station 7

1352 -- Arrive Acoustic Station 7 (33 03.415 118 28.747)

1420 -- Complete Acoustic Station 7 - Retrieving gear

1424 -- Depart Acoustic Station 7 (33 03.574 118 29.196)

1430 -- Arrive Acoustic Station 6 (33 08.060 118 29.248)

1446 -- Complete Acoustic Station 6 - Retrieving gear

1450 -- Depart Acoustic Station 6 (33 02.842 118 29.475)

1454 -- Arrive Acoustic Station 5 (33 02.601 118 29.682)

1510 -- Complete Acoustic Station 5 - Retrieving gear

1512 -- Depart Acoustic Station 5 (33 02.626 118 29.934)

1517 -- Arrive Acoustic Station 4 (33 02.298 118 30.134)

1533 -- Complete Acoustic Station 4 - Retrieving gear

1535 -- Depart Acoustic Station 4 (33 02.202 118 30.116)

1540 -- Arrive Acoustic Station 3 (33 01.821 118 30.494)

1558 -- Complete Acoustic Station 3 - Retrieve gear

1600 -- Depart Acoustic Station 3 (33 01.789 118 30.540)

1606 -- Arrive Acoustic Station 2 (33 01.424 118 30.940)

1621 -- Complete Acoustic Station 2 - Retrieve gear

1624 -- Depart Acoustic Station 2 (33 01.485 118 31.019)

1630 -- Arrive Acoustic Station 1 (33 09.979 118 31.410)

1650 -- Commence ABBA Acoustic experiment Station 1

1655 -- Complete Acoustic Station 1 - Retrieve gear

1657 -- Depart Acoustic Station 1 (33 01.173 118 31.457)

1659 -- Begin CTD cast 12 Station 1 (33 01.106118 31.490)

1735 -- Complete CTD cast 12 Station 1 (33 00.949 118 13.381)

1736 -- Begin XBT launch (SN 296041)

1737 -- End XBT launch

Sunday, 28 Jul 02 (Local Time)

1247 -- Begin CTD cast 14 (34 09.113 120 03.142) Second CTD this morning
Station 11

1344 -- Begin CTD cast 15 (34 13.628 120 00.328) Station 12

1435 -- Begin CTD cast 16 (34 19.017 120 59.801) Station 13

15 -- Begin CTD cast 17 (34 120) Station 14

1643 - completion of Erica's dive (34 25.089 119 57.307)

10.5 SCIUR Range Data Log, 25-27 July 2002

The following is the data log, documented by LT Jorge Garcia, LT Jody Beattie, and Prof. Ching-Sang Chiu, from the NUWC San Clemente Island Undersea Range, ship-self radiated noise array building.

25 JULY 2002

TIME (GMT)	EVENT	FILE (if applicable)
1605	Set Ch 0, 1, 2 to 42dB All transmissions at 30m unless otherwise specified	
1635	Start CW calibration 1230 yds from array	
1652	Start Run 1	
----	Station #1, begin transmission	SCIUR45
1701	Station #1, end transmission	SCIUR57
1705	Set Ch 0, 1, 2 to 48dB (overload)	
----	LED lighting on and off	
1706	Station #1, begin transmission (higher gain)	SCIUR1
1715	Station #1, end transmission (higher gain)	SCIUR13
1735	Set Ch 0, 1, 2 to 42dB	
1736	Station #2, begin transmission	SCIUR31
----	(program closed so files begin at 1 again)	
1745	Station #2, end transmission	SCIUR5
1750	Active Navy sonar transmitted, not in sight	
1804	Station #3, begin transmission	SCIUR1A
1815	Station #3, end transmission	SCIUR1A013
1827	Station #4, begin transmission	SCIUR1A025
1838	Station #4, end transmission	SCIUR1A036
1905	Station #5, begin transmission	SCIUR1A074
1915	Station #5, end transmission	SCIUR1A074
----	CTD and SONAR bouy deployment	
2000	"explosive" heard, not in sight	
2030	Pt sur reported sonobuoy tangled in rudder	
2034	Pt Sur proceeding to station #6 with only 1	
----	sonobuoy VLA in water	
2040	large shot-like sound heard	
2047	Station #6, begin transmission	SCIUR1A0164

TIME (GMT)	EVENT	FILE (if applicable)
25 JULY 2002		
2058	Station #6, end transmission	SCIUR1A0176
----	2nd sonobuoy VLA deployed with 2 depths	
2117	Station #7, begin transmission	SCIUR1A0195
2122	2 speed boats transitting VLA area	
2128	Station #7, transmission end	SCIUR1A0205
2129	Station #7 repeated transmission	SCIUR1A0207
----	small boat traffic resumed near Wilson Cove	
2141	Station #7, transmission ended	SCIUR1A0218
----	lots of ambient marine mammals	
2153	Station #8, begin transmission	SCIUR1A0231
2202	small boat traffic	SCIUR1A0239
2204	Station #8, end transmission	SCIUR1A0242
2208	Small boat traffic (again)	
2221	Station #9, begin transmission	SCIUR1A0256
2235	Station #9, end transmission	SCIUR1A0270
2244	Station #10, begin transmission	SCIUR1A0281
2257	Station #10, end transmission	SCIUR1A0294
2311	Station #11, begin transmission	SCIUR1A0308
2324	Station #11, end transmission	SCIUR1A0321
2336	Station #12, begin transmission	SCIUR1A0333
2348	Station #12, end transmission	SCIUR1A0346
26 JULY 2002		
0131	Ch 0, 1, 2 confirmed at 42dB gain	
----	+/- 2.5 volt input	
0211	Start run 2	
0250	Station #1, begin transmission	SCIUR38
0303	Station #1, end transmission	SCIUR50
0317	Station #2, begin transmission	SCIUR64
0329	Station #2, end transmission	SCIUR76
0346	Station #3, begin transmission	SCIUR92
0357	Station #3, end transmission	SCIUR104
0415	Station #4, begin transmission	SCIUR122
0428	Station #4, end transmission	SCIUR135
0443	Station #5, begin transmission	SCIUR149
0451	Active Navy sonar transmitted, not in sight	
0457	Station #5, end transmission	SCIUR163

TIME (GMT)	EVENT	FILE (if applicable)
26 JULY 2002		
0507	Station #6, begin transmission	SCIUR175
0520	Station #6, end transmission	SCIUR187
0541	Station #7, begin transmission	SCIUR207
0553	Station #7, end transmission	SCIUR219
0557	All data up to this point backed to fire-wire(H:)	
1340	Station #8-10 logged overnight,	SCIUR221
----	stored in run2 / "overnight"	SCIUR676
----	**Ch 0, 1, 2 confirmed at 42dB gain**	
1421	Start run 3	
1421	Sonobouy deployed	
1429	Station #5, begin transmission	SCIUR4
----	restart Matlab,	
1441	Station #5, end transmission	SCIUR16
1455	Station #4, begin transmission	SCIUR31
1507	Station #4, end transmission	SCIUR43
1515	**ambient marine mammals heard**	
1522	Station #3, begin transmission	SCIUR57
----	because of swell, will be klutched	
----	and hove to	
1535	Station #3, end transmission	SCIUR70
1541	**Motor boat passes thru range**	
1548	Station #2, begin transmission	SCIUR83
1600	Station #2, end transmission	SCIUR95
----	PT Sur headed to pick up buoy	
----	Active Navy sonar transmissions	
1638	R/V at Station #1, doing a CTD	
1730	Station #1, begin transmission	SCIUR186
1742	Station #1, end transmission	SCIUR196
2001	Start run 4	
2007	Station #1, begin transmission	SCIUR6
2015	**Small ship transitting roughly over array**	
	transmission continued (not very noisy)	
2019	Station #1, end transmission	SCIUR19
2037	Station #2, begin transmission	SCIUR37

TIME (GMT)	EVENT	FILE (if applicable)
26 JULY 2002		
	2 fishing boats transitting near range (noisy)	
2048	Station #2, end transmission	SCIUR48
2057	Station #2, begin transmission(second time)	SCIUR57
2106	Station #2, end transmission	SCIUR66
2125	Station #3, begin transmission	SCIUR85
2137	Station #3, end transmission	SCIUR97
2154	Station #4, begin transmission	SCIUR114
2156	**Fishing boats transitted close to Pt Sur**	
1008	Station #4, end transmission	SCIUR128
2241	On station #5 Deploying Sonabuoy collecting CTD data	
2250-2350	Station #5, begin transmission	SCIUR**
	Station #5, end transmission	SCIUR**
2359	Station #6, begin transmission	SCIUR238
****	Station #6, end transmission	SCIUR**

27 JULY 2002

0131	Ch 0, 1, 2 confirmed at 42dB gain	
----	+/- 2.5 volt input	
0011	Station #6, begin transmission	SCIUR250
****	Station #6, end transmission	SCIUR**
0024	Station #6, begin transmission	SCIUR263
0039	Station #6, end transmission	SCIUR281
0054	Station #7, begin transmission	SCIUR294
0108	Station #7, end transmission	SCIUR308
0122	Station #8, begin transmission	SCIUR318
0135	Station #8, end transmission	SCIUR334
----	Sonar buoy reception lost periodically	
----	due to heavy swells	
0151	Station #9, begin transmission	SCIUR**
0202	Station #9, end transmission	SCIUR**
0306	Station #10, begin transmission	SCIUR425
0320	Station #10, end transmission	SCIUR439
0324	Station #10, begin transmission(100m)	SCIUR440
0335	Station #10, end transmission(100m)	SCIUR454
0359	Station #11, begin transmission(30m)	SCIUR478
0413	Station #11, end transmission(30m)	SCIUR490

TIME (GMT)	EVENT	FILE (if applicable)
27 JULY 2002		
0415	Station #11, begin transmission(100m)	SCIUR494
0428	Station #11, end transmission(100m)	SCIUR507
0455	Station #12, begin transmission(30m)	SCIUR534
0***	Station #12, end transmission(30m)	SCIUR**
0504	Station #12, begin transmission(30m)	SCIUR543
0517	Station #12, end transmission(30m)	SCIUR555
	active navy sonar transmissions	
0535	Station #12, begin transmission(100m)	SCIUR570
0545	Station #12, end transmission(100m)	SCIUR583
0545	Start run 5	
0545-1341	Ambient data collected(run5/Ambiento)	SCIUR1-SCIUR461
1358	Station #7, begin transmission	SCIUR478
1421	Station #7, end transmission	SCIUR501
----	station #7 is a double (bkfst)	
1435	Station #6, begin transmission	SCIUR514
1447	Station #6, end transmission	SCIUR527
1459	Station #5, begin transmission	SCIUR538
1510	Station #5, end transmission	SCIUR550
1522	Station #4, begin transmission	SCIUR561
1533	Station #4, end transmission	SCIUR573
1546	Station #3, begin transmission	SCIUR586
1558	Station #3, end transmission	SCIUR597
1611	Station #2, begin transmission	SCIUR610
1622	Station #2, end transmission	SCIUR622
1633	Station #1, begin transmission	SCIUR634
1646	Station #1, end transmission	SCIUR646

end test

10.6 OC4270 Transmission Log, 23-28 July 2002

The following table lists the transmission date/time (UTC) for every signal that was transmitted during this experiment. See Sec 4.3 for a detailed explanation of the source signals, content and generation.

7/24/2002	20:50:32.032	3kHztone.mat
7/24/2002	20:50:35.807	orca__wh_01.mat
7/24/2002	20:52:53.936	3kHztone.mat
7/24/2002	20:52:57.511	orca__wh_02.mat
7/24/2002	20:54:38.466	3kHztone.mat
7/24/2002	20:54:42.332	pilot_wh_01.mat
7/24/2002	20:56:38.028	3kHztone.mat
7/24/2002	20:56:42.474	pilot_wh_02.mat
7/24/2002	20:58:45.652	3kHztone.mat
7/24/2002	20:58:49.417	risso_ck_01.mat
7/24/2002	20:59:53.339	3kHztone.mat
7/24/2002	20:59:56.794	sperm_ck_01.mat
7/24/2002	21: 0:52.724	3kHztone.mat
7/24/2002	21: 0:56.349	cw_sweep_01.mat
7/25/2002	16:52:10.705	3kHztone.mat
7/25/2002	16:52:14.500	orca__wh_01.mat
7/25/2002	16:54:32.639	3kHztone.mat
7/25/2002	16:54:36.214	orca__wh_02.mat
7/25/2002	16:56:17.189	3kHztone.mat
7/25/2002	16:56:21.055	pilot_wh_01.mat
7/25/2002	16:58:16.771	3kHztone.mat
7/25/2002	16:58:21.218	pilot_wh_02.mat
7/25/2002	17: 0:24.445	3kHztone.mat
7/25/2002	17: 0:28.200	risso_ck_01.mat
7/25/2002	17: 1:32.142	3kHztone.mat
7/25/2002	17: 1:35.607	sperm_ck_01.mat
7/25/2002	17: 2:31.538	3kHztone.mat
7/25/2002	17: 2:35.163	cw_sweep_01.mat
7/25/2002	17: 6: 6.387	3kHztone.mat
7/25/2002	17: 6: 9.521	orca__wh_01.mat
7/25/2002	17: 8:27.670	3kHztone.mat
7/25/2002	17: 8:30.764	orca__wh_02.mat
7/25/2002	17:10:11.739	3kHztone.mat
7/25/2002	17:10:14.874	pilot_wh_01.mat
7/25/2002	17:12:10.590	3kHztone.mat
7/25/2002	17:12:13.795	pilot_wh_02.mat
7/25/2002	17:14:17.012	3kHztone.mat
7/25/2002	17:14:20.127	risso_ck_01.mat
7/25/2002	17:15:24.079	3kHztone.mat
7/25/2002	17:15:27.163	sperm_ck_01.mat
7/25/2002	17:16:23.093	3kHztone.mat
7/25/2002	17:16:26.198	cw_sweep_01.mat
7/25/2002	17:34:51.778	3kHztone.mat
7/25/2002	17:34:54.922	orca__wh_01.mat
7/25/2002	17:37:13.061	3kHztone.mat
7/25/2002	17:37:16.155	orca__wh_02.mat
7/25/2002	17:38:57.140	3kHztone.mat
7/25/2002	17:39: 0.275	pilot_wh_01.mat
7/25/2002	17:40:55.991	3kHztone.mat
7/25/2002	17:40:59.186	pilot_wh_02.mat
7/25/2002	17:43: 2.423	3kHztone.mat
7/25/2002	17:43: 5.538	risso_ck_01.mat
7/25/2002	17:44: 9.480	3kHztone.mat
7/25/2002	17:44:12.564	sperm_ck_01.mat
7/25/2002	17:45: 8.494	3kHztone.mat
7/25/2002	17:45:11.599	cw_sweep_01.mat
7/25/2002	18: 3:43.087	3kHztone.mat
7/25/2002	18: 3:46.232	orca__wh_01.mat
7/25/2002	18: 6: 4.390	3kHztone.mat
7/25/2002	18: 6: 7.485	orca__wh_02.mat
7/25/2002	18: 7:48.470	3kHztone.mat
7/25/2002	18: 7:51.605	pilot_wh_01.mat
7/25/2002	18: 9:47.321	3kHztone.mat
7/25/2002	18: 9:50.516	pilot_wh_02.mat
7/25/2002	18:11:53.733	3kHztone.mat
7/25/2002	18:11:56.847	risso_ck_01.mat
7/25/2002	18:13: 0.789	3kHztone.mat
7/25/2002	18:13: 3.874	sperm_ck_01.mat
7/25/2002	18:13:59.814	3kHztone.mat
7/25/2002	18:14: 2.918	cw_sweep_01.mat
7/25/2002	18:27: 6.045	3kHztone.mat
7/25/2002	18:27: 9.189	orca__wh_01.mat
7/25/2002	18:29:27.338	3kHztone.mat
7/25/2002	18:29:30.432	orca__wh_02.mat
7/25/2002	18:31:11.417	3kHztone.mat
7/25/2002	18:31:14.552	pilot_wh_01.mat
7/25/2002	18:33:10.268	3kHztone.mat
7/25/2002	18:33:13.463	pilot_wh_02.mat
7/25/2002	18:35:16.700	3kHztone.mat
7/25/2002	18:35:19.815	risso_ck_01.mat
7/25/2002	18:36:23.766	3kHztone.mat
7/25/2002	18:36:26.851	sperm_ck_01.mat
7/25/2002	18:37:22.781	3kHztone.mat
7/25/2002	18:37:25.886	cw_sweep_01.mat
7/25/2002	19: 3:40.620	3kHztone.mat
7/25/2002	19: 3:43.775	orca__wh_01.mat
7/25/2002	19: 6: 1.933	3kHztone.mat
7/25/2002	19: 6: 5.028	orca__wh_02.mat
7/25/2002	19: 7:46.013	3kHztone.mat
7/25/2002	19: 7:49.148	pilot_wh_01.mat
7/25/2002	19: 9:44.864	3kHztone.mat
7/25/2002	19: 9:48.059	pilot_wh_02.mat
7/25/2002	19:11:51.286	3kHztone.mat
7/25/2002	19:11:54.400	risso_ck_01.mat

7/25/2002	19:12:58.352	3kHztone.mat	7/25/2002	22: 2:50.768	3kHztone.mat
7/25/2002	19:13: 1.437	sperm_ck_01.mat	7/25/2002	22: 2:53.853	sperm_ck_01.mat
7/25/2002	19:13:57.377	3kHztone.mat	7/25/2002	22: 3:49.793	3kHztone.mat
7/25/2002	19:14: 0.481	cw_sweep_01.mat	7/25/2002	22: 3:52.897	cw_sweep_01.mat
7/25/2002	20:47: 5.562	3kHztone.mat	7/25/2002	22:21:40.192	3kHztone.mat
7/25/2002	20:47: 8.707	orca__wh_01.mat	7/25/2002	22:21:43.397	orca__wh_01.mat
7/25/2002	20:49:26.866	3kHztone.mat	7/25/2002	22:24: 1.575	3kHztone.mat
7/25/2002	20:49:29.960	orca__wh_02.mat	7/25/2002	22:24: 4.670	orca__wh_02.mat
7/25/2002	20:51:10.935	3kHztone.mat	7/25/2002	22:25:45.655	3kHztone.mat
7/25/2002	20:51:14.070	pilot_wh_01.mat	7/25/2002	22:25:48.790	pilot_wh_01.mat
7/25/2002	20:53: 9.806	3kHztone.mat	7/25/2002	22:27:44.516	3kHztone.mat
7/25/2002	20:53:13.001	pilot_wh_02.mat	7/25/2002	22:27:47.711	pilot_wh_02.mat
7/25/2002	20:55:16.238	3kHztone.mat	7/25/2002	22:29:50.978	3kHztone.mat
7/25/2002	20:55:19.352	risso_ck_01.mat	7/25/2002	22:29:54.092	risso_ck_01.mat
7/25/2002	20:56:23.304	3kHztone.mat	7/25/2002	22:30:58.064	3kHztone.mat
7/25/2002	20:56:26.389	sperm_ck_01.mat	7/25/2002	22:31: 1.149	sperm_ck_01.mat
7/25/2002	20:57:22.329	3kHztone.mat	7/25/2002	22:31:57.089	3kHztone.mat
7/25/2002	20:57:25.434	cw_sweep_01.mat	7/25/2002	22:32: 0.194	cw_sweep_01.mat
7/25/2002	21:17:41.482	3kHztone.mat	7/25/2002	22:44:43.471	3kHztone.mat
7/25/2002	21:17:44.617	orca__wh_01.mat	7/25/2002	22:44:46.606	orca__wh_01.mat
7/25/2002	21:20: 2.796	3kHztone.mat	7/25/2002	22:47: 4.764	3kHztone.mat
7/25/2002	21:20: 5.890	orca__wh_02.mat	7/25/2002	22:47: 7.859	orca__wh_02.mat
7/25/2002	21:21:46.885	3kHztone.mat	7/25/2002	22:48:48.844	3kHztone.mat
7/25/2002	21:21:50.020	pilot_wh_01.mat	7/25/2002	22:48:51.979	pilot_wh_01.mat
7/25/2002	21:23:45.746	3kHztone.mat	7/25/2002	22:50:47.705	3kHztone.mat
7/25/2002	21:23:48.941	pilot_wh_02.mat	7/25/2002	22:50:50.900	pilot_wh_02.mat
7/25/2002	21:25:52.208	3kHztone.mat	7/25/2002	22:52:54.167	3kHztone.mat
7/25/2002	21:25:55.322	risso_ck_01.mat	7/25/2002	22:52:57.281	risso_ck_01.mat
7/25/2002	21:26:59.294	3kHztone.mat	7/25/2002	22:54: 1.243	3kHztone.mat
7/25/2002	21:27: 2.379	sperm_ck_01.mat	7/25/2002	22:54: 4.328	sperm_ck_01.mat
7/25/2002	21:27:58.319	3kHztone.mat	7/25/2002	22:55: 0.268	3kHztone.mat
7/25/2002	21:28: 1.414	cw_sweep_01.mat	7/25/2002	22:55: 3.363	cw_sweep_01.mat
7/25/2002	21:29:36.040	3kHztone.mat	7/25/2002	23:12:10.710	3kHztone.mat
7/25/2002	21:29:39.164	orca__wh_01.mat	7/25/2002	23:12:13.854	orca__wh_01.mat
7/25/2002	21:31:57.323	3kHztone.mat	7/25/2002	23:14:32.013	3kHztone.mat
7/25/2002	21:32: 0.417	orca__wh_02.mat	7/25/2002	23:14:35.107	orca__wh_02.mat
7/25/2002	21:33:41.403	3kHztone.mat	7/25/2002	23:16:16.093	3kHztone.mat
7/25/2002	21:33:44.537	pilot_wh_01.mat	7/25/2002	23:16:19.227	pilot_wh_01.mat
7/25/2002	21:35:40.274	3kHztone.mat	7/25/2002	23:18:14.954	3kHztone.mat
7/25/2002	21:35:43.468	pilot_wh_02.mat	7/25/2002	23:18:18.148	pilot_wh_02.mat
7/25/2002	21:37:46.745	3kHztone.mat	7/25/2002	23:20:21.435	3kHztone.mat
7/25/2002	21:37:49.860	risso_ck_01.mat	7/25/2002	23:20:24.550	risso_ck_01.mat
7/25/2002	21:38:53.832	3kHztone.mat	7/25/2002	23:21:28.502	3kHztone.mat
7/25/2002	21:38:56.916	sperm_ck_01.mat	7/25/2002	23:21:31.586	sperm_ck_01.mat
7/25/2002	21:39:52.857	3kHztone.mat	7/25/2002	23:22:27.537	3kHztone.mat
7/25/2002	21:39:55.951	cw_sweep_01.mat	7/25/2002	23:22:30.631	cw_sweep_01.mat
7/25/2002	21:53:32.986	3kHztone.mat	7/25/2002	23:37: 4.578	3kHztone.mat
7/25/2002	21:53:36.111	orca__wh_01.mat	7/25/2002	23:37: 7.702	orca__wh_01.mat
7/25/2002	21:55:54.269	3kHztone.mat	7/25/2002	23:39:25.871	3kHztone.mat
7/25/2002	21:55:57.364	orca__wh_02.mat	7/25/2002	23:39:28.966	orca__wh_02.mat
7/25/2002	21:57:38.349	3kHztone.mat	7/25/2002	23:41: 9.951	3kHztone.mat
7/25/2002	21:57:41.483	pilot_wh_01.mat	7/25/2002	23:41:13.075	pilot_wh_01.mat
7/25/2002	21:59:37.220	3kHztone.mat	7/25/2002	23:43: 8.832	3kHztone.mat
7/25/2002	21:59:40.414	pilot_wh_02.mat	7/25/2002	23:43:12.026	pilot_wh_02.mat
7/25/2002	22: 1:43.692	3kHztone.mat	7/25/2002	23:45:15.294	3kHztone.mat
7/25/2002	22: 1:46.806	risso_ck_01.mat	7/25/2002	23:45:18.408	risso_ck_01.mat

7/25/2002	23:46:22.370	3kHztone.mat	7/26/2002	4:25:19.967	3kHztone.mat
7/25/2002	23:46:25.454	sperm_ck_01.mat	7/26/2002	4:25:23.052	sperm_ck_01.mat
7/25/2002	23:47:21.385	3kHztone.mat	7/26/2002	4:26:18.992	3kHztone.mat
7/25/2002	23:47:24.479	cw_sweep_01.mat	7/26/2002	4:26:22.097	cw_sweep_01.mat
7/26/2002	2:51: 4.635	3kHztone.mat	7/26/2002	4:43:33.780	3kHztone.mat
7/26/2002	2:51: 7.780	orca__wh_01.mat	7/26/2002	4:43:36.925	orca__wh_01.mat
7/26/2002	2:53:25.949	3kHztone.mat	7/26/2002	4:45:55.103	3kHztone.mat
7/26/2002	2:53:29.043	orca__wh_02.mat	7/26/2002	4:45:58.198	orca__wh_02.mat
7/26/2002	2:55:10.028	3kHztone.mat	7/26/2002	4:47:39.193	3kHztone.mat
7/26/2002	2:55:13.163	pilot_wh_01.mat	7/26/2002	4:47:42.328	pilot_wh_01.mat
7/26/2002	2:57: 8.889	3kHztone.mat	7/26/2002	4:49:38.064	3kHztone.mat
7/26/2002	2:57:12.084	pilot_wh_02.mat	7/26/2002	4:49:41.259	pilot_wh_02.mat
7/26/2002	2:59:15.321	3kHztone.mat	7/26/2002	4:51:44.496	3kHztone.mat
7/26/2002	2:59:18.436	risso_ck_01.mat	7/26/2002	4:51:47.610	risso_ck_01.mat
7/26/2002	3: 0:22.398	3kHztone.mat	7/26/2002	4:52:51.572	3kHztone.mat
7/26/2002	3: 0:25.482	sperm_ck_01.mat	7/26/2002	4:52:54.657	sperm_ck_01.mat
7/26/2002	3: 1:21.422	3kHztone.mat	7/26/2002	4:53:50.587	3kHztone.mat
7/26/2002	3: 1:24.527	cw_sweep_01.mat	7/26/2002	4:53:53.692	cw_sweep_01.mat
7/26/2002	3:18:21.409	3kHztone.mat	7/26/2002	5: 8:31.053	3kHztone.mat
7/26/2002	3:18:24.584	orca__wh_01.mat	7/26/2002	5: 8:34.198	orca__wh_01.mat
7/26/2002	3:20:42.732	3kHztone.mat	7/26/2002	5:10:52.356	3kHztone.mat
7/26/2002	3:20:45.837	orca__wh_02.mat	7/26/2002	5:10:55.451	orca__wh_02.mat
7/26/2002	3:22:26.812	3kHztone.mat	7/26/2002	5:12:36.446	3kHztone.mat
7/26/2002	3:22:29.936	pilot_wh_01.mat	7/26/2002	5:12:39.571	pilot_wh_01.mat
7/26/2002	3:24:25.673	3kHztone.mat	7/26/2002	5:14:35.317	3kHztone.mat
7/26/2002	3:24:28.867	pilot_wh_02.mat	7/26/2002	5:14:38.522	pilot_wh_02.mat
7/26/2002	3:26:32.105	3kHztone.mat	7/26/2002	5:16:41.759	3kHztone.mat
7/26/2002	3:26:35.219	risso_ck_01.mat	7/26/2002	5:16:44.873	risso_ck_01.mat
7/26/2002	3:27:39.221	3kHztone.mat	7/26/2002	5:17:48.835	3kHztone.mat
7/26/2002	3:27:42.306	sperm_ck_01.mat	7/26/2002	5:17:51.920	sperm_ck_01.mat
7/26/2002	3:28:38.236	3kHztone.mat	7/26/2002	5:18:47.860	3kHztone.mat
7/26/2002	3:28:41.340	cw_sweep_01.mat	7/26/2002	5:18:50.965	cw_sweep_01.mat
7/26/2002	3:46:17.800	3kHztone.mat	7/26/2002	5:41:22.097	3kHztone.mat
7/26/2002	3:46:20.944	orca__wh_01.mat	7/26/2002	5:41:25.242	orca__wh_01.mat
7/26/2002	3:48:39.103	3kHztone.mat	7/26/2002	5:43:43.391	3kHztone.mat
7/26/2002	3:48:42.197	orca__wh_02.mat	7/26/2002	5:43:46.485	orca__wh_02.mat
7/26/2002	3:50:23.182	3kHztone.mat	7/26/2002	5:45:27.460	3kHztone.mat
7/26/2002	3:50:26.307	pilot_wh_01.mat	7/26/2002	5:45:30.585	pilot_wh_01.mat
7/26/2002	3:52:22.043	3kHztone.mat	7/26/2002	5:47:26.311	3kHztone.mat
7/26/2002	3:52:25.238	pilot_wh_02.mat	7/26/2002	5:47:29.506	pilot_wh_02.mat
7/26/2002	3:54:28.485	3kHztone.mat	7/26/2002	5:49:32.713	3kHztone.mat
7/26/2002	3:54:31.600	risso_ck_01.mat	7/26/2002	5:49:35.827	risso_ck_01.mat
7/26/2002	3:55:35.562	3kHztone.mat	7/26/2002	5:50:39.769	3kHztone.mat
7/26/2002	3:55:38.646	sperm_ck_01.mat	7/26/2002	5:50:42.854	sperm_ck_01.mat
7/26/2002	3:56:34.576	3kHztone.mat	7/26/2002	5:51:38.784	3kHztone.mat
7/26/2002	3:56:37.681	cw_sweep_01.mat	7/26/2002	5:51:41.889	cw_sweep_01.mat
7/26/2002	4:16: 2.155	3kHztone.mat	7/26/2002	6: 7:55.028	3kHztone.mat
7/26/2002	4:16: 5.310	orca__wh_01.mat	7/26/2002	6: 7:58.183	orca__wh_01.mat
7/26/2002	4:18:23.479	3kHztone.mat	7/26/2002	6:10:16.331	3kHztone.mat
7/26/2002	4:18:26.573	orca__wh_02.mat	7/26/2002	6:10:19.426	orca__wh_02.mat
7/26/2002	4:20: 7.558	3kHztone.mat	7/26/2002	6:12: 0.401	3kHztone.mat
7/26/2002	4:20:10.693	pilot_wh_01.mat	7/26/2002	6:12: 3.525	pilot_wh_01.mat
7/26/2002	4:22: 6.419	3kHztone.mat	7/26/2002	6:13:59.252	3kHztone.mat
7/26/2002	4:22: 9.614	pilot_wh_02.mat	7/26/2002	6:14: 2.446	pilot_wh_02.mat
7/26/2002	4:24:12.881	3kHztone.mat	7/26/2002	6:16: 5.663	3kHztone.mat
7/26/2002	4:24:15.995	risso_ck_01.mat	7/26/2002	6:16: 8.838	risso_ck_01.mat

7/26/2002	6:17:12.810	3kHztone.mat
7/26/2002	6:17:15.894	sperm_ck_01.mat
7/26/2002	6:18:11.825	3kHztone.mat
7/26/2002	6:18:14.929	cw_sweep_01.mat
7/26/2002	6:38:35.895	3kHztone.mat
7/26/2002	6:38:39.040	orca__wh_01.mat
7/26/2002	6:40:57.178	3kHztone.mat
7/26/2002	6:41: 0.273	orca__wh_02.mat
7/26/2002	6:42:41.248	3kHztone.mat
7/26/2002	6:42:44.372	pilot_wh_01.mat
7/26/2002	6:44:40.099	3kHztone.mat
7/26/2002	6:44:43.293	pilot_wh_02.mat
7/26/2002	6:46:46.531	3kHztone.mat
7/26/2002	6:46:49.645	risso_ck_01.mat
7/26/2002	6:47:53.587	3kHztone.mat
7/26/2002	6:47:56.671	sperm_ck_01.mat
7/26/2002	6:48:52.602	3kHztone.mat
7/26/2002	6:48:55.706	cw_sweep_01.mat
7/26/2002	7: 4: 7.367	3kHztone.mat
7/26/2002	7: 4:10.512	orca__wh_01.mat
7/26/2002	7: 6:28.650	3kHztone.mat
7/26/2002	7: 6:31.745	orca__wh_02.mat
7/26/2002	7: 8:12.720	3kHztone.mat
7/26/2002	7: 8:15.844	pilot_wh_01.mat
7/26/2002	7:10:11.561	3kHztone.mat
7/26/2002	7:10:14.755	pilot_wh_02.mat
7/26/2002	7:12:17.973	3kHztone.mat
7/26/2002	7:12:21.087	risso_ck_01.mat
7/26/2002	7:13:25.029	3kHztone.mat
7/26/2002	7:13:28.113	sperm_ck_01.mat
7/26/2002	7:14:24.064	3kHztone.mat
7/26/2002	7:14:27.168	cw_sweep_01.mat
7/26/2002	14:29: 6.629	3kHztone.mat
7/26/2002	14:29: 9.773	orca__wh_01.mat
7/26/2002	14:31:27.932	3kHztone.mat
7/26/2002	14:31:31.026	orca__wh_02.mat
7/26/2002	14:33:12.012	3kHztone.mat
7/26/2002	14:33:15.136	pilot_wh_01.mat
7/26/2002	14:35:10.873	3kHztone.mat
7/26/2002	14:35:14.067	pilot_wh_02.mat
7/26/2002	14:37:17.304	3kHztone.mat
7/26/2002	14:37:20.419	risso_ck_01.mat
7/26/2002	14:38:24.381	3kHztone.mat
7/26/2002	14:38:27.465	sperm_ck_01.mat
7/26/2002	14:39:23.416	3kHztone.mat
7/26/2002	14:39:26.520	cw_sweep_01.mat
7/26/2002	14:55:28.193	3kHztone.mat
7/26/2002	14:55:31.328	orca__wh_01.mat
7/26/2002	14:57:49.486	3kHztone.mat
7/26/2002	14:57:52.581	orca__wh_02.mat
7/26/2002	14:59:33.566	3kHztone.mat
7/26/2002	14:59:36.700	pilot_wh_01.mat
7/26/2002	15: 1:32.457	3kHztone.mat
7/26/2002	15: 1:35.661	pilot_wh_02.mat
7/26/2002	15: 3:38.949	3kHztone.mat
7/26/2002	15: 3:42.063	risso_ck_01.mat
7/26/2002	15: 4:46.025	3kHztone.mat
7/26/2002	15: 4:49.110	sperm_ck_01.mat
7/26/2002	15: 5:45.060	3kHztone.mat
7/26/2002	15: 5:48.164	cw_sweep_01.mat
7/26/2002	15:21:48.005	3kHztone.mat
7/26/2002	15:21:51.139	orca__wh_01.mat
7/26/2002	15:22:11.288	3kHztone.mat
7/26/2002	15:22:14.443	orca__wh_01.mat
7/26/2002	15:24:32.611	3kHztone.mat
7/26/2002	15:24:35.706	orca__wh_02.mat
7/26/2002	15:26:16.701	3kHztone.mat
7/26/2002	15:26:19.826	pilot_wh_01.mat
7/26/2002	15:28:15.572	3kHztone.mat
7/26/2002	15:28:18.767	pilot_wh_02.mat
7/26/2002	15:30:22.024	3kHztone.mat
7/26/2002	15:30:25.138	risso_ck_01.mat
7/26/2002	15:31:29.100	3kHztone.mat
7/26/2002	15:31:32.185	sperm_ck_01.mat
7/26/2002	15:32:28.115	3kHztone.mat
7/26/2002	15:32:31.220	cw_sweep_01.mat
7/26/2002	15:48:37.429	3kHztone.mat
7/26/2002	15:48:40.563	orca__wh_01.mat
7/26/2002	15:50:58.742	3kHztone.mat
7/26/2002	15:51: 1.837	orca__wh_02.mat
7/26/2002	15:52:42.842	3kHztone.mat
7/26/2002	15:52:45.976	pilot_wh_01.mat
7/26/2002	15:54:41.713	3kHztone.mat
7/26/2002	15:54:44.917	pilot_wh_02.mat
7/26/2002	15:56:48.185	3kHztone.mat
7/26/2002	15:56:51.299	risso_ck_01.mat
7/26/2002	15:57:55.271	3kHztone.mat
7/26/2002	15:57:58.355	sperm_ck_01.mat
7/26/2002	15:58:54.306	3kHztone.mat
7/26/2002	15:58:57.400	cw_sweep_01.mat
7/26/2002	17:30:42.837	3kHztone.mat
7/26/2002	17:30:45.971	orca__wh_01.mat
7/26/2002	17:33: 4.140	3kHztone.mat
7/26/2002	17:33: 7.234	orca__wh_02.mat
7/26/2002	17:34:48.220	3kHztone.mat
7/26/2002	17:34:51.344	pilot_wh_01.mat
7/26/2002	17:36:47.081	3kHztone.mat
7/26/2002	17:36:50.275	pilot_wh_02.mat
7/26/2002	17:38:53.522	3kHztone.mat
7/26/2002	17:38:56.637	risso_ck_01.mat
7/26/2002	17:40: 0.599	3kHztone.mat
7/26/2002	17:40: 3.683	sperm_ck_01.mat
7/26/2002	17:40:59.624	3kHztone.mat
7/26/2002	17:41: 2.728	cw_sweep_01.mat
7/26/2002	20: 7:10.546	3kHztone.mat
7/26/2002	20: 7:13.690	orca__wh_01.mat
7/26/2002	20: 9:31.849	3kHztone.mat
7/26/2002	20: 9:34.943	orca__wh_02.mat
7/26/2002	20:11:15.939	3kHztone.mat
7/26/2002	20:11:19.063	pilot_wh_01.mat
7/26/2002	20:13:14.789	3kHztone.mat
7/26/2002	20:13:17.984	pilot_wh_02.mat

7/26/2002	20:15:21.221	3kHztone.mat	7/26/2002	22: 5: 7.542	3kHztone.mat
7/26/2002	20:15:24.336	risso_ck_01.mat	7/26/2002	22: 5:10.656	risso_ck_01.mat
7/26/2002	20:16:28.278	3kHztone.mat	7/26/2002	22: 6:14.598	3kHztone.mat
7/26/2002	20:16:31.362	sperm_ck_01.mat	7/26/2002	22: 6:17.683	sperm_ck_01.mat
7/26/2002	20:17:27.293	3kHztone.mat	7/26/2002	22: 7:13.613	3kHztone.mat
7/26/2002	20:17:30.397	cw_sweep_01.mat	7/26/2002	22: 7:16.718	cw_sweep_01.mat
7/26/2002	20:37:12.397	3kHztone.mat	7/26/2002	23:25:49.624	3kHztone.mat
7/26/2002	20:37:15.551	orca__wh_01.mat	7/26/2002	23:25:52.779	orca__wh_01.mat
7/26/2002	20:39:33.700	3kHztone.mat	7/26/2002	23:28:10.928	3kHztone.mat
7/26/2002	20:39:36.794	orca__wh_02.mat	7/26/2002	23:28:14.022	orca__wh_02.mat
7/26/2002	20:41:17.779	3kHztone.mat	7/26/2002	23:29:54.997	3kHztone.mat
7/26/2002	20:41:20.904	pilot_wh_01.mat	7/26/2002	23:29:58.182	pilot_wh_01.mat
7/26/2002	20:43:16.630	3kHztone.mat	7/26/2002	23:31:53.908	3kHztone.mat
7/26/2002	20:43:19.825	pilot_wh_02.mat	7/26/2002	23:31:57.103	pilot_wh_02.mat
7/26/2002	20:45:23.062	3kHztone.mat	7/26/2002	23:34: 0.360	3kHztone.mat
7/26/2002	20:45:26.177	risso_ck_01.mat	7/26/2002	23:34: 3.475	risso_ck_01.mat
7/26/2002	20:46:30.139	3kHztone.mat	7/26/2002	23:35: 7.417	3kHztone.mat
7/26/2002	20:46:33.223	sperm_ck_01.mat	7/26/2002	23:35:10.501	sperm_ck_01.mat
7/26/2002	20:47:29.153	3kHztone.mat	7/26/2002	23:36: 6.431	3kHztone.mat
7/26/2002	20:47:32.258	cw_sweep_01.mat	7/26/2002	23:36: 9.536	cw_sweep_01.mat
7/26/2002	20:54:33.894	3kHztone.mat	7/26/2002	23:59:53.183	3kHztone.mat
7/26/2002	20:54:37.039	orca__wh_01.mat	7/26/2002	23:59:56.317	orca__wh_01.mat
7/26/2002	20:56:55.207	3kHztone.mat	7/27/2002	0: 2:14.496	3kHztone.mat
7/26/2002	20:56:58.302	orca__wh_02.mat	7/27/2002	0: 2:17.591	orca__wh_02.mat
7/26/2002	20:58:39.287	3kHztone.mat	7/27/2002	0: 3:58.576	3kHztone.mat
7/26/2002	20:58:42.422	pilot_wh_01.mat	7/27/2002	0: 4: 1.700	pilot_wh_01.mat
7/26/2002	21: 0:38.168	3kHztone.mat	7/27/2002	0: 5:57.447	3kHztone.mat
7/26/2002	21: 0:41.363	pilot_wh_02.mat	7/27/2002	0: 6: 0.641	pilot_wh_02.mat
7/26/2002	21: 2:44.600	3kHztone.mat	7/27/2002	0: 8: 3.899	3kHztone.mat
7/26/2002	21: 2:47.714	risso_ck_01.mat	7/27/2002	0: 8: 7.013	risso_ck_01.mat
7/26/2002	21: 3:51.666	3kHztone.mat	7/27/2002	0: 9:10.975	3kHztone.mat
7/26/2002	21: 3:54.751	sperm_ck_01.mat	7/27/2002	0: 9:14.059	sperm_ck_01.mat
7/26/2002	21: 4:50.691	3kHztone.mat	7/27/2002	0:10:10.000	3kHztone.mat
7/26/2002	21: 4:53.796	cw_sweep_01.mat	7/27/2002	0:10:13.104	cw_sweep_01.mat
7/26/2002	21:26: 9.210	3kHztone.mat	7/27/2002	0:11:14.653	3kHztone.mat
7/26/2002	21:26:12.384	orca__wh_01.mat	7/27/2002	0:11:17.767	orca__wh_01.mat
7/26/2002	21:28:30.543	3kHztone.mat	7/27/2002	0:13:35.936	3kHztone.mat
7/26/2002	21:28:33.637	orca__wh_02.mat	7/27/2002	0:13:39.030	orca__wh_02.mat
7/26/2002	21:30:14.612	3kHztone.mat	7/27/2002	0:15:20.016	3kHztone.mat
7/26/2002	21:30:17.737	pilot_wh_01.mat	7/27/2002	0:15:23.140	pilot_wh_01.mat
7/26/2002	21:32:13.473	3kHztone.mat	7/27/2002	0:17:18.887	3kHztone.mat
7/26/2002	21:32:16.668	pilot_wh_02.mat	7/27/2002	0:17:22.081	pilot_wh_02.mat
7/26/2002	21:34:19.905	3kHztone.mat	7/27/2002	0:19:25.348	3kHztone.mat
7/26/2002	21:34:23.020	risso_ck_01.mat	7/27/2002	0:19:28.463	risso_ck_01.mat
7/26/2002	21:35:26.972	3kHztone.mat	7/27/2002	0:20:32.425	3kHztone.mat
7/26/2002	21:35:30.056	sperm_ck_01.mat	7/27/2002	0:20:35.509	sperm_ck_01.mat
7/26/2002	21:36:25.996	3kHztone.mat	7/27/2002	0:21:31.450	3kHztone.mat
7/26/2002	21:36:29.101	cw_sweep_01.mat	7/27/2002	0:21:34.554	cw_sweep_01.mat
7/26/2002	21:56:56.876	3kHztone.mat	7/27/2002	0:24:17.118	3kHztone.mat
7/26/2002	21:57: 0.031	orca__wh_01.mat	7/27/2002	0:24:20.242	orca__wh_01.mat
7/26/2002	21:59:18.180	3kHztone.mat	7/27/2002	0:26:38.401	3kHztone.mat
7/26/2002	21:59:21.274	orca__wh_02.mat	7/27/2002	0:26:41.496	orca__wh_02.mat
7/26/2002	22: 1: 2.249	3kHztone.mat	7/27/2002	0:28:22.481	3kHztone.mat
7/26/2002	22: 1: 5.374	pilot_wh_01.mat	7/27/2002	0:28:25.615	pilot_wh_01.mat
7/26/2002	22: 3: 1.100	3kHztone.mat	7/27/2002	0:30:21.352	3kHztone.mat
7/26/2002	22: 3: 4.295	pilot_wh_02.mat	7/27/2002	0:30:24.546	pilot_wh_02.mat

7/27/2002	0:32:27.814	3kHztone.mat	7/27/2002	3:14:52.526	3kHztone.mat
7/27/2002	0:32:30.928	risso_ck_01.mat	7/27/2002	3:14:55.640	risso_ck_01.mat
7/27/2002	0:33:34.890	3kHztone.mat	7/27/2002	3:15:59.592	3kHztone.mat
7/27/2002	0:33:37.974	sperm_ck_01.mat	7/27/2002	3:16: 2.677	sperm_ck_01.mat
7/27/2002	0:34:33.915	3kHztone.mat	7/27/2002	3:16:58.607	3kHztone.mat
7/27/2002	0:34:37.019	cw_sweep_01.mat	7/27/2002	3:17: 1.712	cw_sweep_01.mat
7/27/2002	0:54:36.124	3kHztone.mat	7/27/2002	3:18: 3.230	3kHztone.mat
7/27/2002	0:54:39.258	orca__wh_01.mat	7/27/2002	3:18: 6.334	cw_sweep_01.mat
7/27/2002	0:56:57.417	3kHztone.mat	7/27/2002	3:23:26.295	3kHztone.mat
7/27/2002	0:57: 0.511	orca__wh_02.mat	7/27/2002	3:23:29.439	orca__wh_01.mat
7/27/2002	0:58:41.496	3kHztone.mat	7/27/2002	3:25:47.588	3kHztone.mat
7/27/2002	0:58:44.621	pilot_wh_01.mat	7/27/2002	3:25:50.682	orca__wh_02.mat
7/27/2002	1: 0:40.367	3kHztone.mat	7/27/2002	3:27:31.657	3kHztone.mat
7/27/2002	1: 0:43.562	pilot_wh_02.mat	7/27/2002	3:27:34.782	pilot_wh_01.mat
7/27/2002	1: 2:46.829	3kHztone.mat	7/27/2002	3:29:30.508	3kHztone.mat
7/27/2002	1: 2:49.944	risso_ck_01.mat	7/27/2002	3:29:33.703	pilot_wh_02.mat
7/27/2002	1: 3:53.906	3kHztone.mat	7/27/2002	3:31:36.940	3kHztone.mat
7/27/2002	1: 3:56.990	sperm_ck_01.mat	7/27/2002	3:31:40.055	risso_ck_01.mat
7/27/2002	1: 4:52.921	3kHztone.mat	7/27/2002	3:32:44.007	3kHztone.mat
7/27/2002	1: 4:56.025	cw_sweep_01.mat	7/27/2002	3:32:47.091	sperm_ck_01.mat
7/27/2002	1:23: 7.605	3kHztone.mat	7/27/2002	3:33:43.021	3kHztone.mat
7/27/2002	1:23:10.719	orca__wh_01.mat	7/27/2002	3:33:46.126	cw_sweep_01.mat
7/27/2002	1:25:28.878	3kHztone.mat	7/27/2002	3:34:47.644	3kHztone.mat
7/27/2002	1:25:31.972	orca__wh_02.mat	7/27/2002	3:34:50.749	cw_sweep_01.mat
7/27/2002	1:27:12.957	3kHztone.mat	7/27/2002	3:59:58.657	3kHztone.mat
7/27/2002	1:27:16.092	pilot_wh_01.mat	7/27/2002	4: 0: 1.802	orca__wh_01.mat
7/27/2002	1:29:11.838	3kHztone.mat	7/27/2002	4: 2:19.950	3kHztone.mat
7/27/2002	1:29:15.033	pilot_wh_02.mat	7/27/2002	4: 2:23.045	orca__wh_02.mat
7/27/2002	1:31:18.290	3kHztone.mat	7/27/2002	4: 4: 4.030	3kHztone.mat
7/27/2002	1:31:21.405	risso_ck_01.mat	7/27/2002	4: 4: 7.164	pilot_wh_01.mat
7/27/2002	1:32:25.367	3kHztone.mat	7/27/2002	4: 6: 2.881	3kHztone.mat
7/27/2002	1:32:28.451	sperm_ck_01.mat	7/27/2002	4: 6: 6.075	pilot_wh_02.mat
7/27/2002	1:33:24.381	3kHztone.mat	7/27/2002	4: 8: 9.323	3kHztone.mat
7/27/2002	1:33:27.486	cw_sweep_01.mat	7/27/2002	4: 8:12.437	risso_ck_01.mat
7/27/2002	1:50:34.262	3kHztone.mat	7/27/2002	4: 9:16.389	3kHztone.mat
7/27/2002	1:50:37.387	orca__wh_01.mat	7/27/2002	4: 9:19.473	sperm_ck_01.mat
7/27/2002	1:52:55.546	3kHztone.mat	7/27/2002	4:10:15.404	3kHztone.mat
7/27/2002	1:52:58.640	orca__wh_02.mat	7/27/2002	4:10:18.508	cw_sweep_01.mat
7/27/2002	1:54:39.625	3kHztone.mat	7/27/2002	4:11:20.027	3kHztone.mat
7/27/2002	1:54:42.750	pilot_wh_01.mat	7/27/2002	4:11:23.131	cw_sweep_01.mat
7/27/2002	1:56:38.486	3kHztone.mat	7/27/2002	4:15:27.222	3kHztone.mat
7/27/2002	1:56:41.681	pilot_wh_02.mat	7/27/2002	4:15:30.337	orca__wh_01.mat
7/27/2002	1:58:44.948	3kHztone.mat	7/27/2002	4:17:48.485	3kHztone.mat
7/27/2002	1:58:48.062	risso_ck_01.mat	7/27/2002	4:17:51.580	orca__wh_02.mat
7/27/2002	1:59:52.024	3kHztone.mat	7/27/2002	4:19:32.555	3kHztone.mat
7/27/2002	1:59:55.109	sperm_ck_01.mat	7/27/2002	4:19:35.690	pilot_wh_01.mat
7/27/2002	2: 0:51.049	3kHztone.mat	7/27/2002	4:21:31.426	3kHztone.mat
7/27/2002	2: 0:54.154	cw_sweep_01.mat	7/27/2002	4:21:34.621	pilot_wh_02.mat
7/27/2002	3: 6:41.890	3kHztone.mat	7/27/2002	4:23:37.868	3kHztone.mat
7/27/2002	3: 6:45.035	orca__wh_01.mat	7/27/2002	4:23:40.982	risso_ck_01.mat
7/27/2002	3: 9: 3.183	3kHztone.mat	7/27/2002	4:24:44.934	3kHztone.mat
7/27/2002	3: 9: 6.278	orca__wh_02.mat	7/27/2002	4:24:48.019	sperm_ck_01.mat
7/27/2002	3:10:47.253	3kHztone.mat	7/27/2002	4:25:43.949	3kHztone.mat
7/27/2002	3:10:50.378	pilot_wh_01.mat	7/27/2002	4:25:47.054	cw_sweep_01.mat
7/27/2002	3:12:46.094	3kHztone.mat	7/27/2002	4:26:48.572	3kHztone.mat
7/27/2002	3:12:49.289	pilot_wh_02.mat	7/27/2002	4:26:51.676	cw_sweep_01.mat

7/27/2002	5: 3:44.679	3kHztone.mat	7/27/2002	14:18:14.869	3kHztone.mat
7/27/2002	5: 3:47.823	orca__wh_01.mat	7/27/2002	14:18:17.953	sperm_ck_01.mat
7/27/2002	5: 6: 5.992	3kHztone.mat	7/27/2002	14:19:13.874	3kHztone.mat
7/27/2002	5: 6: 9.086	orca__wh_02.mat	7/27/2002	14:19:16.978	cw_sweep_01.mat
7/27/2002	5: 7:50.071	3kHztone.mat	7/27/2002	14:35:27.694	3kHztone.mat
7/27/2002	5: 7:53.206	pilot_wh_01.mat	7/27/2002	14:35:30.838	orca__wh_01.mat
7/27/2002	5: 9:48.932	3kHztone.mat	7/27/2002	14:37:48.957	3kHztone.mat
7/27/2002	5: 9:52.127	pilot_wh_02.mat	7/27/2002	14:37:52.051	orca__wh_02.mat
7/27/2002	5:11:55.374	3kHztone.mat	7/27/2002	14:39:33.007	3kHztone.mat
7/27/2002	5:11:58.489	risso_ck_01.mat	7/27/2002	14:39:36.131	pilot_wh_01.mat
7/27/2002	5:13: 2.441	3kHztone.mat	7/27/2002	14:41:31.817	3kHztone.mat
7/27/2002	5:13: 5.525	sperm_ck_01.mat	7/27/2002	14:41:35.012	pilot_wh_02.mat
7/27/2002	5:14: 1.465	3kHztone.mat	7/27/2002	14:43:38.179	3kHztone.mat
7/27/2002	5:14: 4.570	cw_sweep_01.mat	7/27/2002	14:43:41.294	risso_ck_01.mat
7/27/2002	5:15: 6.098	3kHztone.mat	7/27/2002	14:44:45.206	3kHztone.mat
7/27/2002	5:15: 9.203	cw_sweep_01.mat	7/27/2002	14:44:48.290	sperm_ck_01.mat
7/27/2002	5:31:55.440	3kHztone.mat	7/27/2002	14:45:44.200	3kHztone.mat
7/27/2002	5:31:58.574	orca__wh_01.mat	7/27/2002	14:45:47.305	cw_sweep_01.mat
7/27/2002	5:34:16.723	3kHztone.mat	7/27/2002	14:58:52.063	3kHztone.mat
7/27/2002	5:34:19.817	orca__wh_02.mat	7/27/2002	14:58:55.198	orca__wh_01.mat
7/27/2002	5:36: 0.803	3kHztone.mat	7/27/2002	15: 1:13.316	3kHztone.mat
7/27/2002	5:36: 3.927	pilot_wh_01.mat	7/27/2002	15: 1:16.411	orca__wh_02.mat
7/27/2002	5:37:59.674	3kHztone.mat	7/27/2002	15: 2:57.366	3kHztone.mat
7/27/2002	5:38: 2.868	pilot_wh_02.mat	7/27/2002	15: 3: 0.490	pilot_wh_01.mat
7/27/2002	5:40: 6.115	3kHztone.mat	7/27/2002	15: 4:56.177	3kHztone.mat
7/27/2002	5:40: 9.230	risso_ck_01.mat	7/27/2002	15: 4:59.371	pilot_wh_02.mat
7/27/2002	5:41:13.172	3kHztone.mat	7/27/2002	15: 7: 2.529	3kHztone.mat
7/27/2002	5:41:16.256	sperm_ck_01.mat	7/27/2002	15: 7: 5.643	risso_ck_01.mat
7/27/2002	5:42:12.187	3kHztone.mat	7/27/2002	15: 8: 9.555	3kHztone.mat
7/27/2002	5:42:15.291	cw_sweep_01.mat	7/27/2002	15: 8:12.639	sperm_ck_01.mat
7/27/2002	5:43:16.810	3kHztone.mat	7/27/2002	15: 9: 8.550	3kHztone.mat
7/27/2002	5:43:19.914	cw_sweep_01.mat	7/27/2002	15: 9:11.654	cw_sweep_01.mat
7/27/2002	13:57:36.067	3kHztone.mat	7/27/2002	15:21:47.341	3kHztone.mat
7/27/2002	13:57:39.332	orca__wh_01.mat	7/27/2002	15:21:50.475	orca__wh_01.mat
7/27/2002	13:59:57.451	3kHztone.mat	7/27/2002	15:24: 8.584	3kHztone.mat
7/27/2002	14: 0: 0.545	orca__wh_02.mat	7/27/2002	15:24:11.678	orca__wh_02.mat
7/27/2002	14: 1:41.500	3kHztone.mat	7/27/2002	15:25:52.624	3kHztone.mat
7/27/2002	14: 1:44.625	pilot_wh_01.mat	7/27/2002	15:25:55.758	pilot_wh_01.mat
7/27/2002	14: 3:40.311	3kHztone.mat	7/27/2002	15:27:51.434	3kHztone.mat
7/27/2002	14: 3:43.506	pilot_wh_02.mat	7/27/2002	15:27:54.629	pilot_wh_02.mat
7/27/2002	14: 5:46.683	3kHztone.mat	7/27/2002	15:29:57.796	3kHztone.mat
7/27/2002	14: 5:49.797	risso_ck_01.mat	7/27/2002	15:30: 0.911	risso_ck_01.mat
7/27/2002	14: 6:53.719	3kHztone.mat	7/27/2002	15:31: 4.822	3kHztone.mat
7/27/2002	14: 6:56.804	sperm_ck_01.mat	7/27/2002	15:31: 7.907	sperm_ck_01.mat
7/27/2002	14: 7:52.724	3kHztone.mat	7/27/2002	15:32: 3.817	3kHztone.mat
7/27/2002	14: 7:55.819	cw_sweep_01.mat	7/27/2002	15:32: 6.922	cw_sweep_01.mat
7/27/2002	14: 8:57.317	3kHztone.mat	7/27/2002	15:46:11.897	3kHztone.mat
7/27/2002	14: 9: 0.462	orca__wh_01.mat	7/27/2002	15:46:15.031	orca__wh_01.mat
7/27/2002	14:11:18.580	3kHztone.mat	7/27/2002	15:48:33.150	3kHztone.mat
7/27/2002	14:11:21.675	orca__wh_02.mat	7/27/2002	15:48:36.244	orca__wh_02.mat
7/27/2002	14:13: 2.630	3kHztone.mat	7/27/2002	15:50:17.199	3kHztone.mat
7/27/2002	14:13: 5.764	pilot_wh_01.mat	7/27/2002	15:50:20.324	pilot_wh_01.mat
7/27/2002	14:15: 1.451	3kHztone.mat	7/27/2002	15:52:16.010	3kHztone.mat
7/27/2002	14:15: 4.645	pilot_wh_02.mat	7/27/2002	15:52:19.205	pilot_wh_02.mat
7/27/2002	14:17: 7.832	3kHztone.mat	7/27/2002	15:54:22.372	3kHztone.mat
7/27/2002	14:17:10.947	risso_ck_01.mat	7/27/2002	15:54:25.486	risso_ck_01.mat

7/27/2002	15:55:29.398	3kHztone.mat
7/27/2002	15:55:32.483	sperm_ck_01.mat
7/27/2002	15:56:28.393	3kHztone.mat
7/27/2002	15:56:31.498	cw_sweep_01.mat
7/27/2002	16:10:54.519	3kHztone.mat
7/27/2002	16:10:57.633	orca__wh_01.mat
7/27/2002	16:13:15.742	3kHztone.mat
7/27/2002	16:13:18.836	orca__wh_02.mat
7/27/2002	16:14:59.791	3kHztone.mat
7/27/2002	16:15: 2.916	pilot_wh_01.mat
7/27/2002	16:16:58.592	3kHztone.mat
7/27/2002	16:17: 1.787	pilot_wh_02.mat
7/27/2002	16:19: 4.944	3kHztone.mat
7/27/2002	16:19: 8.058	risso_ck_01.mat
7/27/2002	16:20:11.970	3kHztone.mat
7/27/2002	16:20:15.055	sperm_ck_01.mat
7/27/2002	16:21:10.965	3kHztone.mat
7/27/2002	16:21:14.070	cw_sweep_01.mat
7/27/2002	16:34:34.390	3kHztone.mat
7/27/2002	16:34:37.525	orca__wh_01.mat
7/27/2002	16:36:55.653	3kHztone.mat
7/27/2002	16:36:58.748	orca__wh_02.mat
7/27/2002	16:38:39.693	3kHztone.mat
7/27/2002	16:38:42.818	pilot_wh_01.mat
7/27/2002	16:40:38.504	3kHztone.mat
7/27/2002	16:40:41.698	pilot_wh_02.mat
7/27/2002	16:42:44.866	3kHztone.mat
7/27/2002	16:42:47.980	risso_ck_01.mat
7/27/2002	16:43:51.892	3kHztone.mat
7/27/2002	16:43:54.976	sperm_ck_01.mat
7/27/2002	16:44:50.887	3kHztone.mat
7/27/2002	16:44:53.991	cw_sweep_01.mat

10.7 MatLab Code Used During This Experiment

```
function timerwhale
% FUNCTION:  TIMERWHALE
% Program used to automatically load, and play all transmitted signals
% for the July 2002 San Clemente Island cruise.
%
% Anu Kumar, NPS Ocean Acoustics Laboratory
% 7/22/02
disp('  Press Ctrl-C to stop program')

fileparam = ['orca__wh_01.mat';'orca__wh_02.mat';...
        'pilot_wh_01.mat';'pilot_wh_02.mat';...
        'risso_ck_01.mat';'sperm_ck_01.mat';...
        'cw_sweep_01.mat'];

interval = 1;            % pause interval between playtimes in (sec)
fileS = 'Cruise_playlog.txt';  % log name

for n = 1:size(fileparam,1)
    load('3kHztone.mat');
    timeC = clock;
    sound(data,fs);
    pd = pwd; cd(..\PtSurTransmisson\transmisson_log');
    FID = fopen(fileS,'a+');    % opens .txt file to write and append
    fprintf(FID,'%2.0f-%2.0f-%4.0f %3.0f:%2.0f:%6.3f
%s\n',timeC(1,2),timeC(1,3),timeC(1,1),timeC(1,4),timeC(1,5),timeC(1,6),
'3kHztone.mat'); % writes timestamp and filename played to .txt
    fclose(FID); cd(pd);
    fprintf(1,'%2.0f-%2.0f-%4.0f %3.0f:%2.0f:%6.3f
%s\n',timeC(1,2),timeC(1,3),timeC(1,1),timeC(1,4),timeC(1,5),timeC(1,6),
'3kHztone.mat'); % writes timestamp and filename to screen
    pause(length(data)/fs + interval);clear data fs;       % pause the
length of file + interval
    load(fileparam(n,:)) % loads next track
    timeC = clock;
    sound(data,fs);
    pd = pwd; cd(..\PtSurTransmisson\transmisson_log');
    FID = fopen(fileS,'a+');    % opens .txt file to write and append
    fprintf(FID,'%2.0f-%2.0f-%4.0f %3.0f:%2.0f:%6.3f
%s\n',timeC(1,2),timeC(1,3),timeC(1,1),timeC(1,4),timeC(1,5),timeC(1,6),
fileparam(n,:)); % writes timestamp and filename played to .txt
    fclose(FID); cd(pd);
    fprintf(1,'%2.0f-%2.0f-%4.0f %3.0f:%2.0f:%6.3f
%s\n',timeC(1,2),timeC(1,3),timeC(1,1),timeC(1,4),timeC(1,5),timeC(1,6),
fileparam(n,:)); % writes timestamp and filename to screen
    pause(length(data)/fs + interval);               % pause the length
of file + interval
end
%%%%%%%%%%%%%%%%%%%%%%%%% END OF TIMERWHALE %%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
function digitize
% Digitze.m
%
% Function that will collect continuous data from the NIDaq
% PC based data rackmounted data acquisition system.
%
% This program was used during the Hoke seamount cruise for
% data collection and sonobuoy deployment.

% 4 channel max sample rate = 80000;
% 7 channel max sample rate = 42000;

clear ai
filelength=60;                                % 1 minute data files

ai=analoginput('nidaq',1);          % Address the National Instruments
Card #1
hwinfo=daqhwinfo(ai);
%hwinfo.DifferentialIDs              % Display the # of channels
    chan=addchannel(ai,0);        % Define 8 channels to collect data
from
    % 8 channels at 33.333kHz will fill an 80Gbyte (Maxtor) disk in
1.75 days
    ai.SampleRate=33333;
    %setverify(ai,'SampleRate',40000)
%    ai.SampleRate=fix(300000/length(chan));    % Select the maximum
sample rate available

ai.SamplesPerTrigger=filelength*ai.SampleRate;
ai.SamplesAcquiredFcnCount = filelength*ai.SampleRate;  % set data
limit/file
ai.SamplesAcquiredFcn = {@changefile}

    ai.Channel.InputRange=[-2.5 2.5];              % Define input
range for ICOM & monitoring hydrophone
    ai.Channel.SensorRange=[-2.5 2.5];
    ai.Channel.UnitsRange=[-2.5 2.5];
    ai.Channel.Units='Volts';
    ai.Channel(1).ChannelName='monitor';
%    ai.Channel(2).ChannelName='57B monitor';
%    ai.Channel(3).ChannelName='57B VLA1 T';
%    ai.Channel(4).ChannelName='57B VLA1 M';
%    ai.Channel(5).ChannelName='57B VLA2 B';
%    ai.Channel(6).ChannelName='57B VLA2 T';
%    ai.Channel(7).ChannelName='57B VLA2 M';
%    ai.Channel(8).ChannelName='57B VLA2 B';
    ai.LoggingMode='Disk';
    ai.LogToDiskMode='Index';
    ai.TriggerType='Immediate';
    %ai.TriggerRepeat=3;
    ai.InputType='Differential'

% Do not allow overwritting of datafiles during deployment:
```

```
    filename='SCIUR1r1_';
    logfilename=filecheck(filename);
    ai.LogFileName=logfilename;

%disp('Use ^C to break loop and type ''stop(ai)'' at the MatLab prompt
to stop collecting data');
%while(1),
%start(ai);
%    now
%    waittilstop(ai,filelength+5);     % +5 second delay to force stop
%end;
hstart =
uicontrol('String','Start','style','pushbutton','Units','Inches',...
    'position',[1.135 1.96 1.57
1.15],'callback',{@startAcquisition,ai});

hstop =
uicontrol('String','Stop','style','pushbutton','Units','Inches',...
    'position',[3.35 1.96 1.57 1.15],'callback',{@stopAcquisition,ai});

set(gcf,'DeleteFcn',{@killAI,ai});


%
************************************************************************
********
function changefile(obj,event)     % initiates the object everytime it
is called
disp('changefile called');
start(obj)

%
************************************************************************
********
function startAcquisition(h, eventdata, e)
disp('starting now')
start(e)

%
************************************************************************
********
function stopAcquisition(h, eventdata, e)
disp('stopping now')
stop(e)

%
************************************************************************
********
function killAI(h, eventdata, e)
uiwait(msgbox('Delete Analog Input Object','Delete Obj'));
stop(e);


%
************************************************************************
********
% SUBFUNCTION FILECHECK
```

```
function logfilename=filecheck(filename);
% Do not allow overwritting of datafiles during deployment:
    fid=fopen([filename,'.daq'],'r');   % test for file existence
if fid <3,      % file doesn't exist, go ahead and write data
    disp('file doesn''t exist');
    logfilename=[filename,'.daq'];
else,
% File did exist, so now append characters until you find one that
hasn't been written
    for ASCII=65:90,    % loop over A-Z character extensions
        fname=[filename,char(ASCII)];
        fid=fopen([fname,'.daq'],'r')   % test for file existence
        if fid <3,      % file doesn't exist, go ahead and write data
            logfilename=fname;
            fprintf(2,['Writing to output file ',fname]);

            return;
        end;
    end;pause;
end;
%
*************************************************************************
********


return;
for i=0:26,

[data,time,abstime,events,daqinfo]=daqread(['pioneer00',num2str(i),'.da
q']);
    plot(time+(abstime(5)*60)+abstime(6),data(:,1));hold on;pause(.1);
end;hold off;
%%%%%%%%%%%%%%%% END OF DIGITIZE %%%%%%%%%%%%%%%%%%%%%%
```

10.8 Sonobuoy RF Channel Assignments

RF CHANNEL	FREQ. (MHz)	RF CHANNEL	FREQ. (MHz	RF CHANNEL	FREQ. (MHz
1	162.250	34	136.750	67	149.125
2	163.000	35	137.125	68	149.500
3	163.750	36	137.500	69	149.875
4	164.500	37	137.875	70	150.250
5	165.250	38	138.250	71	150.625
6	166.000	39	138.625	72	151.000
7	166.750	40	139.000	73	151.375
8	167.500	41	139.375	74	151.750
9	168.250	42	139.750	75	152.125
10	169.000	43	140.125	76	152.500
11	169.750	44	140.500	77	152.875
12	170.500	45	140.875	78	153.250
13	171.250	46	141.250	79	153.625
14	172.000	47	141.625	80	154.000
15	172.750	48	142.000	81	154.375
16	173.500	49	142.375	82	154.750
17	162.625	50	142.750	83	155.125
18	163.375	51	143.125	84	155.500
19	164.125	52	143.500	85	155.875
20	164.875	53	143.875	86	156.250
21	165.625	54	144.250	87	156.625
22	166.375	55	144.625	88	157.000
23	167.125	56	145.000	89	157.375
24	167.875	57	145.375	90	157.750
25	168.625	58	145.750	91	158.125
26	169.375	59	146.125	92	158.500
27	170.125	60	146.500	93	158.875
28	170.875	61	146.875	94	159.250
29	171.625	62	147.250	95	159.625
30	172.375	63	147.625	96	160.000
31	173.125	64	148.000	97	160.375
32	136.000	65	148.375	98	160.750
33	136.375	66	148.750	99	161.125

RF Channel Allocation Notes:

1. The AN/SSQ-41B, -53, -53A, -57A, -57B, -62, -62A, and -62B transmit on RF channels 1 - 31.

2. The AN/SSQ-110 is assigned RF channels 1 - 31 (fixed) but transmits acknowledgments on RF channels 11, 20 and 30. See Table 110-3 for AN/SSQ-110 RF plan.

3. The AN/SSQ-36 transmits on RF channels 12, 14, and 16. The AN/SSQ-36B has a selectable 99-channel transmitter.

4. The AN/SSQ-53B, -53D, -53E, -53F, -57C, -77A, -77CZ, -77B, and -110A transmit with a selectable 99-channel transmitter. See applicable technical data section for inoperative channels.

5. The AN/SSQ-86 has no RF transmitter.

6. The AN/SSQ-47B transmits on RF channels 1 - 12.

7. The AN/SSQ-62C and AN/SSQ-62D transmit on 86 of the available 99 RF channels. Unused RF channels are: 6, 15, 18, 34, 40, 50, 53, 57, 58, 59, 69, 72, and 93. Sonic channel A has 21 RF channels assigned, sonic channel B has 20 RF channels, sonic channel C has 23 RF channels, and sonic channel D has 22 RF channels.

8. The AN/SSQ-62E transmits on 96 of the available 99 RF channels. Unused RF channels are: 57, 58, and 93. Sonic channel A , B, C, and D default to the appropriate RF channel when selected with EFS but can be changed *without regard to RF channel* using CFS.

9. The AN/SSQ-71 transmits on RF channels 3, 5, and 7.

10. By specification, sonobuoy RF transmitter frequency stability must be within $\pm$25 KHz of center frequency.

11. The UHF/DF frequency for a sonobuoy is twice the sonobuoy radio frequency (RF). For example, RF channel one frequency is 162.25 MHz; its corresponding UHF/DF frequency is 324.5 MHz (162.25 MHz X 2 = 324.5 MHz).

12. SSQ-101 has 47 channels (RF 1 to 16 & 32 – 99 even except 56, 58 & 60), EFS selectable, digital uplink (FSK).

10.9 Beaufort Sea State Scale

BEAU-FORT No.	WIND SPEED KNOTS - MPH		SEAMAN'S TERMS	U.S. WEATHER BUREAU TERM	OBSERVED EFFECTS AT SEA
0	<1	<1	CALM	LIGHT	SEA LIKE MIRROR
1	1-3	1-3	LIGHT AIR	LIGHT	RIPPLES
2	4-6	4-7	LIGHT BREEZE	LIGHT	SMALL WAVELETS, NOT BREAKING
3	7-10	8-12	GENTLE BREEZE	GENTLE	LARGE WAVELETS, BEGINNING TO BREAK, SCATTERED WHITECAPS
4	11-16	13-18	MODERATE BREEZE	MODERATE	SMALL WAVES, NUMEROUS WHITECAPS
5	17-21	19-24	FRESH BREEZE	FRESH	MODERATE WAVES, MANY WHITECAPS, SOME SPRAY
6	22-27	25-31	STRONG BREEZE	STRONG	LARGER WAVES (5'-6'), WHITECAPS EVERYWHERE, MORE SPRAY
7	28-33	32-38	MODERATE GALE	STRONG	SEA HEAPS UP, WHITE FOAM BEGINS TO BLOWN IN STREAKS
8	34-40	39-46	FRESH GALE	GALE	MODERATELY HIGH WAVES (8'-12'), EDGES OF CRESTS BEGIN TO BREAK INTO SPINDRIFT, FOAM BLOWN IN WELL MARKED STREAKS
9	41-47	47-54	STRONG GALE	GALE	HIGH WAVES (12'-20'), SEA BEGINS TO ROLL, DENSE STREAKS OF FOAM
10	48-55	55-63	WHOLE GALE	WHOLE GALE	VERY HIGH WAVES (20'-40'), OVERHANGING CRESTS, SEA TAKES WHITE APPEARANCE FROM FOAM, HEAVY ROLLING
11	56-63	64-72	STORM	WHOLE GALE	EXCEPTIONALLY HIGH WAVES (40'+), SEA COVERED WITH FOAM PATCHES, LOW VISIBILITY
12	64-71	73-82	HURRICANE	HURRICANE	WAVES >45', AIR FILLED WITH FOAM, COMPLETELY WHITE WITH DRIVING SPRAY, CONFUSED
13	72-80	83-92	HURRICANE	HURRICANE	" " " "
14	81-89	93-103	" " " "	" " " "	" " " "
15	90-99	104-114	" " " "	" " " "	" " " "
16	100-108	115-125	" " " "	" " " "	" " " "
17	109-118	126-136	" " " "	" " " "	" " " "

11.0 Initial Distribution List

1.	Defense Technical Information Center 8725 John J. Kingman Rd., STE 0944 Ft. Belvoir, VA 22060-6218	2
2.	Dudley Knox Library, Code 013 Naval Postgraduate School Monterey, CA 93943-5100	2
3.	Research Office, Code 09 Naval Postgraduate School Monterey, CA 93943-5138	1
4.	CDR John Joseph, Code OC Naval Postgraduate School Monterey, CA 93943	1
5.	Chris Miller, Code OC Naval Postgraduate School Monterey, CA 93943	1