Sonobuoys

PIFSC/SWFSC

HICEAS 2017

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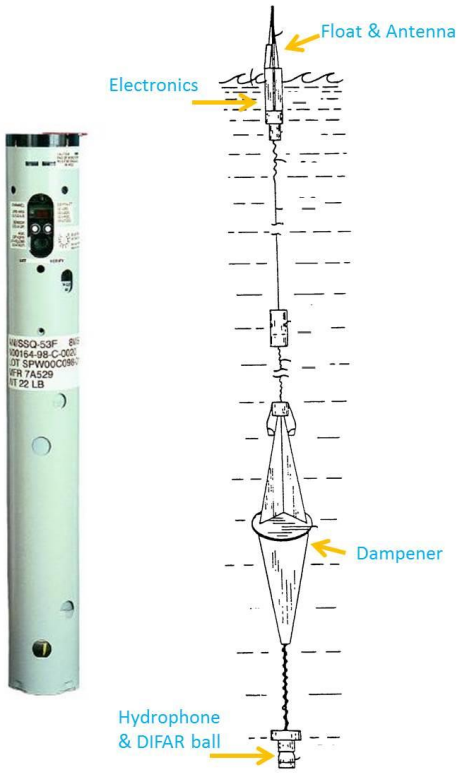
Background Info

Introduction to Our Friend, the Sonobuoy

Sonobuoys are disposable hydrophone units surplused by the Navy, and we manage to scrounge up a few to be used in certain situations. The beneficial aspect of the sonobuoys is that since they are disposable, we can deploy them near a sighting and then leave the area, so that the recordings are less likely to be masked by ship noise. This is especially important with lower frequency vocalizations, such as those from baleen whales. They are also free, that's a good thing. However, the surplused buoys are usually past their prime, and there is a high failure rate, usually due to dead batteries (which are housed within the sonobuoy unit). We will use sonobuoys for evening **sonobuoy stations** (data will be used to estimate call density) and during **opportunistic sonobuoy** deployments associated with baleen whale sightings.



Anatomy of a Sonobuoy

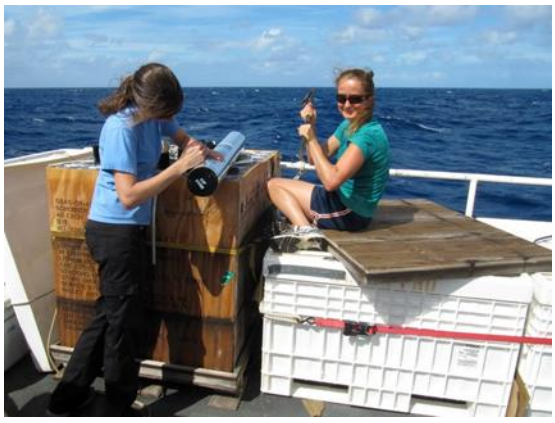
The sonobuoy itself consists of a metal housing, often within a plastic case. Within this housing is a battery, the hydrophone, a float, and an antenna (and some cables). When the buoy is deployed, these separate out and look like the picture (above). The hydrophone hears (duh), sends the info up the wires, and the antenna sends out the information on radio frequency. We then receive this information on the ships antenna on the same radio frequency.

There are several types of sonobuoys, but they all have the same basic parts. During this survey we will be working with 53F or rebuilt (and re-chargeable) and possibly some ancient variety (TBD?!?!).

The 53F sonobuoys have three sensor modes, CSO, CO, and DIFAR. For the most part, we will work with in DIFAR mode to allow for localization of baleen whale vocalizations. If 53F sonobuoys are used on other species, they can be used in CO mode to allow for detection of frequencies up to 20 kHz. Within these DIFAR buoys there is a magnetic compass, and information regarding the direction of the various sounds is relayed up the wires and also sent out on the radio frequency. This "DIFAR" signal is the annoying 7.5 kHz and 15 kHz tonal sound. These buoys are especially important if we need to tell the direction of a vocalizing whale, for example, if we need to positively match a biopsied whale to a vocalization to understand the gender of the vocalizing whale. We can also select the transmission channel (which is the VHF frequency we will send/receive on our Winradio receivers), the Life (how long before the sonobuoy scuttles, or sinks to the bottom of the ocean), the Depth (how deep the hydrophones are deployed to), the Sensor (CSO, CO, or DIFAR), and the AGC Level (Automatic Gain Control: On/Off). The AGC continuously varies the gain according to the current conditions.

Sonobuoy Preparation

You will want to make sure that the sonobuoys are prepped and ready to go before you need them. To make life a little easier, put a tape label on them with the programmed settings. This label can then be transferred to the greenbook to make sure we get that info in correctly (I have tossed buoys and forgotten to see what frequency they were at, that sucks). Channel usage will be different for opportunistic vs. station buoys—and you will want 3 buoys prepped for each of these methods at any given time (that is a total of 6 buoys prepped at any time!).



When you prep the buoy, you want to take it out of the plastic case and cut off any excess garbage. First you will take off the tabs on the lid, then the lid. Take out the buoy and cut off the "L-shaped" plastic doo-hickey and the parachute. To increase the likelihood of the buoys working well, we need to take off the plastic cap on top. Usually you will need to pry off a flat bar (using a screwdriver) and then break off a plastic bar (good luck). Once that cap is removed,

take off any accessory plastic to save a few more fishies, but be careful to not cut the antennae float. The sonobuoys have better success in deployment with the parachutes in place.
The settings for the 53F sonobuoys include: Sensor, Depth, Channel, AGC Level. Three of these settings will be standardized and only changed for specific situations; only the channel will vary for most situations. All prepped buoys should have the following settings for:

- Channel (see table below)
- Sensor: DIFAR
- AGC Level: OFF
- Depth: 90ft

Buoy Type	Sonobuoy #	Sonobuoy Channel	WinRadio Channel	FireFace Channel	Pamguard Channel
Station	1	62	1	1	0
Station	2	64	2	2	1
Station	3	54	TBD	TBD	TBD
Opportunistic	1	56	1	1	0
Opportunistic	2	60	2	2	1
Opportunistic	3	54	TBD	TBD	TBD

** TBD = To Be Determined; backup sonobuoy will use the WinRadio/ FireFace/Pamguard channel of the buoy it is replacing.*

When choosing a transmitting frequency, there are several factors to take into consideration. First, there are many channels that cannot be used in the EEZ (within two hundred miles) of any country (Ch 1, 5, 12, 17, 19, and 25). Also, for many buoys, selection of Ch 58 is not an option. Also, each ship has a range of frequencies that are optimal for their antenna system. The HICEAS antenna has a peak reception at 144-148 MHz (which correspond to channel 53-64). . Another factor to take into consideration is if other buoys were tossed nearby. You want to make sure that you receive from a "clean" frequency, with minimal interference. Therefore, if you will be using two sonobuoys in a sighting, or on sightings near each other (w/in 10 nm or so), then you will want to choose transmitting frequencies that differ by at least 2 channels. For your prepped sonobuoys, choose different frequencies over the optimal frequency range. The channels selected in the above table were done so to make life simpler, but you may need to vary from the channels outlined in this specific table.

After the buoy is prepped, label the information on the tape and put it on the lid. Prior to deployment, you will view the settings to make sure they match the settings on the tape, then remove the tape and put it in the greenbook for that deployment.

Deployment

We have a limited number of sonobuoys and we expect to deploy two sonobuoys per evening station in addition to opportunistic sonobuoys during sightings of baleen whales. Sonobuoys will ALWAYS be deployed from the stern, unless there is good reason to do otherwise (in that case, note it in the Pamguard notes!).

All shipboard communications should use handheld radios during sonobuoy deployment, at least for the 1 hour station, but preferably whenever a sonobuoy is deployed and there is not an absolute need for using the mounted radios (which interfere with sonobuoy reception). It is critical that the deployment button in Pamguard is hit as closely as possible to the time of the deployment—errors increase rapidly as the vessel is moving!

Deployment of the Sonobuoy

You will want to take a radio with you when you deploy the sonobuoy for communication. Ask the flying bridge when the best time is to throw the buoy (closest approach to the animal, if possible). You will also want to ask permission from the bridge to throw it overboard, and ask the flying bridge to mark the location in WinCruz. Watch the sonobuoy until the antennae pops up, then return to the acoustics lab. If there is a good signal, let the flying bridge know and monitor the sonobuoy. If there is no signal and you suspect that it was a bad sonobuoy, prepare to toss another buoy (and let the flying bridge and bridge know your intentions).

Good Buoy/ Bad Buoy

Maybe the most difficult part to get the swing of is determining if the buoy was good or bad. First, you want to know if the float popped up. It usually happens within 30 seconds, but sometimes this takes up to five minutes. Second, when you get in the lab, check the reception on the receivers. Are all the bars lit to show full reception? If Yes, GOOD! Are there good bars on the TotalMix Mixer? If Yes, GOOD! Finally, check that you have good reception on Pamguard? If Yes, GOOD!

If the answer to one or more of these is ‘NO’, it’s time to troubleshoot.

- Listen on the headphones—do you hear ship noise? DIFAR signal (high pitched tone)?
- Check the spectrogram
- Go over the TroubleShooting Guide (at the end of this document)

If your buoy is good, then you are set and you can move on to the monitoring part. If the buoy appears to be bad, then decide if you want to throw another buoy. If it is a very high priority sighting in great conditions, then toss another buoy (make sure it is a different channel!). If it is so-so conditions, you are low on buoys, or you have left the location or lost the whale, then you may want to blow this one off.

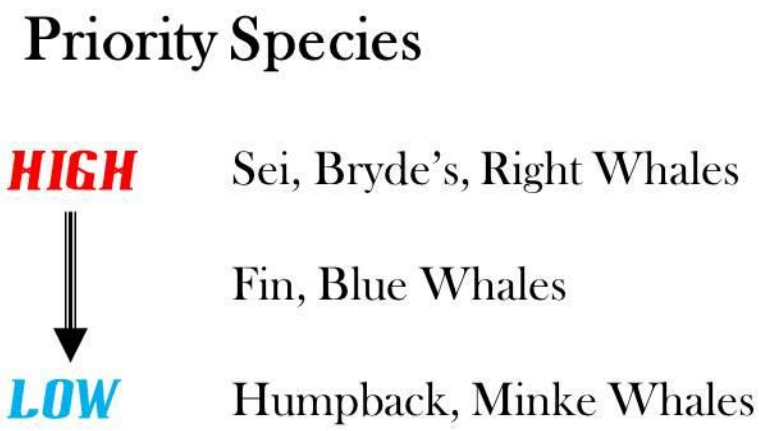
If you do decide to toss a second buoy, it should be a different channel (two channels away from the first buoy), and you will want to initially set each receiver to a different channel. Sometimes you will get the first buoy a little bit later, so you want to be ready.

Opportunistic Deployments on Sightings

Opportunistic deployment of sonobuoys on sighted baleen whales provides us with fundamental information on the vocal repertoire and behavior of these species. These provide the foundation for larger studies involving density estimation and stock assessment.

Unfortunately, we do not have sufficient sonobuoys to deploy on all sightings of baleen whales. We have therefore developed priorities for sonobuoy deployment to ensure that we have sufficient sonobuoys for the entire cruise. These priorities may be revisited later in the cruise if there are enough remaining sonobuoys to relax some of the restrictions.

It is difficult to choose when to toss a sonobuoy, there are conflicting factors involved. You will need to think about the priority of this species, the group size, time available for operations, the number of sonobuoys you have, and how far into the cruise you are.



We will *always* want to deploy sonobuoys on priority species sightings of 1-2 animals that will be approached for biopsy operations if there are no other baleen whale species in the area and the animals are not traveling fast. If the animal is traveling too quickly, both the animal and the ship will leave the area of the sonobuoy rather quickly. If it is a large group of animals, we cannot use the DIFAR to determine which animal is calling. Deployment of sonobuoys on a large group that is single-species is preferred over a mixed-species group.

Do **not** deploy a sonobuoy on fast-traveling animals or if we will not approach the animals.

After you decide "if" you will toss a buoy, then you need to decide when to toss the buoy. If you toss a buoy at the beginning of the "chase", you will have a longer time to record, but there is a good chance that the whale will move away from the sonobuoy and that ship noise will interfere with recordings. However, if you wait too long, you may miss your chance entirely, or you may only have a very brief time to make any recordings at all. With the exception of fast-moving

animals, I have generally found that it is better to deploy the buoy at the beginning of the operations. Be sure to give enough time to ensure the species identification and that there will be attempts at biopsy (I find its best to camp out on the flying bridge while making this decision—then you will know what their plan is).

Before you head out to toss the sonobuoy, you will want to double-check the lab equipment and make sure everything is hooked up properly. Request permission to deploy the sonobuoy, and then let her go!

The value is DIFAR sonobuoys is the ability to localize calling animals, but the quality of this localization can vary depending on the situation. For example, if the ship, whale, and buoy are all in a straight line—then it is difficult (or impossible) to differentiate the bearing angles from the ship and whale. It is best if the ship and whale are at different angles from the sonobuoy (see figure below). Also, if the buoy is too close to the whale- the bearing angles may not be informative (for example, once we had the whale swimming around the buoy—so the angles were meaningless!).

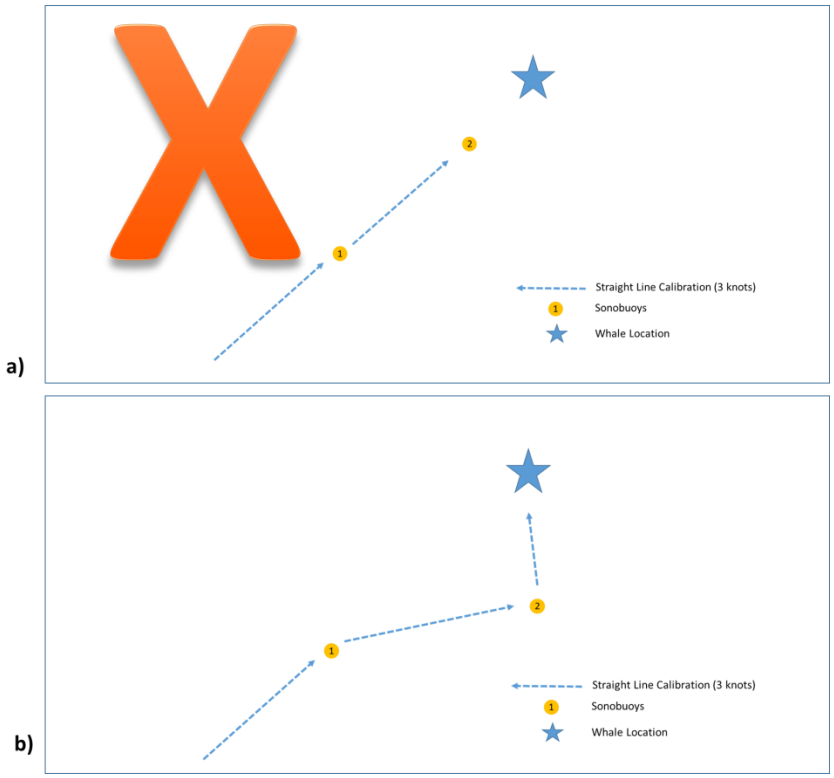


Figure. Sonobuoy deployment configuration options for opportunistic sonobuoys. A sub-optimal configuration (1a) where the buoys, vessel, and whale are in a line limits localization options. A preferred configuration will provide significantly different DIFAR bearing angles from each buoy to the whale (1b).

Real-time calibration will begin shortly after deployment for each sonobuoy (see detailed instructions). If variation in bearing angles varies by > 20 degrees while the vessel is traveling on a straight course, then the buoy will be considered to be poor quality. If time/opportunity allows, the third (backup) sonobuoy will be deployed in the location of the poor quality buoy. In this case, the straight line calibration must be completed in full.

Also, we will want as many resights as possible entered into the computer. Ask the flying bridge observers to enter in as many resights on the animals as they are able to—these will save automatically into Pamguard (on the Array—but these datasets will be merged). Alternatively, write down as much information on location of the ship and whales relative to the sonobuoy as you are able to within the Pamguard comments (on the Sonobuoy computer). Continue recording until sonobuoy reception is lost on all sonobuoys. If you are still in the area—you can continue recording if you think there may be an opportunity to regain sonobuoy reception.

Sonobuoy Stations

We will have evening sonobuoy stations for a minimum of 1 hour most evenings (see schedule at end of this section). These stations will consist of two sonobuoys recorded for a minimum of 1 hour while the ship is stationary. There is a very specific pattern for deployment/calibration that must be followed for each station. Details of station preferences are outlined below.

To ensure that calibration is completed before the CTD station, it is imperative that the sonobuoy protocol begin as soon as possible after cessation of daytime effort. All sonobuoys should be deployed at the same location on the vessel (preferably the stern). Deploy Sonobuoy #1; using handheld radios, the bridge and acoustics lab will be notified at the exact moment the sonobuoy is deployed.

Acoustician in lab will immediately hit the ‘DEPLOY’ button in the DIFAR interface in Pamguard. Continue in a straight line at the same speed (Fig. 1, blue line). Sonobuoy #2 will be deployed 2 km (~ 1nmi) from the location of the first sonobuoy. The bridge should provide a countdown to deploy Sonobuoy #2, confirmation of deployment should be made immediately when the sonobuoy is deployed. Acoustician in lab will immediately hit the ‘DEPLOY’ button in the DIFAR interface in Pamguard. After deployment, the vessel will be maneuvered to allow for calibration. There will be two components to calibration: straight line calibration (for individual buoy variation and magnetic deviation) and drift calibration (requires calibration over multiple angles).

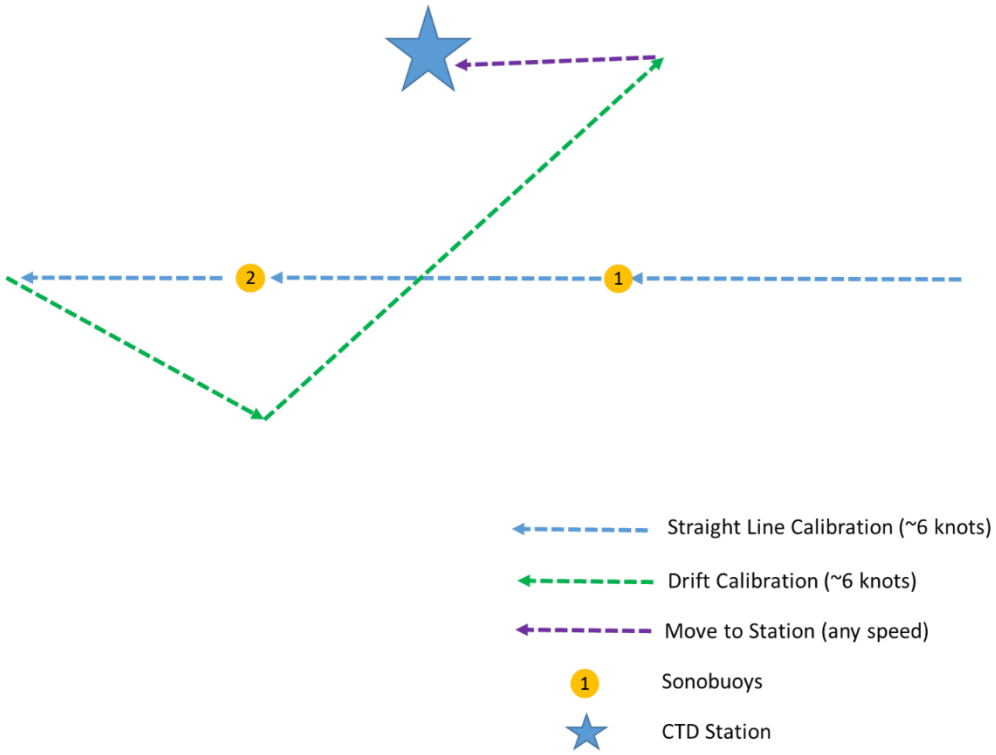


Figure. Deployment and Calibration of Sonobuoy Stations. Calibration is subdivided into two categories: straight line calibration @ 6 knots (blue line) and Angular Calibration @ 6 knots (green line). The vessel will then transit to the CTD Station location (purple line).

***Straight Line Calibration*:** Real-time calibration will begin shortly after deployment for each sonobuoy (see detailed instructions). If variation in bearing angles varies by > 20 degrees while the vessel is traveling on a straight course, then the buoy will be considered to be poor quality. If time/opportunity allows, the third (backup) sonobuoy will be deployed in the location of the poor quality buoy. In this case, the straight line calibration must be completed in full.

***Drift Calibration*:** After completing the straight line calibration (minimum 0.5nmi beyond Sonobuoy #2), turn the ship ~140° to begin the drift calibration (Fig. 1, green line). Continue for ~ 10 minutes until the vessel has passed below the location of sonobuoy#2. At this point, turn the vessel ~80° so that the vessel will then transit BETWEEN the two sonobuoys (at an angle).

> *This may be modified after initial tests. It is critical that ship noise is clearly detected for the calibrations. If necessary, adjustments can be made to increase vessel noise or increase the time in which vessel noise is detected (change speed, course). If vessel noise is limited, acousticians should discuss with the ship officers if there are ways in which they can increase vessel noise during the calibrations. This will be especially critical for the Lasker and may require specific tests at the beginning of the survey.*

Once the final Angular Calibration line is completed, the acousticians will notify the bridge that they may position the vessel for CTD Operations. Ideally, this will be at a location such as that outlined in the figure. The station will be at a distance from the sonobuoys such that it is ~ equidistant to each sonobuoy, but at a distance where there is little ship noise interference (not too close) but where reception levels for the sonobuoys are high (not too far). The vessel will ideally remain in this area for as long as possible (minimum 1 hour, ideally 3+ hours).

***Final Drift Calibration (optional)*:** If possible, **o**nce the vessel is ready to depart the station, they should first transit in a straight line (at full speed) towards and across the sonobuoy axis (Fig. 2, Orange Line). This will provide additional information to inform the drift calculation. Acoustician will continue recording until sonobuoy reception is completely lost, but real-time monitoring is not necessary.

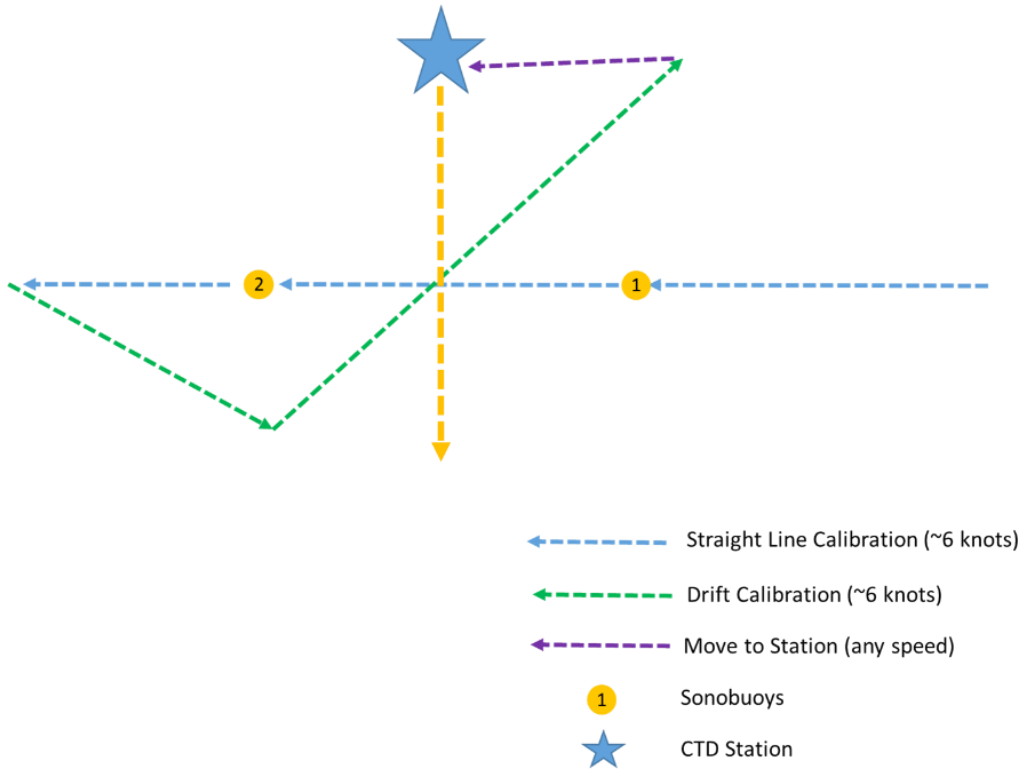


Figure. Termination of Sonobuoy Station. Prior to termination of sonobuoy station, vessel will transit towards and across the 'sonobuoy axis' (line connecting the two sonobuoys) at a speed determined by the bridge. This will provide a final calibration to inform the drift estimate.

Sonobuoy Station Schedules

Deploy sonobuoys on the dates listed below during the evening CTD station. See Sonobuoy protocols for deployment details. If you skip the CTD for whatever reason, skip the sonobuoy as well.

R/V Sette

Leg 1- 7/7, 7/10, 7/11, 7/12, 7/13, 7/14, 7/15, 7/16, 7/18, 7/19, 7/20, 7,21, 7/22, 7/23, 7/24, 7/26, 7/27, 7/30, 7/31, 8/1

Leg 2- 8/10, 8/11, 8/12,8/13, 8/14, 8/15, 8/16, 8/17, 8/18, 8/21, 8/22, 8/23, 8/24, 8/25, 8/27, 8/28, 8/29, 8/31, 9/1, 9/2, 9/4

Leg 3- 9/12, 9/13, 9/14, 9/15, 9/16, 9/17, 9/18, 9/20, 9/22, 9/23, 9/24, 9/25, 9/27, 9/28, 9/30, 10/1, 10/2, 10/3, 10/5, 10/6, 10/7, 10/8

R/V Lasker

There are no sonobuoy stations during transits to/from the west coast.

Leg 1- 8/26, 8/27, 8/29, 8/30, 8/31, 9/1, 9/2, 9/3

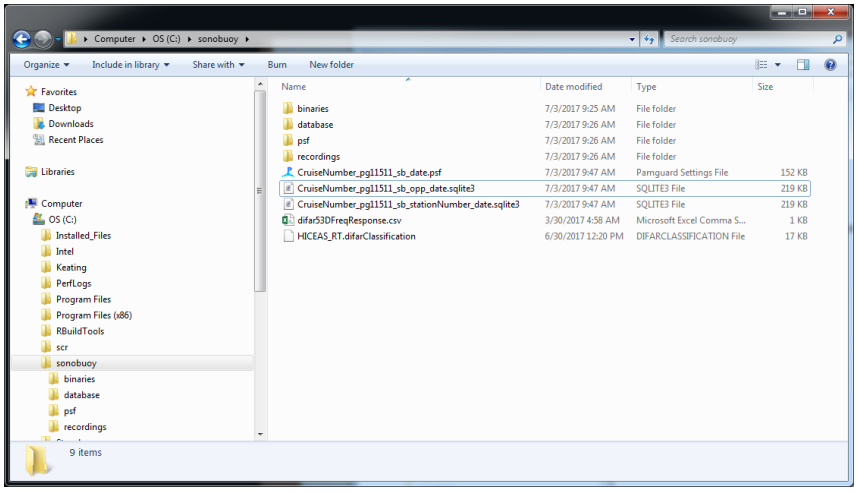
Leg 2- 9/12, 9/13, 9/14, 9/16, 9/17, 9/18, 9/19, 9/20, 9/21, 9/22, 9/23, 9/24, 9/25, 9/27, 9/28, 9/30, 10/1, 10/2, 10/3, 10/4, 10/7

Leg 3- 10/17, 10/18, 10/19, 10/20, 10/21, 10/22, 10/23, 10/25, 10/26, 10/27, 10/28, 10/29, 10/30, 10/31, 11/1, 11/2, 11/4, 11/6, 11/7, 11/8

Leg 4 - 11/18, 11/21, 11/22, 11/23, 11/24, 11/25, 11/26, 11/27, 11/28, 11/29, 11/30

Data Collection

Data should be prepared first thing in the morning (or last thing at night), so that you are ready for sonobuoys first thing in the morning. The sonobuoy folder should be saved in the c: root directory, with the following file structure:



At the end of the day (or first thing in the morning), the files from the previous day should be backed up. There will be two databases, one for opportunistic recordings (CruiseNumber_pg11511_sb_opp_date.sqlite3) and one for each individual station (CruiseNumber_pg11511_sb_stationNumber_date.sqlite3). Every day, the station database is MOVED to the database folder and the opportunistic database is COPIED.

Once data is copied, then create a NEW station database for the next station. Ensure that this database has the Lookup and UDF_Deploy tables in it. You will continue to add opportunistic sonobuoy deployments to the opportunistic database—the copied database is just provided as a backup (just in case!). Next, copy the psf to the psf folder w/ a date added to the name. Again, this is only for a backup, just in case something changes, we can identify when the change was made.

Once you have completed creating the files for the new day and backing up the old data, you can then turn open the WinRadio and Fireface to ensure that you are receiving signals and that the channels are appropriately set. You will be all ready for when its time for a sonobuoy.

Ensure that Pamguard has the sonobuoy options set in the Hydrophone Streamers. Note that there can be up to 2 sonobuoys (Channels 0, 1). When you hit ‘deploy’, you can choose to update either streamer (sonobuoy). If this is an opportunistic sonobuoy, select a name according to the sonobuoy # (increases incrementally for each ship independently). If this is a station—the station # will be embedded in the filename, and each sonobuoy is labeled as the radio frequency (channel) it is using.

Note: You do NOT need to keep Pamguard running the entire time (it's a lot of GPS storage), but when you expect to deploy a sonobuoy—turn it on immediately! Once you turn on Pamguard, ensure that you are receiving sound on each channel, and that they are appropriately aligned. Double check that all of your data is being saved to the correct location (recordings, binaries, database). Once everything is set—you are ready for deployment!

Data Collection During Deployment:

1. Record: Record PRIOR to deployment of sonobuoy. Check that files are being saved (increasing in file size).
2. Hit Deploy Button in DIFAR table when sonobuoys are deployed. Name them by their radio frequency channel. If it is an opportunistic sonobuoy, name the deployment according to the sonobuoy # (incrementally increases), if this is a sonobuoy station, put in the radio frequency #.
3. Logger Deploy Form- Enter in metadata associated with the deployment (which can consist of one or more sonobuoys).
4. DIFAR Calibration- Ensure that course for calibration is followed; if opportunity allows, conduct real-time DIFAR calibration.

Record all channels at 48kHz sample rate. It is helpful to start the recordings prior to deployment (sometimes a buoy will die upon deployment, and this recording can help identify this situation). Record until reception is lost on *all* buoys. Be sure to note which sonobuoy is recorded on which channel. This is absolutely critical. Double-check the folder to ensure that the recordings are being saved to file.

Logger forms should be completed for EACH deployment (which can consist of one or more sonobuoys). Comments should be made in Pamguard, which allows for a GPS stamp. Any additional information from the observers regarding the animal's location, behavior, or other species/animals in the area is also helpful. Remember that the person analyzing this data will have no idea of the situation in which the recordings were made, so any information is helpful!! Add any information regarding the position of the whale and sonobuoy in relation to each other and in relation to the ship. Note any behavior. Record the reception strength the time when the signal starts to fade.

RT Calibration of Vessel Noise in the DIFAR module in Pamguard may occur if it does not interfere with basic recording and monitoring. Ensure that the vessel calibration is tuned to the noise emitted by the vessel.

Ideally, the sonobuoys will be preset and ready to go, with a strip of labeled tape on the plastic canister. Pick the best buoy, toss it, and stick the tape in the green book.

Troubleshooting

The receivers show reception, but I can't hear the sonobuoy!

- Check the volume for the headphones, is the headphone setting correctly set?
- Check the wires from the receivers into the Fireface, and from the Fireface to the computer and headphones… are they setup correctly?
- Is the Computer recording? Turn up the recording volume on the Fireface. Do you hear anything now?
- Can you hear the DIFAR signal (high pitched annoying tone at 7.5 kHz and 15 kHz)? This is the easiest way to identify a 'good' signal.

Signal fades too quickly.

- How far is the ship from the buoy? Ask if the ship can stay w/in 1nmi of the buoy.

No Reception on Receivers

- Did you put in the correct channel? Slowly scan all the channels and see if you get reception elsewhere.
- Did the sonobuoy pop up? Maybe it was a bad one. Give it 5-15 minutes, ask if anyone saw the float pop up.
- Do the "channels" on the Winradio receivers match the frequencies they are supposed to (check the chart)?

I sometimes hear loud interference

- Does it coincide with radio communication? If so, ask the observers and bridge to minimize radio communication, and ask the bridge to switch to handheld radios, if possible.
- Is the sonobuoy far away? As the signal gets weaker, it takes less and less to "interfere" with the signal. You may need to move closer to the buoy.

Everything was fine for a while, then the sound from the buoy turned to bad noise

- Check the Winradio receivers… are you still getting reception? If no, then there is a good chance your buoy died a sudden death. Still hang out for a while, they have been known to come back from the "dead".
- If you still have what appears to be "good" reception on the receivers, then reset the spectrogram to look at the full frequency range. Do you see the DIFAR signals? Do you see the roll off on the ship noise? Does it look "good" to you????

I don't have a visual display on the computer

- Is the wiring hooked up correctly, with all the connections firmly in place?
- Are all the channels of the Winradio receiving good levels of input? If no, increase the recording level as necessary. If yes, then check the output to the computer (headphone jack), do you need to increase the volume?
- Check the computer settings: first look at the full spectrogram (up to 20 kHz) to see if you can see the DIFAR signals, if applicable (7.5 kHz and 15 kHz), and the roll off of the ship noise. If not, then recheck your wiring. If yes, then when you switch back to viewing for vocalizations, recheck your parameters, and maybe increase the volume.
- Give the computer a re-boot if it is acting up. Talk nicely to it.

Sonobuoy Deployment: *the short version*

2. **To Buoy or not to Buoy?** Is it a priority species? Is it a smaller group size? Are the animals traveling fast? Will there be a biopsy? Is there sufficient time for recording? Determine the best location to deploy (beginning of sighting? Closest point of approach?)
3. **Check receiver/recorder connections:** Are all the connections in place? Start the computer spectrogram program. Are the receivers on and tuned to the correct channels? Is Pamguard up and running and ready to go? Is Pamguard reading the correct database? Is it saving binaries/recordings to the correct location?
4. **Prep Sonobuoy Notes**: Enter in the initial information into the Logger form. Tape the sonobuoy settings into the notes.
5. **Buoy Deployment**: Recheck the settings on the buoy, ask permission to toss the buoy, and throw that bad boy over. Wait to see if the float pops up. Ask the bridge/flying bridge to use hand-held radios and to minimize communication.
    a. **Opportunistic**: Deploy ID is the buoy # (increases incrementally for each ship)
    b. **Station**: Deploy ID is the radio frequency (channel)
6. **Check Buoy**:
    a. Check the receiver: are you getting reception?
    b. Check the recording: do you have a reasonable level? Is it set to 'continuous' recording?
    c. Listen to the recording: do you hear ship noise? Do you hear the DIFAR?
    d. Check the spectrogram: do you see ship noise? Do you see the DIFAR?

At this point, double-check that you are actually recording, and that the "pause" is not on!

7. **Monitor and Notes**:
    a. Perform Calibration (if applicable)
    b. Add notes re: visual updates (if applicable)
    c. Continue recording as long as sonobuoy is viable.

8. Death of a Sonobuoy
    a. Is the reception on the receivers dropping to low level?
    b. Is radio communication interfering with reception?
    c. Can you hear static rather than ship noise?
    d. Is there too much static on the spectrogram to see vocalizations?

IF SO, THEN YOUR BUOY IS DYING!!!!

⇒ IF YOU NEED MORE TIME: ask to return to the buoy, stay approx 1nmi away from the buoy for good reception and low ship noise

⇒ IF IT IS NOT WORTH IT: then keep recording for the helluvit, and but go and enjoy the day

53F Specifications

SonobuoyTech Systems

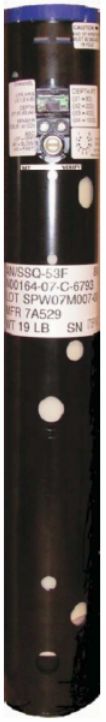
AN/SSQ-53F DIFAR Sonobuoy

Passive Directional

The AN/SSQ-53F is a NATO A-size sonobuoy manufactured for the U.S. Navy which combines a passive directional and calibrated wide band omni capability into a single multi-functional sonobuoy. This advanced sonobuoy combines the capabilities of both the AN/SSQ-53D and AN/SSQ-57 sonobuoys.

The Q-53F can operate in three available acoustic sensor modes that are selectable via EFS or CFS. A Constant Shallow Omni (CSO) provides acoustic information at a fixed depth of 45 ft (13.7 m) while a Calibrated Omni (CO) co-located with a DIFAR sensor provides acoustic information at a selectable operational depth. The buoy amplifies the underwater acoustics and provides directional data necessary to establish bearing to the source of the acoustic energy.

This sonobuoy features both Electronic Function Select (EFS) for use prior to loading and launching, and Command Function Select (CFS) to allow the operator to modify the sonobuoy's mode of operation after it has been deployed in the water. These functions allow the operator to select operating mode (sensor selection), buoy life, depth setting, AGC level and RF channel.



- Acoustic Sensor Selection
  - *CSO, CO, or DIFAR*
- EFS Selectable
  - *RF Channel, Life, Depth, Sensor, AGC level*
- CFS Commandable
  - *RF Channel, Life, Sensor, AGC Level*
- 1 Watt 96-channel RF transmitter
- Factory configurable to AN/SSQ-53D standard
  - *Single Sensor (DIFAR)*
  - *3 Depths (90 ft, 400 ft, 1000 ft)*
  - *No CFS*

Sonobuoy Tech Systems supplies U.S.-specified sonobuoy products and support to the international market.
Phone: 260.248.3503 • Fax: 260.248.3510 • Website: www.sonobuoytechsystems.com

SonobuoyTech Systems

SPECIFICATIONS

NSN 5845-01-475-9870

PHYSICAL CHARACTERISTICS

Weight	8.6 kg (19 lbs)
Sonobuoy Launch Container	LAU-126/A

PERFORMANCE DATA

RF Command Receiver	UHF – single channel
RF Transmitter Power Output	1 W minimum
RF Transmitter Operating Frequency	96 Channel Selectable (136.000 to 173.500 MHz)
Sensors/Audio Frequencies	CSO (30 to 5000 Hz) CO (5 to 20 kHz) DIFAR (5 to 2400 Hz)
Operating Life	0.5, 1.0, 2.0, 4.0, or 8.0 hours
Operating Depth	d1: 27 meters (90 ft) d2: 61 meters (200 ft) d3: 122 meters (400 ft) d4: 305 meters (1000 ft)
EFS selections	RF, Life, Depth, Sensor, and AGC
CFS selections	RF, Life, Sensor, and AGC
Launch Altitude	12 to 9144 meters (40 to 30000 ft)
Launch Speed	0 to 370 KIAS
Shelf Life	5 years in sealed container

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Sonobuoy Tech Systems, is a joint venture between Undersea Sensor Systems Incorporated and Sparton Electronics Florida, Inc.