

Biological and Behavioral Response Studies of Marine Mammals in Southern California, 2010 ("SOCAL-10")

FINAL TEST PLAN - 25 June 2010



Applied Physical Sciences



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an Organized Research Unit
at UC Santa Cruz



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1. GENERAL OVERVIEW, OBJECTIVES, CONFIGURATION, and TEAMS

1.1. OVERVIEW/BACKGROUND

SOCAL-10 is the first phase of a multi-year effort (2010-2015), more generally referred to as “SOCAL-BRS” (Behavioral Response Study), which is designed to contribute to emerging understanding of marine mammal behavior and changes in behavior as a function of sound exposure for various species. It is, in some ways, an extension of previous BRS efforts in the Bahamas and Mediterranean Sea in 2007-2009¹. However, it is being strategically integrated with several related, ongoing, successful field efforts in southern California, including population surveys of Navy range areas and satellite tagging efforts before active sonar operations.

SOCAL-10 is also part of an integrated, international, comprehensive effort to measure impacts using opportunistic observational methods, satellite tagging prior to real exercises, and controlled exposure (CEE) studies (as is being done here). Each of these approaches has demonstrated advantages and disadvantages in terms of sample size and the type and detail of resulting data. What is emerging as the most logical means of understanding the underlying issues is an integrated strategy of both experimental and opportunistic/observational methods. SOCAL-10 extends existing collaborations among scientists from the U.S. National Oceanic and Atmospheric Administration (NOAA); U.S. Navy sponsors, researchers, and operational personnel; and academic and private sector researchers and engineers. It extends these previous efforts by these diverse interests to understand and thereby better manage the potential negative effects of sounds, including simulated and eventually operational military sonar sounds, on a wider variety of marine mammal species than have previously been studied.

Previous BRS efforts in the Bahamas and Mediterranean Sea have included large and very expensive teams and platforms and have had a corresponding lack of flexibility to changing environmental and biological conditions. At the outset of a five-year research program, SOCAL-10 is attempting to contrast several different operational modes in terms of sound source vessels, each with much smaller scientific parties than previous efforts. SOCAL-10 will use both a conventional oceanographic research platform more similar to previous BRS efforts (bigger and slower), as well as a “fast/light” option that has greater operational flexibility, but with some limitations. In each case, visual monitoring teams will be in place on the source vessel, but the small tagging vessels (rigid hull inflatable boats, or RHIBs) will generally lead the efforts to locate and tag focal marine mammals and may operate well away from the source vessel; this is a significantly different operational configuration than previous BRS efforts in the Bahamas and Mediterranean Sea. How these configurations differ/perform will inform subsequent SOCAL BRS efforts in terms of mother/source vessel selection, including whether a truly fast/light, shore-based approach (*e.g.*, based just from RHIBs)

¹ See project reports, presentations, and associated links for these projects at: <http://www.sea-inc.net/science/#brs>

could be a feasible approach for future years. Similarly, the results across the larger number of species, intended to expand the knowledge base of noise impacts on more marine mammal groups and conditions, will inform SOCAL-BRS efforts in 2011 and beyond.

1.2. SOCAL-10 OBJECTIVES

1.2.1. SOCAL-10 Primary Objectives:

- (1) Tag a variety of focal species (primary and secondary) and obtain baseline behavioral data;
- (2) Conduct CEEs on focal species using modifications of exposure methodology from previous BRS experiments for odontocetes, adapt and apply protocols for mysticetes, and develop new “tagless” playback protocols where focal animal(s) are not carrying acoustic tags;
- (3) Determine optimal BRS configuration for SOCAL in scaled playback configuration, integration of pinnipeds as focal species, and use of realistic/actual military sources in subsequent (2011-15) years.

1.2.2. SOCAL-10 Secondary Objectives:

- (1) Obtain basic distribution, behavior, and foraging ecology data for focal marine mammal species and/or relevant oceanographic data (as possible, given difference in mother vessel capabilities) to support range monitoring and or habitat models.

1.3. OVERALL CONFIGURATION

WHAT & WHY: SOCAL-10 is the first phase of a multi-year effort (2010-2015) designed to contribute to emerging understanding of marine mammal behavior and changes in behavior as a function of sound exposure for various species. These data are critically needed to assess and mitigate potential negative effects of sound on marine mammals from human activities, including military sonar training and testing.

WHERE: SOCAL-10 operational area includes southern/northern “inshore” areas around southern California and an offshore area that includes the U.S. Navy’s SCORE/SOAR range OPAREAS (more detail on operational areas given in section 3 below). SOCAL-10 will not use active acoustic sources in CEEs within 1nm of any land mass; this coastal exclusion area is extended to 3nm from any landmass within the Channel Islands National Marine Sanctuary.

WHEN: SOCAL BRS will occur during the summer/autumn months of 2010-2015 (see Fig. 1). In Fall 2010, SOCAL-10 will occur in two phases²:

² note: several related efforts (including a scouting mission in support of SOCAL-10) will be conducted prior to phase 1, and related field operations involving satellite tagging will occur between phases I and II.

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Phase I: 22 August to 10 September 2010 (source vessel: *R/V Truth*)

Phase II: 21 September to 1 October 2010 (source vessel: *R/V Sproul*)

HOW: Specialized teams³ will perform different operational functions, including:

- The **source vessel** will be the logistical hub of operations, will have visual monitoring capabilities, primarily geared toward monitoring responses during CEEs, and will move to RHIBs once tag attached and conduct CEEs, monitoring/mitigation, and tag retrieval;
- **Tagging RHIBs** may operate independently of source vessel (in some cases many miles away), providing their own visual detection in support of tagging efforts, and will switch to a supporting/data collection role once tags are attached and the source vessel initiates CEE protocols;
- **Passive acoustic monitoring** will guide field operations, as possible, when operations are conducted on the SCORE range; Ship-board PAM (towed possible from *Sproul*; dipping hydrophones possible from *Truth*; remote-deployed sonobuoys possible from either) as possible may provide a secondary detection capability in support of RHIB visuals;
- No specific aerial survey effort will be included in SOCAL-10, but researchers will coordinate with other scientists and military personnel in the operational area, as well as local stranding networks.

SCORE Range Marine Mammal Opportunistic & BRS Efforts: 2009-2015 Notional Timeline

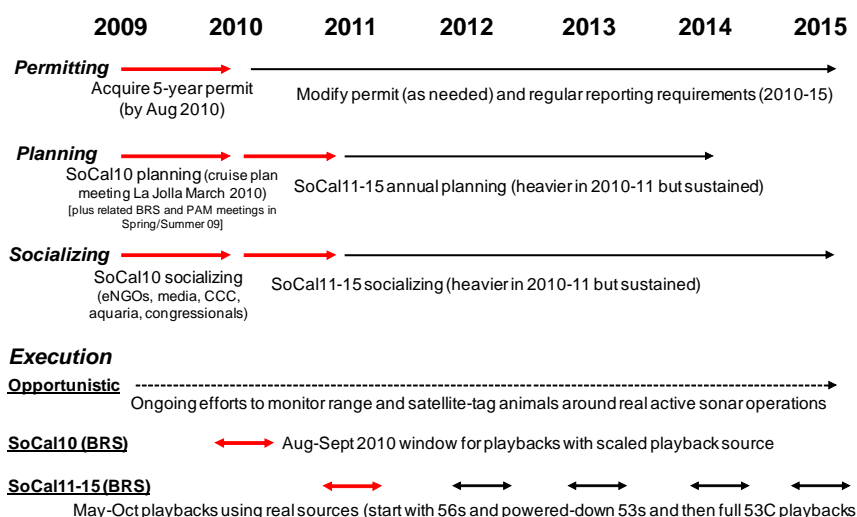


Figure 1. Notional timeline for integrated SOCAL BRS and related, ongoing monitoring research efforts.

³ See also §1.4. below

1.4. SOCAL-10 SPECIALIZED TEAMS/PERSONNEL

- Overall project coordination, permits, project chief scientist, data analysis (SEA);
- Marine mammal tracking/visual monitoring (Cascadia, SIO);
- Marine mammal tagging and tag data analysis (Cascadia, WHOI);
- Serve as SIO chief scientist on SOCAL-10 phase II (SIO);
- Passive acoustics (NUWC, SIO, SWFSC);
- Geospatial data logging and visualization (SPAWAR);
- Sound source development/operation (NUWC/APS);
- Stranding response coordination (SEA, NOAA, Navy).

1.5. SOCAL-10 RESOURCE SPONSORS and FUNDING COORDINATORS

- U. S. Navy, Chief of Naval Operations, Environmental Readiness Division (OPNAV N45); Program manager: Dr. Frank Stone.
- Office of Naval Research, Marine Mammal Research Program; Program manager: Dr. Michael Weise.



- Funding Coordinators: Naval Postgraduate School, Monterey, CA

2. SOCAL-10 SCIENTIFIC RESEARCH PERMITS

The scientific research permit application for SOCAL-10 BRS (**#14534 submitted on 11 August 2009; expected to be issued in July 2010**) is a five-year Marine Mammal Protection Act (MMPA)/Endangered Species Act (ESA) Research/Enhancement permit, entitled *“Behavioral Response Studies of Pacific Marine Mammals Using Controlled Sound Exposure: Research Applications to Support Conservation Management.”* An accompanying EA was prepared by the SOCAL BRS team and delivered to the NOAA National Marine Fisheries Service (NMFS) Protected Resources Office for their consideration and possible adoption in issuing the permit. This scientific research permit sought both directed and incidental behavioral “takes” of marine mammals (as defined under the U.S. Marine Mammal Protection Act) for the purposes of scientific research of specified “focal” marine mammals; incidental takes of “non-focal” species were also requested.

The scientific research permit holder is the Director (currently Dr. Ned Cyr) of the Office of Science and Technology (OST), within NMFS/NOAA. The principle investigator on the research permit is B. Southall (SEA); several co-investigators will be included among the on-water teams identified above. The permit was open for public comment during August-September 2009. A supplemental document was added to the permit application on 1 March 2010 to clarify and make additional requests in four areas:

- (1) Request close approach, focal follow, tagging and CEE takes for four additional

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- focal marine mammal species (Risso's, bottlenose, and Pacific white-sided dolphins, and northern elephant seals);
- (2) Increase the number of possible "tagless" playbacks for some species and include that option for several others;
 - (3) Clarify proposed protocols for tagging and exposures with regard to dependent cetacean calves, mothers of dependent calves, and groups including dependent calves; and
 - (4) Slightly expand and clarify the proposed area of operation under this permit (essentially extending the operational area northward to 35° N latitude).

This supplemental information triggered an additional 30-day public comment following FR notice. With these proposed changes for "focal" species, the permit now requests:

- either 40 or 80 close approach/tagging takes per year per species;
- up to 20 playback takes per year per species for tagged animals;
- up to 20 playback takes per year per species to groups of animals where no individual animal is affixed with a suction cup acoustic tag;
- incidental harassment takes for close approach, focal follow, photo ID, tagging and CEE for focal marine mammal species (and for CEE for non-focal species as well), the number being dependent on density estimations.

B. Southall, as specified principal investigator for the research permit will ultimately be responsible to ensure that on-water activities are consistent with the permitted actions under NMFS scientific research permit #14534. This will be done in direct and frequent communication and deliberation with project co-investigators and others involved in operations on the water. B. Southall will also be responsible for ensuring that all required data are collected for reporting marine mammal directed and incidental takes, as specified within the permit as issued.

For SOCAL-11 and beyond, an Institutional Animal Care and Use Committee (IACUC) review will be conducted by NMFS (likely through the Southwest Fisheries Science Center (SWFC)), but that process is not yet ready for considering SOCAL-10. Consequently, proposed activities for SOCAL-10 will be reviewed by the WHOI IACUC, which has reviewed previous BRS projects in the Bahamas and Mediterranean Sea. Similarly the proposed research activities for SOCAL-10 are being reviewed as part of a consistency determination by the California Coastal Commission, as well as within a separate research permit (B. Southall, principal investigator) for activities within the Channel Islands National Marine Sanctuary (CINMS).

3. OPERATIONAL AREAS (INSHORE/OFFSHORE; PORTS)

SOCAL-10 will operate in three general operational areas (see Fig. 2 below):

- 1) INSHORE NORTH** to include areas within approximately 50 NM of mainland CA coast from 35° N latitude to approximately Long Beach area (Primary harbor: Santa Barbara Harbor (where *R/V Truth* is housed); Possibly back-up/secondary harbors: Channel Islands Harbor, Marina del Rey);

- 2) **INSHORE SOUTH** to include areas within approximately 50 NM of mainland CA coast from approximately Long Beach to the Mexican border (Primary harbor: Avalon harbor on Catalina; possible back-up/secondary harbors: Dana Point, Mission Bay);
- 3) **OFFSHORE** to include areas around San Clemente Island, particularly the SOAR range to the west of the island (Primary harbor would also be Avalon or one of the smaller harbors on Catalina; possible back-up shelter for just mooring is SCORE range facility on San Clemente Island).

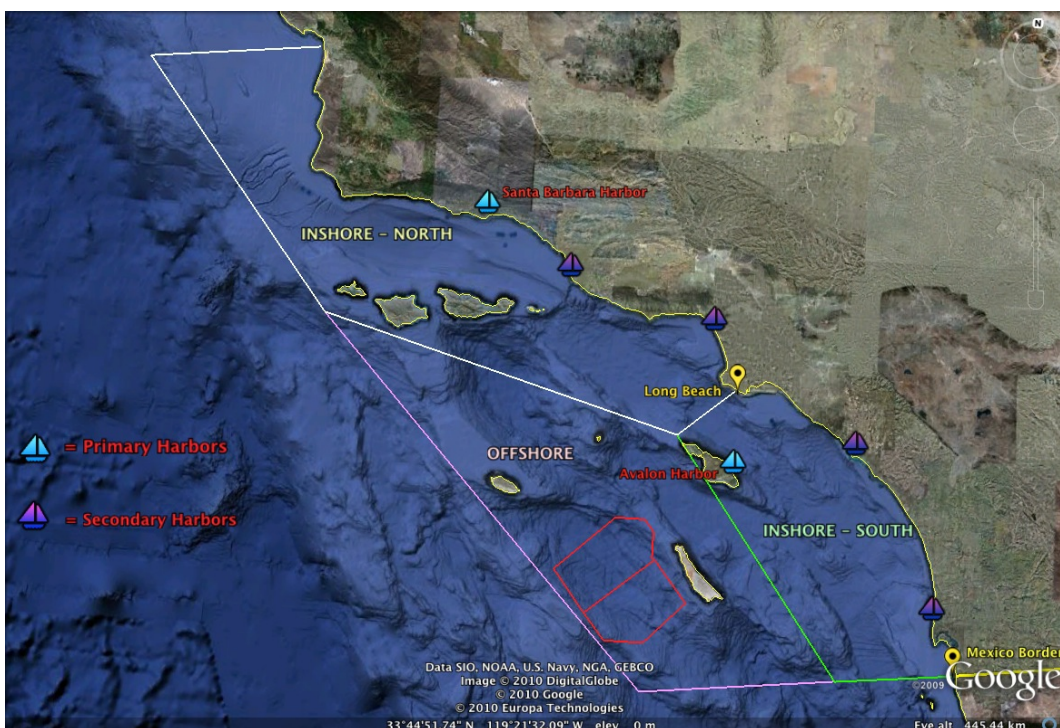


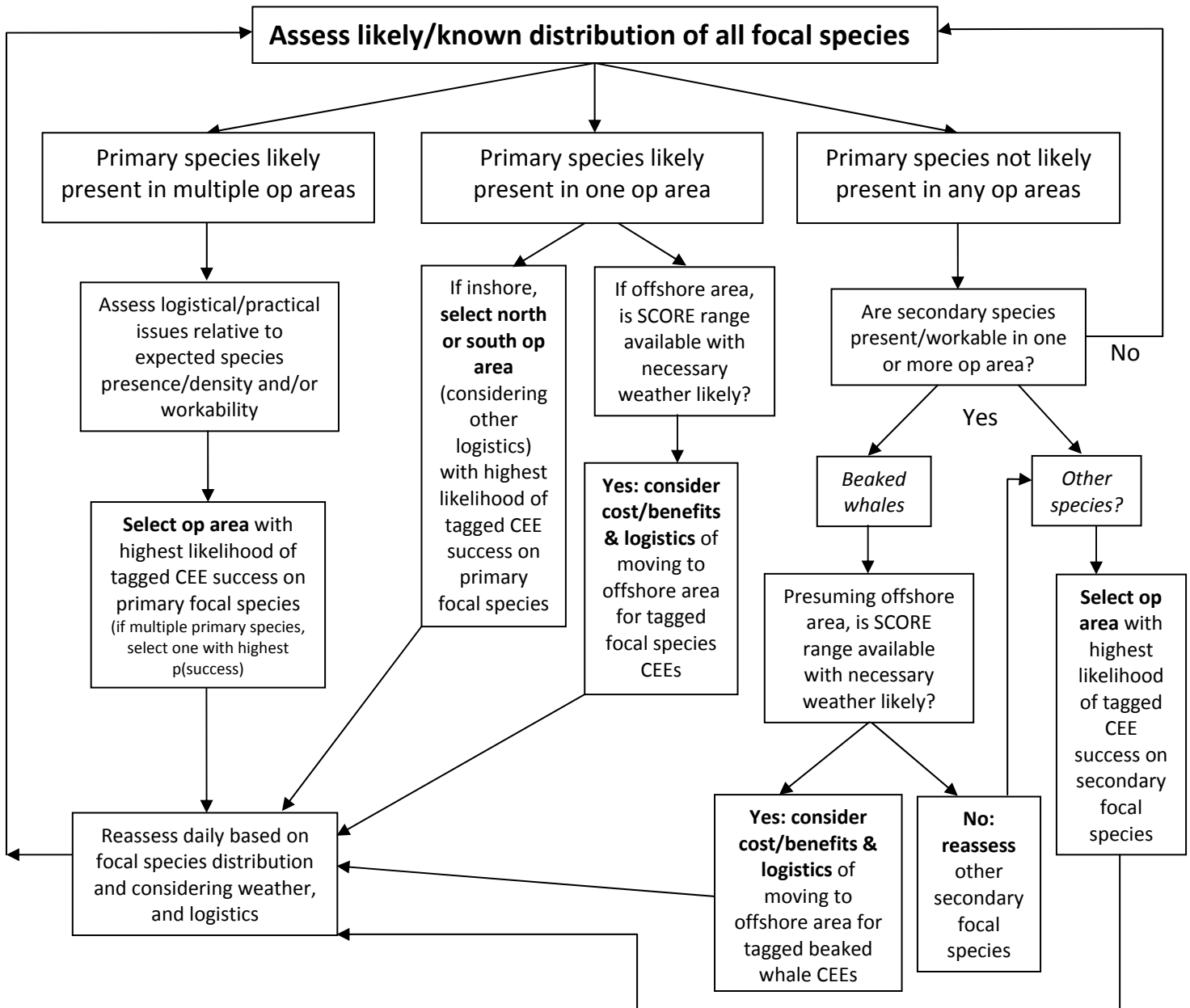
Figure 2. SOCAL-10 BRS operational areas, including primary and possible back-up ports in the inshore areas. The SCORE range is outlined in red to the west of SCI.

Which of the three general operational areas SOCAL-10 will occupy at any point in time (and where in that area) will depend on an inherently unpredictable combination of (at least):

- presence, density, and configuration of focal species groups;
- weather and/or sea conditions;
- availability of SCORE range areas;
- requirements of vessel operations (*e.g.*, fueling, crew changes); and
- level and type of accomplishments made up to that point.

A draft decision tree for operational area/species selection, which takes some of these conditions into account, is given on the following page.

Draft decision tree for operational area & species selection



4. SOCAL-10 FOCAL SPECIES

As noted above, for purposes of the SOCAL BRS permit application, all marine mammals that may occur in the operational area are considered either “**focal**” or “**non-focal**” species, with the resulting take estimates calculated accordingly. For strategic planning in SOCAL-10, we have categorized the **focal species** for which we have requested the ability to tag and conduct CEEs (either tagged or tagless) into four general categories (each with 20 tagged and 20 tagless playbacks possible per species per year).

These categories are given below in the approximate anticipated probability of success (see Fig. 3 below), and thus general priority, for SOCAL-10. The selection of species from these focal group categories will depend on operational conditions and areas, as well as sightings, tracking, successes and lessons-learned leading up to and during the project. Some of those considerations are evident in the decision-tree given above. Operational decisions for species selection in the field will be agreed upon by the chief scientist and team leaders. Priorities and criteria for species selection are almost certain to change in subsequent years, based on successes/lessons learned, developments in tags and attachment/tracking technologies, the integration of pinniped species in SOCAL-11 and beyond, transition to operational sources, or other factors.

4.1. **Mysticetes** (primarily blue and fin whale; grey whale unlikely)

It is expected that, given current tagging technologies and their success rates in previous related projects, the greatest chance of success for SOCAL-10 lies with blue and fin whales. Given the nearly complete lack of direct data on behavioral responses of mysticete species to sonar or sonar-like sounds, their presence in areas where sonar training operations are used and impacts on these species assessed, and their status as endangered species, there is a clear importance of these data.

4.2. **Medium/large odontocetes** (short-finned pilot whale, sperm whale, Risso’s dolphin)

Non-beaked whale odontocete species are important as well, given their regular interactions with military sonar and reliance on sound communication; several species will be selected for tagging and CEE as possible. Sperm and short-finned pilot whales are preferable, but are expected to be relatively unlikely to occur in the SOCAL-10 operational area; Risso’s dolphins are much more likely to occur but probability of tagging success is questionable based on previous experience in other areas.

4.3. **Beaked whales** (primarily Cuvier’s, but also including various *Mesoplodon* species)

Obtaining direct measurements of the effects of sonar signals on beaked whales is critically important and was the near-exclusive focus of previous BRS studies in the Bahamas and Mediterranean Seas. Results of those projects confirmed work in other areas that the conditions required for tagging and CEEs on these species, and the time

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and effort required to achieve success, are extremely limiting given current tag and (especially) tag attachment technologies. Thus, while they are an extremely high priority species for tagging and CEE, given current tagging technologies and the requirement for acoustic monitoring of the SCORE range for any CEEs on these species, SOCAL-10 will focus on beaked whales only in situations where weather and range access conditions make the probability of success reasonably acceptable.

4.4. Small, pelagic odontocetes (Short-beaked common dolphin, Northern right whale dolphin, Pacific white-sided dolphin, and bottlenose dolphin (offshore stock)).

These relatively common pelagic species, which often occur in large groups, are also quite important in terms of measuring behavioral responses (or lack thereof) to simulated and real sonar. In fact, most of the incidental “takes” of marine mammals during military training operations are of these species. However, current archival acoustic tagging technologies are not well-suited for these species and they will thus be involved in SOCAL-10 in the context of behavioral observations without acoustic tag attachments (see §15. below).

SOCAL-10 FOCAL SPECIES	Prob. occur on SCORE range	Prob. occur elsewhere in SOCAL	Prob. Suitable Weather for Detection	Prob. Detection Given Suitable Weather	Prob. successful close approach	Prob. tag-on given close approach	Prob. monitoring tagged individual(s) post-tagging for CEE	OVERALL Probability of Success for tagging/CEE
Blue whale	Low	Very High	High	High	Very high	High	Very high	Very high
Fin whale	High	High	Moderate	Moderate	High	Moderate	Very high	Moderate
Sperm whale	Low	Moderate	Moderate	Low	Moderate	High	High	Low
Pilot whale	Low	Low	High	Low	High	Very high	High	Low
Cuvier's beaked whale	High	Moderate	Moderate	Moderate	Low	Low	Moderate	Low
Baird's beaked whale	Low	Low	Moderate	Moderate	Low	Low	Moderate	Very low
Blainville's beaked whale	Low	Low	Moderate	Moderate	Low	Low	Moderate	Very low

Figure 3. SOCAL-10 decision matrix supporting categorization and general categorization of focal species groups for tagging and CEEs⁴.

⁴ Risso's dolphins were not initially considered (in part because of concerns about tag attachment), but is included in the medium/large odontocete species group above based on regular occurrence in the operational areas and relative ease of approach (overall probability of success was estimated as “moderate” given these competing concerns). Small odontocetes are not included, since they will not be selected for acoustic tagging attempts in SOCAL-10.

5. ACOUSTIC TAGGING AND TISSUE/BIOPSY SAMPLING

Multiple different position-only (e.g., satellite) and archival acoustic (suction-cup) tags will be involved in SOCAL-10, either in “tagless” playback conditions or “tagged” animal CEEs (acoustic, suction-cup tags). The acoustic tags, which are the primary focus for SOCAL-10 in terms of CEEs and measurements of animal responses, are described in greater detail below.

5.1. Acoustic tags

All archival acoustic (suction cup) tags affixed to animals for baseline behavior and/or CEEs will be considered “tagged” focal animal takes under the SOCAL BRS permit (#14534 – Southall PI). These tags must be recovered for data to be obtained and every effort will be made to follow, track, and retrieve tags using various methods. However, due to the configuration of the source vessel and RHIBs during phase I, as well as previous successes in re-locating tags on subsequent days in southern California by Cascadia previously, there will generally not be attempts to track acoustic tags during nighttime hours.

Any dart/implantable tags (e.g., satellite position) will be attached to animals as part of related studies (and thus tagging takes accounted for under different permits. CEEs conducted to animals affixed with these tags will be considered “tagless” takes under the SOCAL BRS permit (#14534 – Southall PI). Specifications on different tag types were given by G. Schorr at the November SOCAL-10 planning meeting (see below).

TAG TYPE	Atcmnt. mech.	Primary method of Atcmnt.	Atcmnt. dur. (max days)	Sensor Data						Location data		Cost (incl. attachmt. mech. VHF trans., etc)	Analysis	Subjective		Commercially available?			
				Acoustics (Max Samp.)	Depth Res. (m)	Pitch/Roll (+/- # axis)	Magneto meter (# Axis)	Light level (Y/N)	VHF Transm. Incorp (Y/N)	Fastloc GPS (# locs/day)	Argos (# locs/day)			Pros	Cons				
Suction Cup	Dtag (Gen2)	4 suction	Pole	24 hrs	192 KHz	<1	3	3	N	Y	13 Gb	N/A		Analysis of received sound levels, acoustic events, underwater movements and tracking, surfacing behavior, foraging ecology, behavioral response	Used in previous controlled exposures, good tools for analysis, history on beaked whales	Not commercially available, limited past deployments on blue whales	N		
	Dtag (Gen3)	2-4 suction	Pole	24 hrs	192 KHz	<1	3	3	N	Y	13 Gb	Y		Analysis of received sound levels, acoustic events, underwater movements and tracking, surfacing behavior, foraging ecology		Available 2010?	N		
	Bprobe	2 suction cups	Pole	2	9 kHz	~1	2*	0*	N	Y		N/A	N/A	Analysis of received sound levels, acoustic events, underwaterbody position, surfacing behavior, foraging ecology	Available, lots of baseline comparative data for Bm, Mm, Bp	Reliability issues, slow download, no longer commercially available, low acoustic: sampling rate, pitch and roll only	Limited to what is in market now		
	Acusoundc	2 suction cups	Pole	2	232 kHz	unk	3	3	unk	Y	8 Gb	N/A	N/A	\$17,000	Analysis of received sound levels, acoustic events, underwater movements, surfacing behavior, foraging ecology		Untrtested (11/9/09)	still under development	
	Mk10F	1 or 2 suction cup	Pole	3	N/A	(+/-) 0.5	0*	0*	Y	Y		30hr	N/A	\$ 4,000	analysis of underwater dive behavior, surfacing behavior and location/movements, foraging ecology	reliable, high-res dive and loc. Data	no acoustics	Y	
	Star-Odi	piggy-back	Pole	3	N/A	(+/-) 6	3	3	N	Y		N/A	N/A	\$ 1,400	Analysis of underwater dive behavior, and movements	caddy piggy-backed on other tags as a backup data collector	short battery life	Y	
Satellite dart	Spot 5 dart	dart	projector	150	N/A	N/A	0	0	N	N	N/A	N/A		limited by overpasses	\$ 3,200	surface movement, longer term habitat use and residency, gross response movements	Longer duration attachments for mvmt data, deployable at greater ranges	Location only, limited locations/day depending on species, Argos location quality constraints	Tag only, not darts or deployment device
	Mk10a dart	dart	projector	50**	N/A	0.5 (sum)	0	0	N	N	N/A	N/A		limited by overpasses	\$ 4,200	Surface movement, summary dive data, behavior, long term habitat use and residency, gross response movements	Longer duration attachments for mvmt data and dive summary data	limited locations/day depending on species, Argos location quality constraints, dive stats in summary only	No, still under development/est phase

Figure 4. Acoustic and satellite tags considered and (in part) available for SOCAL-10

5.1.1. DTags

The primary archival acoustic (suction cup) tags for SOCAL-10 will be the WHOI Dtags (v.2). These will be applied in different combinations on various focal species (blue and fin whales = LF DTags; Risso's dolphins = HF DTags; beaked, pilot, sperm whales = HF DTags). The v.2 DTags will not be deployed on smaller delphinids in SOCAL-10, but hopefully v.3 DTags will be ready for SOCAL-11 for deployment on these species.

WHOI will fabricate tag housings, suction cups, and release mechanisms, testing and replacing electronic components as needed, and provide VHF radio transmitters for DTAGS⁵. Poles, attachment mechanisms, and radio tracking gear will be refurbished and tested prior to the field work, and tags will be tested and calibrated. At least 2-3 LF and 2 HF DTAGS will be available for Phase I and 2-3 LF and ~5 HF DTags will be available during Phase II. Ideally, each RHIB will carry one LF and one HF DTag during tagging attempt operations.

5.1.2. BProbe/ACOSOUNDE

Secondary suction cup tags for SOCAL-10 will be the Burgess Bprobes and next-generation ACOUSOUNDE (as available). Four to six BProbes will be available in tagging RHIBs for deployments as back-ups to DTags or in addition if multiple tagging options are available. Cascadia, Scripps, and/or NOAA will provide these tags and tag attachment/tracking gear for retrieval.

5.2. Tissue/Biopsy sampling

Tissue (skin) samples obtained from retrieved suction cup tags will be preserved for genetic analysis (in DMSO); this is authorized and will be reported under the SOCAL BRS permit (#14534 – Southall PI).

⁵ A complete list of DTag equipment is shown below:

Tag support

- 3 9V power supply and 400mA current limit set - used to recharge the DTag battery.
- 3 IR dongle - used to communicate with the DTag via a PC serial port.
- 3 IRPP box, 5V power supply and parallel port cable - used for high-rate infra-red data off-load from the DTag via a PC parallel port.
- High-voltage-reset (hvr) battery - this is simply a small 9V battery with a 470Ω current limiting resistor and crocodile clips and is used to wake up the DTag via the salt-water-switch pins.
- 2 De-gaussing coils - a TV repair style 110V degaussing coil is used to minimize the remnant field of the DTag.
- 3 Palm Pilots - a M100 or similar model Palm computer is convenient to program and check settings on the DTag in the field. This must have the IR-modified VT100 software installed.
- 2 Computers - a PC compatible with the IRPP off-load system is needed to communicate with the DTag, archive data, and check data quality. It must have a CD writer for archiving.
- 4 Analysis computers with Matlab R2007b and Adobe Audition

DTag Radio tracking and recovery

- 3 148-150 MHz telemetry receivers (Telonics TR2 or Communications Specialists R1000) with headphones and wall charger.
- 1 ATS automatic direction finder (ADF).
- 2 Handheld directional antenna for locating floating tags.
- Set of 4 mast-mounted 148 MHz Cushcraft yagi antennas with cables for tracking tags on whales.
- Spotlight (Q-beam) for finding the DTag at night-time.
- Hand net for picking up a floating tag without touching the cups.
- Sample bottles, DMSO, tweezers, and gloves etc. for tissue collection.

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Biopsy sampling of various species may occur using SOCAL-10 as platform of opportunity on a not-to-interfere basis with tagging/CEEs, but as part of related projects (and thus considered biopsy takes under different permits (*e.g.*, Cascadia, SWFSC)). Biopsy samples will be collected from some of the non-target animals in the vicinity of the playback to provide information on sex and evaluate potential future use of hormone-based impact assessments. Biopsy sampling will be attempted of focal animals after post experiment period to obtain samples if possible. Procedures for biopsy sampling include the following:

- Tissue samples consisting of a small piece of skin and attached blubber will be collected using a specialized dart or bolt fired from a crossbow with a 68 kg (150 lb) pull, or in the case of bow-riding cetaceans, using a dart tip on the end of a pole.
- Each stainless steel biopsy tip is coupled with a flange or “stop” that regulates penetration of the bolt/dart and causes recoil after sampling. Flotation material secured to the shaft of the bolt/dart allows it to float on the surface for retrieval.
- Biopsy tip size will vary depending on the size of the target individual and the amount of blubber needed, but will not exceed 40mm in length and 11mm in diameter, the standard of Finn Larsen design employed by most researchers today.
- To collect a sample, the target individual is approached to a distance ranging from 5-50m.

6. PRE-SOCAL-10 SCOUTING TRIPS AND OTHER PROJECTS

6.1. SOCAL-10 scouting trips

Cascadia will lead pre-cruise scouting trips during late July and early August, ahead of SOCAL-10. SWFSC will be involved in these pre-SOCAL-10 scouting trips and will provide PAM support of that effort to compliment Cascadia visual observers.

These surveys will serve to provide operational awareness of the location, densities, and general configuration of focal species to inform area and species selection for SOCAL-10. Specifically, these surveys have two primary goals:

- 1) Investigate summer 2010 distribution of SOCAL-10 focal species, especially blue whales, to inform site and species selection at the start of SOCAL-10.
- 2) Identify potential areas of beaked whale occurrence that may provide alternate locations for future BRS work using PAM and visual observations.

Scouting resources and activities will include the following:

- Daily RHIB surveys within the inshore study region to areas of past blue whale use;
- A 14-day cruise with SWFSC using a chartered sailboat and PAM to both identify offshore areas of blue whale use and also possible beaked whale habitat;
- Surveys of the northern portion of the Santa Barbara Channel in conjunction with CINMS aboard the Truth, planned for late July;
- Coordination with the local network of collaborators, naturalists, and whale watch operators to collect opportunistic observations of whale distribution;
- Other local efforts by Cascadia, including surveys related to ship impacts and M3R/Satellite tagging efforts in and around SCORE prior to SOCAL-10 BRS;

6.2. Other related projects in operational area ahead of SOCAL-10

The scouting efforts described above are effectively a preliminary part of SOCAL-10, although no CEEs will be conducted. Additionally, there are several other related research and/or marine mammal-related activities in the operational area in the period leading up to SOCAL-10 from which information on marine mammal distributions may be obtained. While animals will likely redistribute in the period between these precursor efforts and SOCAL-10, they should still provide a reasonable estimate of where to focus initially. This is especially true for blue whales, which often feed in some areas predictably over the intervals proposed here. Several other related efforts include:

- Satellite tag data from marine mammals tagged in and around San Clemente Island in June by Cascadia as part of the monitoring work at SCORE could provide real-time data on locations of some species;
- 23-28 July is tagging with Cascadia in area south of Santa Cruz Island on the *R/V Shearwater*;
- Cascadia and other SOCAL-10 participants have excellent local connections to whale watching and fishing vessels and other boats in the area with on-water presence;
- CINMS may be flying aerial surveys during July-Aug to include the operational area;
- Marine mammals will likely be detected through various operational and monitoring means through U.S. Navy activities (available to SOCAL-10).

7. SCORE RANGE CAPABILITIES AND COMMUNICATIONS WITH SOCAL-10

7.1. SCORE range capabilities

SCORE range hydrophones were designed for use in tracking cooperative undersea vehicles equipped with a tracking pinger; they are cabled to San Clemente Island where a tracking signal processor detects and precisely time-tags the pings for use in a hyperbolic tracking algorithm. A prototype Marine Mammal Monitoring on Navy Ranges (M3R) processor has been installed on San Clemente Island, monitors the SOAR hydrophones, and is being used to develop and apply passive acoustic marine mammal Detection, Classification, Localization, and Density Estimation (DCLD) algorithms.

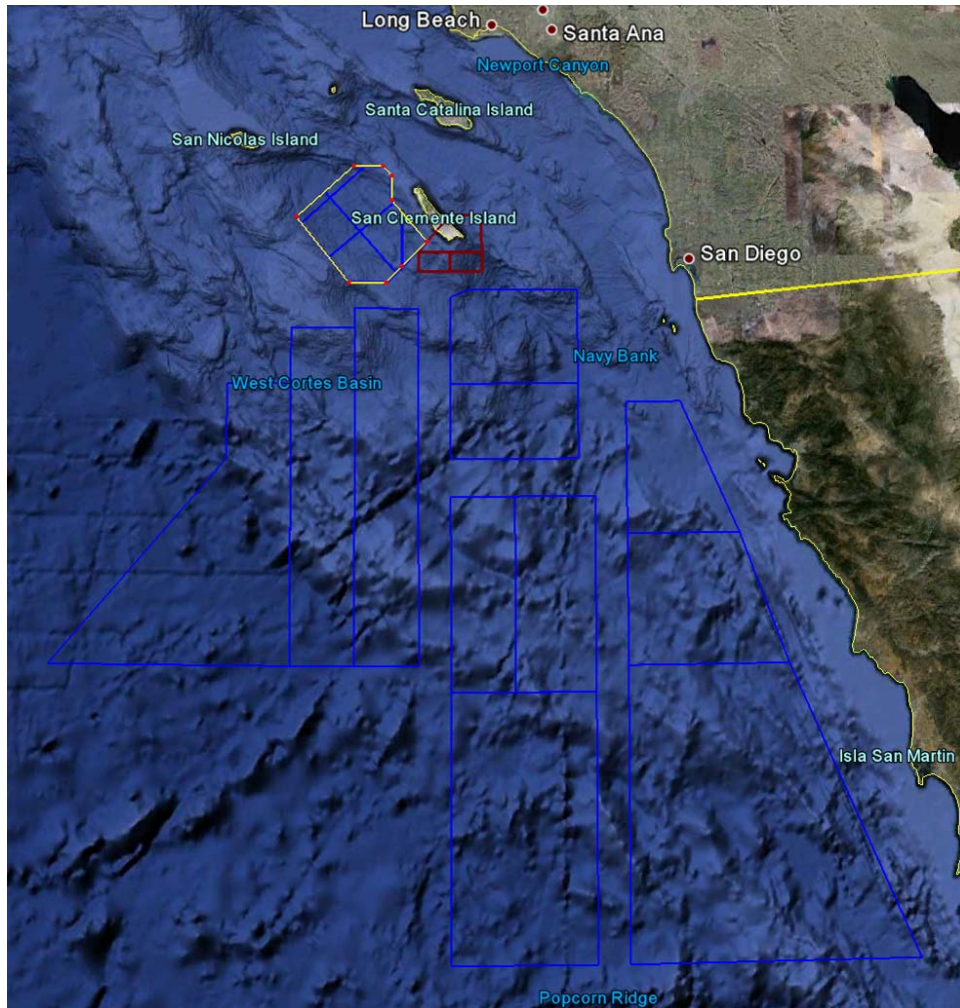


Figure 5. SOCAL range complex (blue lines) with the Southern California Antisubmarine Warfare Range off San Clemente Island outlined in yellow.

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During FY09, a major hydrophone project to replace the existing 81 working hydrophones with 88 new hydrophones was undertaken. Hydrophones were installed on range and the shore electronics system and range tracking signal processor was upgraded to accommodate the new hydrophones. One of nine multiplexed arrays failed upon deployment and the array was recovered. Final repair and installation of the array is being planned. The survey of hydrophone positions has not been completed and will be undertaken after redeployment of the repaired array. Until the survey is completed, precise hydrophone positions are not known. Localization algorithms which include the new phones are being modified but will provide degraded accuracy until the exact positions of the hydrophones are provided from the survey.

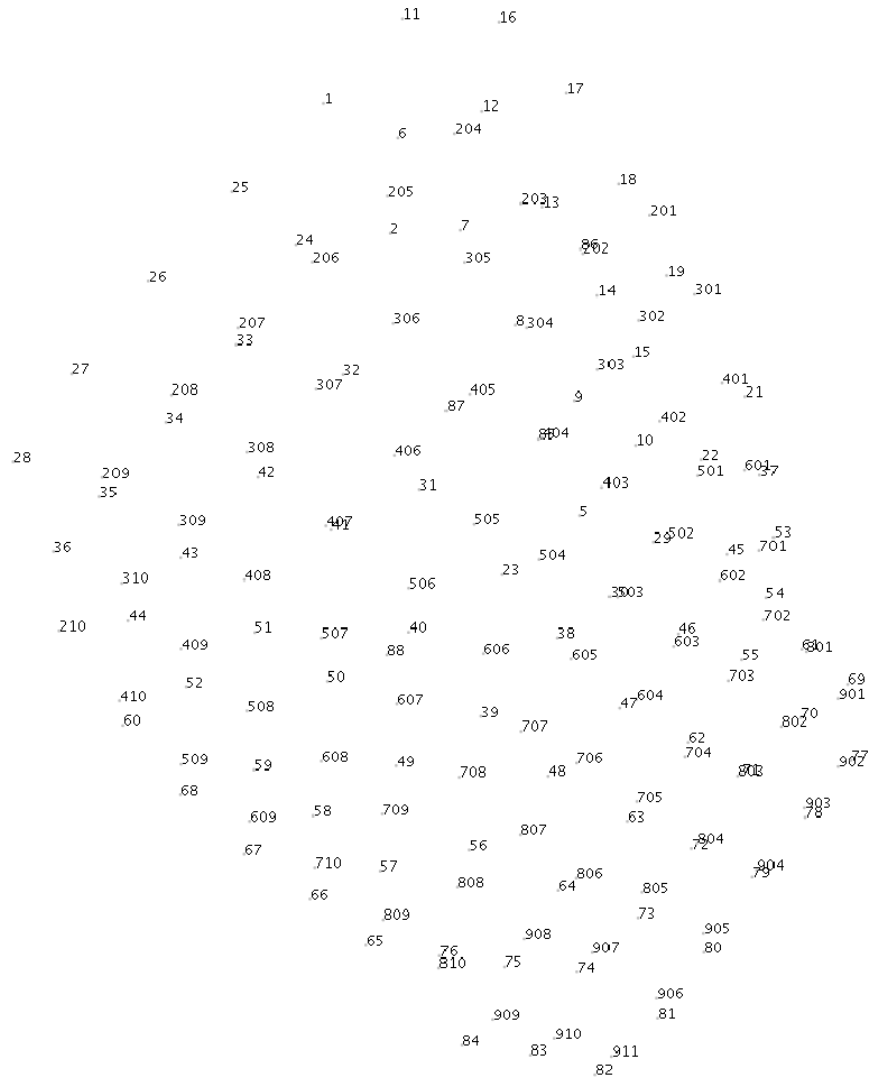


Figure 6. SOAR range hydrophone map including old and newly installed SOAR replacement hydrophones

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The replacement hydrophones represent a new design which expands the bandwidth from 8 - 39 kHz to 50 Hz - 40 kHz. This makes possible detection of an increased number of lower frequency baleen species. A digital data interface was provided that outputs data on a network link in a format directly compatible with the M3R processor.

7.2. SCORE Range Status and Communications Plans

Lori Mazucca (SPAWAR) is serving as the primary liaison between various operational U.S.Navy entities for SOCAL-10 (regarding updates, intentions, and eventually on-water activities/plans); this includes the SCORE range on San Clemente and the Pt. Magu range for planning purposes and during execution. She has and will continue to provide information/questions to SCORE and Pt. Magu range facilities, and serve as liaison to the SOCAL-10 sponsors and chief scientist.

As of 25 June 2010, our current understanding of the situational relationship between the SOCAL-10 BRS project and the SCORE range, and range availability to the project is as follows:

- SOCAL-10 will have limited access to the SCORE range on a not-to-interfere basis from 28 August to 3 October 2010; major operations are planned before and after that limit that will completely preclude SOCAL-10 activities entirely.
- During this period, there are three other activities known at this time that could affect SOCAL-10 access (or that of sat-tagging efforts between the SOCAL-10 Phases). These are:
 - a carrier air wing conducting anti-submarine warfare and other exercises from 17 Aug-10 Sept (very little additional information);
 - a 15-28 Sept exercise scheduled that would either confine BRS to North SOAR, South SOAR or possibly preclude us from using the range; and
 - a 19-21 Sept installation of a new array to replace one that failed in very North SOAR.

8. TAG BOATS

Tagging RHIBs will largely be autonomous of the mother/source vessel and will serve as their own visual observation team. They will remain in communication with the source vessel for coordination. Two Cascadia RHIBs will be used in SOCAL-10. Both will be equipped with bow pulpits to aid in tag deployments. These will be two of the following three RHIBS owned and operated by Cascadia, and used for tagging in the past:

- Zodiac Pro15 Man, 21 ft, with twin 75Hp Honda

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- Zodiac Hurricane 590, 19 ft, with twin 75 HP Honda
- Novurania DX540, 18 ft, with twin 50 HP Honda

Each RHIB will have a crew of at least two to include a driver and a tagger, each of whom will provide visual observation for focal marine mammal species. If space on the mother/source vessel allows sufficient personnel to support a third person on the RHIB, this may occur, depending on operational conditions.

Each RHIB will be equipped, at a minimum, with the following safety/communications gear:

- o Console VHF and back-up hand-held VHF radios;
- o Cell phone, including a Nextel for use at SCORE;
- o Personal Locator Beacon with vessel ID and internal GPS;
- o Console mapping GPS and back-up handheld waterproof GPS;
- o Mustang work suits for all people on board;
- o AIS tracking unit integrated with console GPS; and
- o All other typical safety gear (flares, anchor, etc.).

Each RHIB will also at a minimum have the following research gear:

- o VHF tracking equipment (receiver and antenna) to aid in following tagged marine mammals (potentially two sets for different frequencies);
- o Suction cup tagging gear (poles, tags, etc.);
- o Photo-ID gear including at least two digital SLR cameras with 300 mm or greater lenses;
- o Biopsy sampling gear (crossbow/rifle, darts, vials, etc);
- o Reticle/compass binoculars (to get bearing to sightings);
- o Laser range finder (to aid in getting range to animals and vessels); and
- o Datasheets.

Photo-ID will be conducted primarily from the RHIBs for the following purposes:

- o Link to historical sighting information for species with large historical catalogs (blue, humpback, fin, killer whale, beaked whales) for ongoing studies of demographics, movements, etc.;
- o Allow long-term follow up of focal animals to evaluate any long-term impacts;
- o Provide determination of any repeat observations and experiments on the same animal;
- o Provide information on the number, movements, and residency of whales in the study area and in the area of playback;
- o Species of high priority for photo ID and the method used include:
 - Blue whales – pigment pattern on the right or left side especially near the dorsal fin as well as flukes;
 - Humpback whales – underside of flukes supplemented with photographs of the back and dorsal fin;
 - Fin whales – preferably right side including the chevron and

- perpendicular photos of the back around the dorsal fin;
- Sperm whales – underside of flukes supplemented by dorsal fin;
- Killer whales –right side showing dorsal fin and saddle patch;
- Other delphinids including Risso’s, bottlenose dolphins, pilot whales, false killer whales – right and left sides including dorsal fin and markings on the back.

Tag delivery will be conducted in a manner to minimize the disturbance to both target and non-target animals. The Cascadia research team successfully attached suction cup tags to both bow-riding small odontocetes and large baleen whales from their RHIBS using a hand-held pole, and the WHOI team has successfully used a 7-m vessel and a 12+ m long cantilevered pole for attaching tags to large whales with minimal signs of disturbance. The tagging vessel must come within about 10m for attachment using the cantilever pole method and within about 8 m for attachment using hand-held poles.

When one RHIB attaches a suction cup acoustic tag to an individual, they will communicate with the chief scientist on the source vessel regarding the likelihood of conducting a CEE. If conditions are favorable, the source vessel will move to the tagged animal location as rapidly as possible and the tagging RHIB will then switch to serve as visual observation support (described more in CEE protocols to follow); the second RHIB may join the tagged animal group depending on conditions, or may stay separate to pursue other tagging opportunities for baseline behavior.

During Phase I (*R/V Truth*), tagging RHIBs will either accompany the source vessel into port or to a sheltered anchor location and/or tie to her overnight (RHIB crew will berth with crew aboard the *Truth*). During Phase II (*R/V Sproul*), tagging RHIBs and crews will be housed aboard overnight.

9. “FASTER/LIGHTER” SOURCE VESSEL (*R/V Truth*)

9.1. *Truth* overview

The *R/V Truth* (a converted dive boat anchored at Santa Barbara Harbor⁶) will serve as the source vessel for the first operational phase of SOCAL-10. The dates for Phase I are scheduled as **22 August to 10 September 2010**. The *Truth* will carry, in addition to its crew, a science party of (15), to include: chief scientist (1), research assistant (1), source/PAM operator (1), geospatial data analyst (1), *Truth* visual team (3), RHIB teams (6), and rotating slots for other affiliated scientists (see crew schedule in §9.5 below).

The *Truth* is 65-foot V-hull dive/fishing boat with a cruising speed of 10-12 knots (max. 15). It has been used for diving and fishing expeditions, as well as for previous

⁶ See: <http://www.truthaquatics.com>

successful fieldwork in the general southern CA area. It's relatively greater speed, operational flexibility, relatively low cost, and ability to accommodate a reasonably large science party for its small size were primary selection factors. One purpose in using the *R/V Truth* in Phase I will be to contrast its performance with the larger, slower, much more expensive *R/V Sproul* in Phase II.

Two of the Cascadia RHIBs (see §8. re: tag boats above) will be used as the primary observation platforms for detection and tagging of primary species (small visual team on *Truth* will support as possible). They will operate autonomously from the source boat but be in radio communication during operation and tagging; once animals are tagged, the source boat. Each RHIB will have (at least) a boat driver and a tagger; an optional third RHIB personnel is possible and likely on Phase I.

It is simply inevitable that planning and scheduling will be less predictable and more complicated for SOCAL-10 than previous BRS projects. This is a consequence of the fast/light approach with much smaller teams and source vessel focusing on more species and different areas than previous BRS' with large ships, all supplies aboard, and ports planned months ahead of time. Logistical issues in terms of the maximum range (~400NM) and associated requirements for fuel and stores will be more challenging during Phase I and SOCAL-10 personnel will have to make required adjustments and preparations accordingly. All SOCAL-10 on-water scientific/RHIB crew will stay onboard at anchor (RHIBs tied to *Truth*) for ~3-4 nights in a row. All vessels will return to one of the primary/secondary ports every 4-5 days (see Fig. 2 above), depending on the nature and location of operations, for fuel, water, and food.

As noted in the areas of operation above (§3), SOCAL-10 will operate within either a northern or southern inshore or an offshore operating area. The expectation during the first phase is that SOCAL-10 will operate primarily in the inshore areas (no range access until essentially the second half) focusing on various focal species (most likely baleen whales).

Consequently, once the *Truth* leaves her home port (Santa Barbara) on 22 August (21 Aug mobilization in Santa Barbara harbor; 11 Sept demobilization), SOCAL-10 will operate in inshore areas where focal species have been seen and/or tagged in the Cascadia/SWFSC scouting trips and/or other efforts. During the second portion of the first phase (from ~29 Aug to 10 Sept), depending on range access, weather, distribution of animals, and tagging/CEE success during the first portion, the *R/V Truth* may move to the offshore operational area, to utilize the SOAR range capabilities to the west of San Clemente Island. Because of the *Truth's* range limitations and the distance from the inshore op areas, she will need to refuel at Catalina and can then operate on and around the range for 2-3 days at a time before needing to refuel and refresh supplies, again at Catalina.

9.2. *Truth* modes of operation

- 9.2.1. **Search mode:** *Truth* will perform visual monitoring as possible given small visual team and remain in radio communication with the RHIBs and with the range facilities on SCORE (if in offshore op area); *Truth* will remain within no

more than one hour transit to either of the two RHIBs and will coordinate their positions to ensure this. RHIBs will be operating independently of the *Truth* and one another but in radio communication; RHIBs have the lead in terms of locating and tagging animals.

- 9.2.2. **Playback mode:** Once animals have been located, tagged, and a sufficient baseline period following tagging has been completed with appropriate criteria (see playback protocols in §13. and 14.), playback mode will be initiated. The RHIB working on the focal group will provide observational backup to the *Truth* during this period, but control will shift to the source vessel for CEEs. The other RHIB may join to provide additional visual monitoring support or may continue to operate independently in pursuit of baseline tagging for other focal groups; in either case the second RHIB will continue to conduct on-water observations that may be useful in detecting and interpreting responses of incidentally-exposed marine mammals. The sound source will be deployed to the appropriate depth and the *Truth* will hold station as much as possible and limit propulsion noise during transmissions. The other RHIB may provide additional backup or may continue to work another group for other tagging opportunities. The *Truth* will maintain an appropriate range from focal animal/group and conduct the CEE while repositioning the RHIB(s) as needed.
- 9.2.3. **Monitoring/tracking mode:** Depending on location, daylight, range, etc. the RHIB(s) may continue to provide visual and/or VHF monitoring of the tagged animal(s) during the monitoring/tracking period following CEEs. However, the source vessel will have primary responsibility in continuing to perform visual observation of the focal animal/group, as well as radio tracking of tags until retrieved. If this continues into nighttime hours, RHIBs will return to port while *Truth* continues tracking tags until retrieved.

9.3. *Truth* visual observer teams

The *Truth* will have a three-person visual crew (Pusser, Douglass, and one Cascadia/SIO person) that will support RHIB operations and record all marine mammal sightings, but primary role will be in monitoring of focal groups (and detecting non-focal groups inside the specified shut-down zone) before, during, and after CEEs.

Visual observations will be primarily with high-powered, hand-held binoculars (e.g., Fujinon, 7x50). We are also exploring possible acquisition and mounting of “mini” big-eye (e.g., Steiner 15x80) binoculars (probably with unipods) on the *Truth*. Traditional big-eye binoculars (e.g., Fujinon, 25x150) will not be used, due to the nature of the platform

9.4. *Truth* passive acoustic monitoring (PAM)

The *Truth* will not tow an array in SOCAL-10. However, dipping hydrophones may be used for detecting animals, and a calibrating hydrophone will be used to monitor sound source transmissions. Possible use of sonobuoys on the *Truth* will depend on their availability and space on the vessel.

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SOAR range hydrophones will provide passive acoustic monitoring as possible when SOCAL-10 is operating on the SCORE range; this information will be relayed via radio to the Truth and RHIBs.

9.5. Truth technical specifications

Vessel	<i>Truth</i>
Date launched	1974
Where built	Venice , California
Length	65'-0" (weather deck)
Length overall (LOA)	69'-0"
Beam	22'-0"
<u>Bunk Capacity</u>	<u>45 people maximum, 14 double bunks, 17 single bunks.</u>
Type of Bunk facility	Open berthing with pillows, blankets, curtains, and reading lights. Dressing room located in bunkroom.
Main engines	Detroit V892 Turbo DDEC
Generators	Detroit 471-50kw-220/110 volts
Cruising speed	12 Knots
Fuel Capacity	1000 Gals.
Range	400 miles
Electronics	46 mile radar, VHF, Video depth finder, Digital depth finder, Loran, GPS, Underwater Recall, Dive tracker™
Heads	2
Showers	4 (2 on deck, 2 below deck) , fresh hot water
Water capacity	1050 gallons
Galley	Outfitted with all appliances necessary for food preparation and is waterproof for divers in wetsuits. Onboard built-in Barbeque.
Galley seating	cushioned and separate chairs.
Sundeck	large upper deck area provides seating and

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	pads for sunbathing.
First Aid	Full first aid kit, O2 bottles, and crew is certified annually in CPR and O2 administration.
Compressors	Two Ingersoll-Rand @18 C.F.M. Capable of filling to 3000 P.S.I.
Live Game Wells	Built in in transom for game storage.
E-6 Photo Lab	Run by special request
Stern Compartment	used for Wetsuit Drying Room, Game Freezing, Clothes Dryer
Exits	Port, Starboard, and Bow exits for easy water entry. Mask rinsers at each exit.
Water Boarding	State of the art Ramp at stern for easy boarding
Dive area	All offshore Islands of Southern California. Primary destination of Anacapa, Santa Cruz, Santa Rosa, San Miguel Islands. Other Islands visited are Catalina, Santa Barbara, San Clemente, San Nicolas, and Cortez Banks.
Cost	Individual prices vary depending on charterer. All multi day trips include all meals, snacks, beverages (excluding alcoholic), and air refills
Owner	Glen Fritzler, Truth Aquatics Inc.
Shipping Address	Truth Aquatics/Sea Landing 301 W. Cabrillo Blvd. Santa Barbara, CA 93101-3886 USA [SPECIFY "for SOCAL-10 BRS PROJECT"]
Phone	805-962-1127 805-962-1127 or 805-963-3564 805-963-3564
Fax	805-564-6754
Web	www.truthaquatics.com
E-mail	info@truthaquatics.com

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9.6. Truth Science Party Personnel Schedule

Science Party #	Personnel (Team)	A	A	A	A	A	A	A	A	A	A	S	S	S	S	S	S	S	S	S
		u	u	u	u	u	u	u	u	u	u	e	e	e	e	e	e	e	e	e
		g	g	g	g	g	g	g	g	g	g	p	p	p	p	p	p	p	p	p
		2	2	2	2	2	2	2	2	3	3	1	2	3	4	5	6	7	8	9
		2	3	4	5	6	7	8	9	0	1	1	2	3	4	5	6	7	8	9
		2	3	4	5	6	7	8	9	0	1	1	2	3	4	5	6	7	8	9
1	J. Calambokidis (RHIB/tagging)																			
2	A. Friedlaender (RHIB/tagging)																			
3	G. Schorr (RHIB/tagging)																			
4	E. Falcone (RHIB/tagging)																			
5	A. Allen (RHIB/tagging)																			
6	J. Foster (RHIB + Visual rotate)																			
7	A. Douglas (Truth Visual)																			
8	T. Pusser (Truth Visual)																			
9	B. Diehl (Truth Visual/Data)																			
10	C. Kyburg (WILD)																			
11	B. Southall (Chief Sci)																			
12	C. Casey (Chief Sci assist)																			
13	J. Goldbogen (Visiting Scientist)																			
14a	D. Moretti (Source)																			
14b	R. Morrissey (Source)																			
15a	M. McKenna (Visiting Scientist)																			
15b	J. Barlow (Visiting Scientist)																			
16a	M. Pelettiere (Visiting Scientist)																			
16b	M. Weise (Sponsor)																			
16c	L. Mazucca (Navy/Range coord.)																			

10. “TRADITIONAL (SLOWER/BIGGER)” SOURCE VESSEL (*R/V Sproul*)

10.1. *Sproul* overview

The *R/V Sproul* (operated by Scripps Institute of Oceanography) will serve as the source vessel for Phase II of SOCAL-10. The dates for this phase are scheduled as **21 September to 1 October 2010**. The *Sproul* will depart and return to San Diego at 1700 hours on these dates with mobilization on 20 September and demobilization on 2 October; there will also be a “hotwash” meeting to wrap-up and discuss the quick look report on 2 October after demobilization but before researchers depart.

The *Sproul* will carry, in addition to crew, a science party of eleven plus a research technician. This will include the *Sproul* chief scientist; SOCAL-10 chief scientist, source/PAM operator (1), geospatial data analyst (1), *Sproul* visual team (3), and RHIB teams (4); see §10.5 below for additional detail.

Two of the Cascadia RHIBs (see §6. re: tag boats) will be used as the primary observation platforms for detection and tagging of focal species (small visual team on *Sproul* will support as possible). They will operate autonomously from the source boat but be in radio communication during operation and tagging; once animals are tagged, the source boat. Each RHIB will have (at least) a boat driver and a tagger (two total).

The *Sproul* phase is expected to be more like the conventional BRS efforts in the Bahamas and Mediterranean Sea the last three years in that it will be on a larger, slow vessel that will leave from and return to a specified port on scheduled days with no interim port-calls. Both RHIBs will be craned onto the *Sproul* at night and all science crew will stay aboard. However (as described in modes of operation below), she will have essentially the same functions as the *Truth* in terms of tracking, tagging, and CEEs, with a few exceptions noted in the sections below.

10.2. *Sproul* modes of operation

- 10.2.1. Search mode:** *Sproul* will perform visual monitoring as possible given small visual team (and PAM using towed array and/or other assets) and remain in radio communication with the RHIBs and with the range facilities on SCORE (if in offshore op area); *Sproul* will remain within no more than one hour transit to either of the two RHIBs (note that this will be approximately half the range possible during the *Truth* phase due to much slower speed) and will coordinate their positions to ensure this. RHIBs will be operating independently of the *Sproul* and one another but in radio communication; RHIBs have the lead in terms of locating and tagging animals.
- 10.2.2. Playback mode:** Once animals have been located, tagged, and a sufficient baseline period following tagging has been completed with appropriate criteria (see playback protocols in §13. and 14.), playback mode will be initiated. The RHIB working on the focal group will provide observational backup to the *Sproul* during this period, but control will shift to the source vessel for CEEs. The sound source will be deployed to the appropriate depth

and the *Sproul* will hold station as much as possible and limit propulsion noise during transmissions. The other RHIB may provide additional backup or may continue to work another group for other tagging opportunities. The *Sproul* will maintain an appropriate range from focal animal/group and conduct the CEE while repositioning the RHIB(s) as needed.

10.2.3. Monitoring/tracking mode: Depending on location, daylight, range, etc. the RHIB(s) may continue to provide visual and/or VHF monitoring of the tagged animal(s) during the monitoring/tracking period following CEEs. However, the source vessel will have primary responsibility in continuing to perform visual observation of the focal animal/group, as well as radio tracking of tags until retrieved. If this continues into nighttime hours, RHIBs will be loaded onto *Sproul* to continue tracking tags until retrieved.

10.3. *Sproul* visual observer teams

Sproul will have a three-person visual crew (Pusser, Douglass, and one Scripps/SIO person) that will support RHIB operations and record all marine mammal sightings, but primary role will be in monitoring of focal groups (and detecting non-focal groups inside the specified shut-down zone) before, during, and after CEEs.

Visuals will be primarily high-powered, hand-held binoculars (e.g., Fujinon, 7x50). We may also possibly use “mini” big-eye (e.g., Steiner 15x80) binoculars on the *Sproul* and may have access to traditional big-eye binoculars (e.g., Fujinon, 25x150) but will not plan to primarily use these due to the nature of the platform

10.4. *Sproul* passive acoustic monitoring (PAM)

Several PAM capabilities will be used from the *R/V Sproul*. These may include: towed linear arrays of hydrophones, single hydrophones, compact 4-hydrophone bearing arrays, and regular and/or broad band sonobuoys. Scripps also has access to some 53-F unmodified Navy sonobuoys and DIFAR sonobuoys. A small 3-channel sonobuoy receiver, acoustic signal processor, and GPS demodulator will be provided along with sonobuoys, tracking and acoustic monitoring displays, if required.

SOAR range hydrophones will provide passive acoustic monitoring as possible when SOCAL-10 is operating on the SCORE range; this information will be relayed via radio to the *Sproul* and RHIBs.

10.5. *Sproul* technical specifications

Owner: University of California, San Diego

Operator: Scripps Institution of Oceanography

Contact: Rose Dufour/Elizabeth Brenner

Shipping Address: Capt Richard Vullo; R/V Robert G. Sproul; Nimitz Marine Facility; 297

Rosecrans Street; San Diego, CA 92106-3505; Phone: 858.534.1649

Shipboard Technical Support: Scripps Institution of Oceanography, 297 Rosecrans St, Bldg 2,

Room 1, San Diego, CA 92106, Voice: 858-534-1632 Fax: 858-534-1635; mail to:

restech@ucsd.edu

Specifications: Built: 1981

Length: 125'LOA, 116' LWL; Beam: 32'; Draft (max): 9'6'

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Gross Tonnage: 84 tons; Displacement: 696 full load
 Crew: 5 Scientific berthing: 12
 Main Engines: 2 Detroit Diesel 12V-149,675 hp
 Bow Thruster: White-Gill trainable Hydraulically operated 155 hp
 Generators: Two, 75kW
 Water Capacity: 7,800 gals.
 Open deck space: 1,854 sq. ft
 Holding tank: None
 Incinerator: None
 Propellers: Two, fixed pitch
 Speed, Cruising: 9 knots; Maximum: 10.5 knots; Minimum: 2 knots
 Endurance: 14 days full speed (fuel)
 Range: 4,300nm at 9 knots (fuel)
 Fuel Capacity: 25,000 gal
 Fuel Consumption: 1,350 gal/day full spd - 850 gal/day average
 Radio Call Sign: WSQ2674
 Laboratory, Wet: 130 sq. ft
 Laboratory, Dry: 220 sq. ft
 Laboratory, Portable: 130 sq. ft
 Sewage System: MDF
 Document/State I.D#: CF2166XS
 Ownership: University of California, San Diego
 Navigational Capabilities: GPS Trimble Tansmon P-Code; GPS Trimble NT 300 DGPS; RADAR
 Furuno 3cm(2); ADU GPS Ashtech Attitude-sensing System Fathometer Furuno FCV 382
 50/200 KHz; Gyro - Sperry MK 37(2); Autopilot - ROBERTSON

10.6. Sproul Science Party Personnel Schedule

Science Party #	Personnel (Team)	Sept	Sept	Sept	Sept	Sept	Sept	Sept	Sept	Sept	Sept	Oct
		21	22	23	24	25	26	27	28	29	30	1
1	J. Calambokidis (RHIB/tagging)											
2	A. Friedlaender (RHIB/tagging)											
3	G. Schorr (RHIB/tagging)											
4	E. Falcone (RHIB/tagging)											
5	A. Allen (RHIB/Sproul Visual)											
6	A. Douglas (Sproul Visual)											
7	T. Pusser (Sproul Visual)											
8	R. Carlson (WILD)											
9	NUWC (Source)											
10	J. Hildebrand (Chief Sci)											
11	B. Southall (Chief Sci)											

11. SOCAL-10 SOUND SOURCE

The SOCAL-10 scientific research permit requests directed takes of marine mammals to received sound exposures of up to 180dB re: 1 μ Pa for relatively short (~1-3s signals) repeated every ~30s for ~ 30 min max duration of exposure. Achieving these levels for a remote-deployed sound source from a small to medium-sized ship would be very difficult without being immediately next to focal animals. An objective of 150-160 dB received level (RL) for ranges of ~ 1km was thus the objective in designing the SOCAL-10 sound source. Additional design specifications were that it be easily deployable (by small crane/davit and/or by hand) from a relatively small vessel, that it have a small and ruggedized dry-side footprint, and that it be operable from a laptop computer by a single operator.

B. Abraham of Applied Physical Sciences designed and constructed the source and associated equipment, and is testing and calibrating it with D. Moretti (NUWC) at various locations (see below). Source specifications are given below (11.1.), as well as a schematic of the source (Fig. 7) and a block diagram of the overall source/vessel configuration (Fig. 8).

11.1. SOCAL-10 Sound Source Specifications

- Vertical line array of active transducers for projecting mid-frequency, short-duration sounds;
- 16 transducers driven by individual power amplifiers;
- Time-delayed inputs effectively steer the output beam to desired elevation angle;
- Estimated maximum source level of up to 215 dB re 1 μ Pa @1m within mid-frequency band (2-6 KHz);
- Deployable to at least 100 m (cable is 125m);
- Two-person, hand-deployable, lightweight configuration for rapid response;
- 25-50 lb. ballast weight – dry weight of array and ballast is ~125 lb.;
- Simple 120VAC, 10A ship power requirements;
- All components shock-mounted in rugged, shipping-ready rack (30x48”);
- Source controlled from remote laptop computer by a single operator;
- A calibrated hydrophone will also be used to validate source performance and to provide a degree of passive acoustic monitoring when the ship is stationary. Both the output signal and the receive signal from the hydrophone will be recorded along with an IRIG time signal derived from a GPS satellite to allow precise signal reconstruction following CEEs.

SOCAL10 BRS Acoustic Source Layout

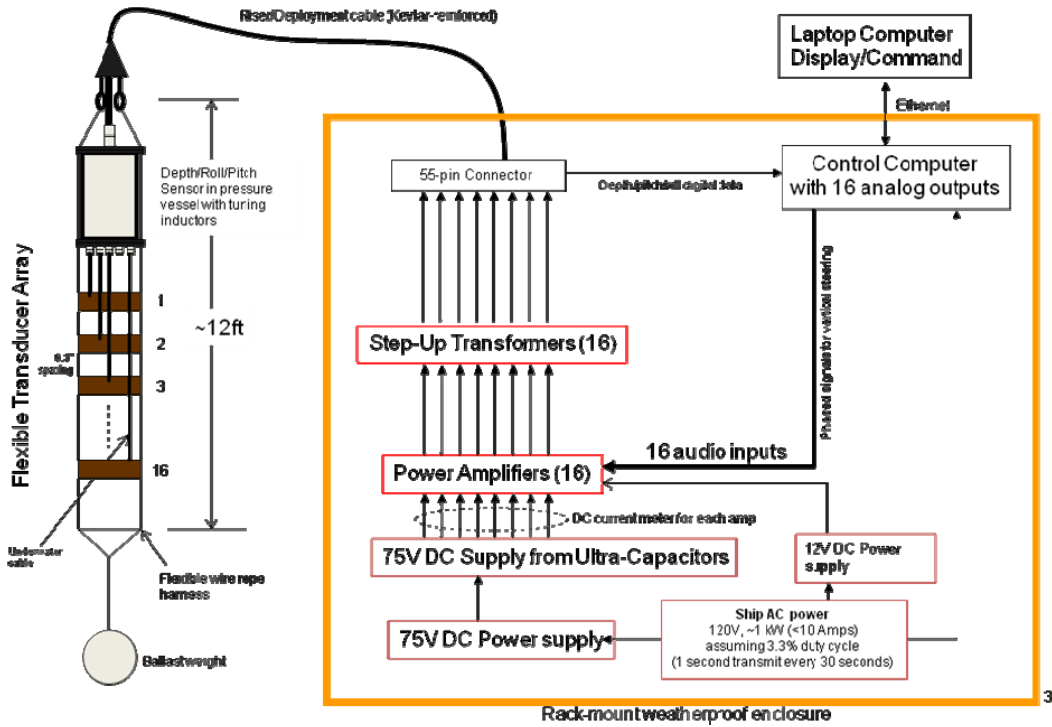


Figure 7. SOCAL-10 sound source and power supply schematic diagram (not to scale)

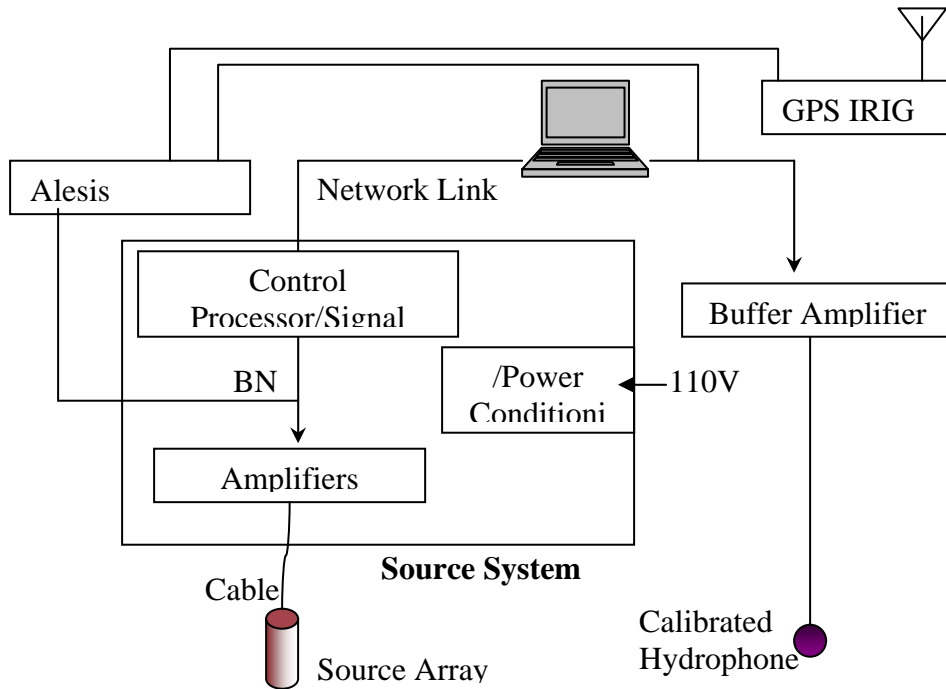


Figure 8. SOCAL-10 sound source/vessel system block diagram

10.2. Sound Source Construction, Testing, and Calibration:

- Elements were tested individually at Dodge Pond in Nov 2009; results suggest SL approaching 215 dB possible.
- The following have been completed:
 - o Amplifier fabrication;
 - o Transducer fabrication;
 - o Custom rack-mount shelves for amplifiers, transformers, and other components, and majority of wiring;
 - o Complete underwater housing, transducer array mounting brackets
 - o Installation of transformers, inductors, and completion of wiring
- Source will be fully assembled and tested/calibrated, including with the SOCAL-10 waveforms at the Dodge Pond facility in late June and NUWC Seneca Lake test facility in Dresden, New York in mid-July. The purpose of this test is to verify the system performance in the field and isolate any problems with handling, deployment, and durability prior to the at-sea test. To accomplish this, the system will be deployed off a small boat which will be tracked with GPS and the transmission levels measured using calibrated arrays on the Seneca Barge. The deployment will mimic anticipated at-sea conditions.
- D. Moretti and R. Morrissey will coordinate in person (1 July) with *Truth* personnel regarding deployment, operation, retrieval, storage of the source, amplifier rack, and associated gear.
- Pending results of the Seneca field test, the source will be ready to ship to NUWC for SOCAL-10 field testing in southern California by the end of July.

11.3. SOCAL-10 Waveforms

- Source waveforms for SOCAL BRS will include some of the same five simulated sonar and PRN stimuli prepared for the MED-09 BRS project; no killer whale sounds will be used in SOCAL-10.
- The synthetic mid-frequency waveforms (simulated mid-frequency active sonar (MFA-1) or pseudorandom noise (PRN-1) within a comparable frequency band) will be 0.5-2 seconds in length, transmitted every 25 sec. with a ramp up from 160 dB re: 1 μ Pa to the maximum source level planned for transmitting (210 dB).
- LCDR K. Ryan (NURC) will be supporting SOCAL-10 through ONR reserve duty and has provided these to B. Abraham and D. Moretti for testing and calibrating the source at Dodge Pond and Seneca Lake.

11.4. Sound Source Field Operation

- A single NUWC person will be assigned to the source vessel and will be responsible for source operation as well as source calibration, playback, and recording from, at a minimum, a deployed hydrophone. In addition, NUWC personnel will be responsible for set-up and operation of any additional passive

acoustic monitoring such as sonobuoys, with assistance of other scientific or ship's crew.

- If/when operations take place on the SCORE range, two M3R personnel will be stationed in the Range Operations Center on North Island. Their responsibilities will include operation of the M3R system, interfacing with range personnel, archiving passive acoustic data, and vectoring of the SOCAL-10 source vessel to animals of interest.

12. Whale Identification Logging and Display (WILD) System

WILD is a custom, data logging and geospatial display software system developed by SPAWAR Systems Pacific for integrating different kinds of biological and other information into a common, GIS-based viewing and analytical environment. Its capabilities are described as follows:

- Real time integration of mother ship navigation data, visual observations and RHIB locations to provide successful detection and focal follow of beaked whales.
- The type of real time data that will be logged and displayed will include:
 - o animal lat/long and direction of travel;
 - o continuous source vessel tracks;
 - o RHIB locations from AIS;
 - o a measurement tool for field distance measurements.
- Base maps will available that contain the following information:
 - o bathymetry (raster and vector);
 - o Raster nautical charts at a range of scales;
 - o boundaries of marine sanctuaries and other protected areas;
 - o OPAREA boundaries;
 - o range boundaries;
 - o range acoustic sensor locations
- Data management will be achieved using automatic archiving in geo-database format. Data transfer will be accomplished via UDP protocol using standard NMEA strings.

WILD SOCAL-10 Configuration

- WILD will be a stand-alone system on the source vessel (both *Truth* and *Sproul*) that will be serviced by one SPAWAR personnel during each SOCAL-10 phase. Two ruggedized computers will be provided to support the WILD Logger and the WILD mapper. WILD will have its own GPS, digital compass and AIS receiver; no ship interfaces will be required. 110 power outlets will be required for the two notebook computers, GPS, digital compass and AIS.
- All observation data will be saved locally on the notebook computers. A daily

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archive DVD can be made to backup the data since it will not be sent to a server.

- A small amount of desk space in an interior area will be required to set up a separate notebook computer and printer to be used to create the daily plots.

13. SOCAL-10 EQUIPMENT LIST

The following is a listing of all antennas to be mounted in SOCAL-10 and a partial listing of equipment by team. More details on the DTag gear and the equipment to be included in each of the tagging RHIBs is given in sections 5 and 8 (respectively) above.

SOCAL-10 Antennas:

1. ~ 10' aluminum, 4-element mast-mounted Cushcraft yagi VHF for location of acoustic tags – to be mounted on forward port corner of flying bridge with bundled connection through conduit to small unit on wheel house dash (port side);
2. ~ 3-4' simple VHF AIS receiver antenna (WILD) – to be mounted on forward port corner of flying bridge bundled through conduit to unit in back of wheel house;
3. Vector G2 (3.3 lb, 5 in wide, 24 in long) GPS compass antenna (WILD) – on forward port corner of flying bridge bundled through conduit to unit in back wheel house;
4. Small mushroom type GPS antenna (WILD) – to be mounted on forward port corner of flying bridge, connection through conduit to unit in back wheel house;
5. AIS transponder (for *Truth* leg) – to be in wheelhouse; exact location TBD
6. Intuitcom pod – (for *Truth* leg) – to be in wheelhouse; exact location TBD
7. Two handheld VHF directional antenna for locating floating tags (NOT mounted)

CHIEF SCIENTISTS TEAM: EQUIPMENT

Item (make and model number, as appropriate)	General Description/location	Approximate Size/Weight	Power requirements
Chief Scientist Laptop	Standard PC laptop for chief sci logs, blog, etc. (back desk in wheel house primarily)	Nominal laptop size/weight	110V; standard amperage
Data management; Chief Scientist Assistant	Standard PC laptop for data management for chief sci assistant, plus permits stuff, etc. (different locations)	Nominal laptop size/weight	110V; standard amperage
Data management: External hard drives	2 nominal external hard drives for data management/archive	Nominal external hard disk size/weight	110V; standard amperage
GENERAL LAPTOPS/CAMERAS for Team	Accounting for individual laptops other than those used in specific team equipment – assume ~ 10 additional laptops than those accounted for elsewhere here, plus maybe this many individual cameras and/or cell phone chargers , many of which may be used in the galley especially	Nominal laptop and camera size/weight	110V; standard amperage

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RHIBs/TAGGING TEAM: EQUIPMENT

Item (make and model number, as appropriate)	General Description/location	Approximate Size/Weight	Power requirements
RHIBs will be equipped with a variety of tracking and telemetry gear as well	ONLY RHIB equipment that will be housed and charged on the Truth/Sproul is specified here	n/a	n/a
3 9V power supply and 400mA current limit set - used to recharge the DTag battery.	Power supply to re-charge DTag battery (Tag station in galley)	~5 pounds	110V; 400 mA capacity
3 IRPP box, 5V power supply and parallel port cable	Used for high-rate infra-red data off-load from the DTag via a PC parallel port (Tag station in galley).	~5 pounds	110 V to supply 5V power
High-voltage-reset (hvr) battery	This is simply a small 9V battery with a 470Ω current limiting resistor and crocodile clips and is used to wake up the DTag via the salt-water-switch pins (Tag station in galley).	~5 pounds	Charged with power supply above
2 laptop/desktop computers for tag download and analysis	PC compatible with the IRPP off-load system is needed to communicate with the DTag, archive data, and check data quality. It must have a CD writer for archiving. Matlab R2007b and Adobe Adobe Audition DTag Radio tracking and recovery (for analysis) (Tag station in galley).	Nominal laptop size/weight	110V; standard amperage
2-3 148-150 MHz telemetry receivers (Telonics TR2 or Communications Specialists R1000)	Telemetry receivers for tracking tags for use with hand-held yagi antennas – (battery powered) (stored and used when tracking tags)	~5 pounds	Battery powered

WILD TEAM: EQUIPMENT

Item (make and model number, as appropriate)	General Description/location	Approximate Size/Weight	Power requirements
Two notebook computers	For WILD logger and WILD mapper (WILD station on the deck aft of the wheel house)	11.5" (L) x 11.9" (W) x 2.7-2.8" (H) 8.4 lbs. each	110V; standard amperage
GIS laptop computer	GIS laptop (WILD station in back wheel house)	Nominal laptop size/weight	110V; standard amperage
GIS Display	Standard computer monitor (WILD station in back wheel house)	Nominal monitor size/weight	110V; standard amperage
Printer/Scanner	HP Deskjet F4280 (WILD station in back wheel house)	6.35 in (h) x 17.22 in (w) x 11.42 in (deep) 11 lb	110V; standard amperage
AIS receiver	AIS receiver (WILD station on the deck aft of the wheel house)	103 mm W x 50mm H x 150 mm D ~1 lb	110V; standard amperage
Vector G2 GPS compass	Vector G2 GPS compass (WILD station on the deck aft of the wheel house)	Cable only from antenna to power supply and PC	110V; standard amperage
Router and UPS conditioner	Small accessories to WILD system (WILD station on the deck aft of the wheel house)	Small (< 1lb.)	No power

SOURCE/PAM TEAM: EQUIPMENT

Item (make and model number, as appropriate)	General Description/location	Approximate Size/Weight	Power requirements
SOCAL-10 sound source	Vertical line array of active transducers for projecting mid-frequency, short-duration sounds (stored on back deck in 10' long, 1x1' wooden crate secured to deck; deployed from davit on starboard quarter)	~ 8' length; dry weight of array and ballast is ~125 lb	See below – individual power amps run source and require ships power
SOCAL-10 sound source power supply	15 individual power amplifiers, step-up transformers, and ultra-capacitor banks in a shock-mounted, waterproof housing	29x24x55"; total weight?	120VAC, 10A ship power requirements
SOCAL-10 sound source monitoring hydrophone	Calibrated receiving hydrophone for measuring output from SOCAL-10 sound source	~5 pounds; integrated into source deployment	Provided through source power
Source laptop computer	Laptop computer for remotely operating SOCAL-10 sound source	Nominal laptop size/weight	110V; standard amperage
Sonobuoys	1 pallet (24 total) U.S. Navy 53-F unmodified DIFAR sonobuoys (Stored and individually deployed from back deck)	4x4' footprint; Total weight ~1,000 lb	No external power required

14. TAGGED ODONTOCETE CEE PROTOCOLS

14.1 . OBJECTIVE (TAGGED FOCAL INDIVIDUAL CEE)

Conduct CEEs to focal individuals/groups of cetaceans (odontocetes or mysticetes⁷ of various possible focal species – see §4. above) in which *at least* one animal is carrying a suction cup acoustic tag. For mysticetes, the focus in SOCAL-10 will initially be on feeding animals rather than traveling ones generally, given the anticipated challenges in tracking and monitoring traveling whales.

14.2. CONDITIONS TO BEGIN CEE (TAGGED FOCAL INDIVIDUAL CEE)

- Tags must be successfully deployed for long enough to reduce attachment disturbance effects and obtain a reasonable amount of baseline behavioral data.
 - o For Bahamas BRS, this was defined for beaked whales as at least one deep foraging dive and complete surface sequence; same criterion will be used for SOCAL-10 for beaked whales, as well as a comparable interval (ideally **two hours following attachment**) for other **odontocetes** as well;

⁷ Note that differences in protocols for mysticete versus odontocete cetacean are noted below; where no distinction is made, the protocols are the same for each group.

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- For **mysticetes**, this is specified as a **minimum of 45 min post-tagging and ideally two hours**;
- During this interval, obtain all possible visual observation on baseline behavior from source vessel and RHIBs;
- **Determine/confirm that no calves in group are neonates**, as defined in §2. regarding permits above, namely:
 - The presence of fetal folds for non-ESA listed species (most odontocetes);
 - That the calf be no less than six months of age, as determined by trained field biologists, for ESA-listed species (mysticetes that are potential SOCAL-10 focal species, sperm whales);
- Determine that **operational conditions** (*e.g.*, weather, location of non-SOCAL-10 vessels) are likely to allow for **successful completion of CEE and interpretation of results, as well as post-exposure monitoring**.

14.3. CEE PROCEDURES (TAGGED FOCAL INDIVIDUAL CEE)

- **Position source vessel ~1000m from focal group**, taking into account group movement/distribution, to extent possible;
- Reduce engine propulsion noise and speed, as much as possible;
- Determine location of any other (non-SOCAL-10) vessels relative to focal individual/group; **ideally avoid conditions where other vessels approach to within 1 km of focal animals**;
- Deploy source to specified depth (variable depending on focal species distribution and deflection angle);
- Determine no marine mammals within 200m of source vessel;
- **Initiate sound transmissions at a source level of 160 dB re: 1 μ Pa, with one transmission every 25s ramped up by 3 dB per transmission to maximum output level**;
- **Maintain transmissions once/25s at max. source level**, unless any contra-indicators require shut-down (see below), for a **total maximum transmission time (including ramp-up) of 30 min.**;
- Exposure protocol is for **one signal type** (MFA-1 or PRN-1, as described above) **per focal individual**, with sufficient pre-exposure baseline “control” (defined above) and as much post-exposure “recovery” as possible until tag falls off.

14.4. DATA TO BE COLLECTED (TAGGED FOCAL INDIVIDUAL CEE)

- Archival acoustic tags are primary data collection in this mode, providing

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movement and acoustics of animals and received sound exposures at the animals;

- However, all visual observation data are critical as well and source vessel visual team will record position, orientation, social configuration, and other parameters of focal individual/group (*e.g.*, respiratory behavior, swim speed), as possible;
- Source visual team will also monitor to insure no marine mammals inside 200m shut-down zone and provide any observations of responses of other marine mammal groups (as possible without conflicting with observations of focal individual/group);
- RHIB teams will provide additional visual observation support, along same lines as described above for source vessel observations;
- RHIB teams will also collect prey field data, as possible, using existing depth sounders (50 kHz and 200 kHz sources) on these vessels – **either or both may be used during mysticete focal follow/CEE but just the 200 kHz sources will be used when focal species are odontocetes.**

14.5. SHUT-DOWN CRITERIA (TAGGED FOCAL INDIVIDUAL CEE)

- **Any marine mammal inside 200m shut-down zone around source vessel during transmissions;**
- **Visual detection from source boat or RHIBs of focal group or incidentally-exposed marine mammals exhibiting:**
 - o **Directed, high speed or other abnormal swimming behavior (at surface), especially toward shore;**
 - o **Unusual and abnormal surface/subsurface behavior involving apparent disorientation and confusion or dramatic changes in group cohesion;**
- Controlled sound exposures may be conducted with focal groups that include dependent calves that are not neonates (see §2. And 14.2 above for working definition of neonates). However, in order to reduce the risk of abandonment to the greatest extent possible, **if the mother-calf pair begins to become clearly separated** during sound exposure (as determined by trained marine mammal biologists dedicated to observing mother-calf pair(s)), **sound transmissions will be terminated.**
- For beaked whale CEEs on SCORE range in SOCAL-10, we would use the same criterion as BRS at AUTEK/MED, which is:
 - o After animal starts foraging dive, commence exposure soon after animal starts clicking (average vocal time 26 min);
 - o Terminate exposure when focal group is determined to cease clicking (3

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min criteria);

- Subsequent years will likely include options for continuing or initiating exposures during/through surface sequences.

14.6. POST-PLAYBACK MONITORING (TAGGED FOCAL INDIVIDUAL CEE)

- **Source boat and/or RHIB visual teams will maintain visual** (and PAM if applicable) monitoring of focal groups **for a minimum of one hour post CEE.**
- If there are multiple individuals with tags in a group and the animals stay in the same group, the source boat will stay with them; if individuals separate, the source boat will go with one and one or both RHIBs will monitor the other.
- Source boat will maintain visual/VHF radio monitoring of focal animal as long as possible following CEE, but (at least for SOCAL1-10 Phase I) there will generally not be nighttime tracking of tags/focal animals.

15. "TAGLESS" CEE PROTOCOLS

15.1. OBJECTIVE (TAGGLESS CEES)

Conduct CEES to focal individuals/groups of cetaceans (primary focus is small, pelagic odontocetes – see section #3 above) in which no animals are carrying a suction cup acoustic tag, but one or more may be tagged with a satellite tag attached by other researchers.

15.2. CONDITIONS TO BEGIN CEE (TAGGLESS CEES)

Beaked whales will not be used in tagless playback scenarios in SOCAL-10, and mysticetes will only be used if acoustic tag attachment is not possible for some reason but conditions are favorable to support a successful tagless CEE. As noted, the primary species for tagless CEE focus is smaller, pelagic odontocetes for which acoustic tag attachments are currently not possible. For those species that are used in tagless CEES, the following conditions are required prior to sound exposure:

- Identify and photo-ID focal group for tagless playback and **monitor behavior using source boat and RHIB visual capabilities** (and PAM as possible) for a **minimum of 45 min. to 2 hr.**, as possible (same criterion as for tag playbacks);
- During this interval obtain all possible visual observation on baseline behavior from source vessel and RHIBs;
- **Determine/confirm that no calves in group are neonates**, as defined in permit section (#2) above, namely the absence of fetal folds for non-ESA-listed species

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and six months for ESA-listed species;

- Determine that **operational conditions** (*e.g.*, weather, location of non-SOCAL-10 vessels) are likely to allow for **successful completion of CEE and interpretation of results, as well as post-exposure monitoring**.

15.3. CEE PROCEDURES (TAGGLESS CEEs)

- **Position source vessel ~1000m from focal group**, taking into account group movement/distribution, to extent possible;
- **Reduce engine** propulsion noise and speed, as much as possible;
- Determine location of any other (non-SOCAL-10) vessels relative to focal individual/group; **ideally avoid conditions where other vessels approach to within 1 km of focal animals**;
- **Deploy source to specified depth** (variable depending on focal species distribution and deflection angle);
- **Determine no marine mammals within 200m** of source vessel;
- **Initiate sound transmissions at a source level of 160 dB re: 1 μ Pa, with one transmission every 25s ramped up by 3 dB per transmission to maximum output level**;
- Maintain **transmissions once each 25s** at max. source level, unless any contra-indicators require shut-down (see below), for a **total maximum transmission time (including ramp-up) of 30 min.**;
- Protocol is one exposure type per focal group, with sufficient pre-exposure baseline and as much post-exposure “recovery” as possible until tag falls off.

15.4. DATA TO BE COLLECTED (TAGGLESS CEEs)

- Other (non-acoustic) tags, if attached, may ultimately provide some data on movements and exposures, but visual observation data are essential in real-time (and all we will have if no ancillary tags attached);
- Source vessel visual team will record position, orientation, speed of travel; social configuration, and other parameters of focal individual/group as possible;
- Source visual team will also monitor to insure no marine mammals inside 200m shut-down zone and provide any observations of responses of other marine mammal groups (as possible without conflicting with observations of focal individual/group);
- RHIB teams will provide additional visual observation support, along same lines as described above for source vessel observations;

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- RHIB teams will also collect prey field data, as possible, using existing depth sounders (50 kHz and 200 kHz sources) – either or both may be used during mysticete focal follow/CEE but just the 200 kHz sources will be used when focal species are odontocetes.

15.5. SHUT-DOWN CRITERIA (TAGGLESS CEEs)

- **Any marine mammal inside 200m shut-down zone around source vessel during transmissions;**
- **Visual detection from source boat or RHIBs of focal group or incidentally-exposed marine mammals exhibiting:**
 - o **Directed, high speed or other abnormal swimming behavior (at surface), especially toward shore;**
 - o **Unusual and abnormal surface/subsurface behavior involving apparent disorientation and confusion or dramatic changes in group cohesion;**
- Controlled sound exposures may be conducted with focal groups that include dependent calves that are not neonates. However, in order to reduce the risk of abandonment to the greatest extent possible, **if the mother-calf pair begins to become clearly separated** during sound exposure (as determined by trained marine mammal biologists dedicated to observing mother-calf pair(s)), **sound transmissions will be terminated.**

15.6. POST-PLAYBACK MONITORING (TAGGLESS CEEs)

- Source boat and/or RHIB visual teams will maintain visual (and PAM if applicable) monitoring of focal groups for a minimum of one hour post CEE;
- If the focal group separates prior to this period, the source boat and RHIBs will diverge to try and monitor the groups as possible.

16. STRANDING RESPONSE PLAN

There is little reason to believe that SOCAL-10 will result in harm to marine mammals, based on safe and successful efforts in BRS 07-08, but it is only responsible to have stranding response protocols. Strandings are common in California and could occur in the same area, even if there is no correlation with SOCAL-10. In coordination with the NMFS Southwest Regional Office, Protected Resources Division, southwest marine mammal stranding network, response contingencies are in place to ensure rapid reporting of any stranded marine mammal, facilitate response and investigation, and assess any possible relationship to SOCAL-10. These protocols are described briefly

here.

In the event of a marine mammal stranding in the southern California area during the operational phases of SOCAL-10, researchers will exchange critical information with the NMFS SW regional stranding network and the Navy. The SOCAL-10 chief scientist or a co-investigator if necessary, will provide cellular and satellite phone numbers and email contacts to the NMFS SW regional stranding network in order to receive any information on marine mammal stranding events in real time. If SOCAL-10 researchers locate a dead floating or injured marine mammal while at sea, the chief scientist or a co-investigator will provide that information to the NMFS SW regional stranding network using the following contacts:

NMFS SWR PRD

Joe Cordaro: 562-506-4315 (C);
562-980-4017 (O),
Joe.Cordaro@noaa.gov, if no answer
Sarah Wilkin: 301-755-4981 (C);
562-980-3230 (O),
Sarah.Wilkin@noaa.gov, if no answer
Chris Yates: 808-371-6184 (C);
562-980-4007 (O),
Chris.Yates@noaa.gov, if no answer
Christina Fahy: 310-809-0300 (C);
562-980-4023 (O), Christina.Fahy@noaa.gov

NMFS SW regional stranding network will then, as necessary, provide relevant information to the NMFS HQ Protected Resources office. SOCAL-10 will separately provide any information on marine mammal stranding events to the resource sponsors and through the specified liaison with the appropriate operational U.S. Navy entities.

As a general practice, SOCAL-10 will operate according to the contingencies, communications, and conditions within an established stranding response plan between U.S. Navy operations and NOAA for the SOCAL-10 operating areas. This plan is available at: http://www.nmfs.noaa.gov/pr/pdfs/permits/socal_stranding.pdf and it includes an operational response plan, initial stranding response, shutdown and restart procedures, and post investigation, debriefing, and evaluation. Some of the operational descriptions and protocols described in this document are not relevant to the experimental operations in SOCAL-10. However, as a Navy-funded and in some ways Navy-coordinated project, SOCAL-10 is aware of and will operate in accordance with this established protocol in areas where it is relevant to research and monitoring activities.

In addition to these established protocols, SOCAL-10 will provide any

communication and/or logistical support that are appropriate and useful (in coordination with the NMFS SW regional stranding network) in supporting such efforts, but will have no direct involvement in stranding response or investigations. SOCAL-10 will also provide information to the NMFS SW regional stranding network regarding whether or not sound controlled exposure experiments were being conducted prior to and in reasonable proximity (~50nm) of the stranding area and if so, provide where, when and signal types.

Following verification of a live-stranded or dead marine mammal within a reasonable range of SOCAL-10 operations, SOCAL-10 will not conduct CEEs until they confer directly (within 24 hours) with the NMFS SW regional stranding network using the contacts specified above. If, based on those discussions, there is sufficient reason for concern regarding possible association between the stranding event and SOCAL-10 operations, as agreed upon by the SOCAL-10 chief scientist and/or co-investigators and the NMFS SW regional stranding network, CEEs will be temporarily halted. Other SOCAL-10 activities (*i.e.*, visual observations, passive acoustic monitoring, and marine mammal tagging and tracking) may continue during this shutdown period (as possible and appropriate). Daily communication will be maintained between SOCAL-10 and the NMFS SW regional stranding network (and the NMFS HQ PR office as deemed necessary by NMFS SWR PR) during and following any stranding event to communicate status, review progress, and discuss whether to initiate, sustain, or discontinue any shutdown of SOCAL-10 CEEs.

17. DATA MANAGEMENT

SOCAL-10 will involve the collection of a wide variety of biological, acoustical, and environmental data, including:

- visual sightings and behavioral observations (from both source vessels and tagging RHIBs);
- photographs and video for multiple purposes (*e.g.*, photo-identification);
- acoustic tag data (animal movement and produced/received sounds);
- ship log, chief scientist log;
- permit/authorization log of location and type of animal “takes”;
- active acoustic transmissions during CEEs;
- passive acoustic data from sonobuoys and/or other hydrophones; and
- a diversity of geospatial positional data on SOCAL-10 vessels, animal sightings, and other key operational/environmental data.

The WILD system will serve as a common geospatial environment for operational awareness and archive of many of these time-synched data. However, the daily archives of WILD will only contain a sub-set of the relevant SOCAL-10 data. SOCAL-10 will not have a dedicated server and/or level support for the type of comprehensive archive conducted in BRS-08 and MED-09. However, it is essential that the above data are managed, archived, and backed up in a systematic manner to ensure their maximum utility during data analysis.

17.1 Data Collection/Archive

Each of the SOCAL-10 research teams (RHIB/tagging, source vessel visuals, sound source/PAM, chief scientist, WILD) will ultimately be responsible for ensuring that the appropriate data are being collected in an acceptable and useful format and organization. Where these teams overlap, and especially as they are input into the WILD system, there will clearly be need for cross-team coordination. However, ultimately each team (lead) is responsible for ensuring that the correct data are being collected and maintained in a timely manner with protocols for quality control/assurance.

While each team will ultimately collect and compile their own data, the SOCAL-10 chief scientist will ultimately be responsible for ensuring that the data from individual teams are either coalesced into a common daily archive (backed-up daily). All of the data integrated into the WILD geospatial data will be maintained in a daily archive within this master data archive, as will all photo-ID data, daily logs, source output data during CEEs, acoustic tag metadata, and other relevant environmental/operational data. Passive acoustic data from sonobuoys and/or other hydrophones (other than related to source transmissions) will be maintained and archived as possible (the main function of these in SOCAL-10 is to aid operational awareness), but will not be included in the daily data archive. The master archive will be constructed with a common directory by day and will be updated daily on a centralized computer and backed up on redundant external hard drives.

17.2 Data Analysis

It is understood that all SOCAL-10 participating organizations will have access to the daily data archive and/or other SOCAL-10 data during (as possible) and at the conclusion of the project. However, this is contingent on the general understanding that these data will be treated with the high level of professional courtesy and mutual respect appropriate to a multi-team partnership such as ours. Thus, participants will not release or use SOCAL-10 data without the appropriate credit, permission, or collaboration and subsequent analyses, presentations, and publications will be coordinated among the co-PIs and/or SOCAL-10 team leads.

The type, timing, and nature of specific data analyses will, of course, depend on the level of success, species tested, and nature of data collected during the project. A

follow-up meeting to summarize the data collected, develop a “quick-look” report, derive a detailed data analysis plan, and discuss the implications of the results for the planning of SOCAL-11 is being planned for November 2010 in LaJolla, CA (see below).

18. SOCAL-10 SOCIALIZING: PUBLIC/MEDIA OUTREACH AND POLICIES

18.1 SOCAL-10 Socialization Summary and Planned Events

The SOCAL-10 project (participants and sponsors) will continue the dedication to openness and transparency in plan, protocols, and results that has been demonstrated from the Bahamas 2007-2008 and MED-09 related projects. This plan for “socializing” the plans and results of the project include reaching out to conservation groups, other researchers, media, aquaria, and/or the general public, before, during, and after phases of the project. This has included and will include an extensive set of presentations and interactions at different kinds of venues (see below).

- **5 November 2009:** *Naval Postgraduate School, Monterey, CA* – B. Southall provided BRS overview and SOCAL-10 project to NPS community, including a number of local researchers and military personnel;
- **2 December 2009:** *NMFS, Southwest Fisheries Science Center, Pacific Grove Laboratory* – B. Southall provided BRS overview and SOCAL-10 project to NMFS, Pacific Grove community, including a number of local researchers and members of conservation groups;
- **7 January 2010:** *NMFS Offices of Protected Resources and Science and Technology, Silver Spring, MD* – B. Southall provided BRS overview and SOCAL-10 project to NMFS community, including staff from permitting and scientific programs and individuals from other federal agencies;
- **9-10 January 2010:** *Southern California Marine Mammal Workshop, Newport, CA* – L. Mazucca gave SOCAL-10 overview poster;
- **25 February 2010:** *Moss Landing Marine Laboratory, Moss Landing, CA* – B. Southall provided BRS overview and SOCAL-10 project to MLML community;
- **11 March 2010:** SCORE Range Briefing, San Diego, CA
- **12 March 2010:** PACFLEET Briefing, San Diego, CA
- **7 April 2010:** B. Southall, J. Calambokidis, J. Hildebrand participate in *teleconference and Q&A with NRDC and CA Coastal Commission*;
- **29 April 2010:** F. Stone, M. Weise, others to provide SOCAL-10 brief to *House Natural Resources Committee* (several other Hill briefings expected);
- **13 May 2010:** *California Coastal Commission meeting, Santa Cruz, CA* – B. Southall to provide presentation summarizing project and participate in Q&A there and follow-up;

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- **18 May 2010:** *Channel Islands National Marine Sanctuary, Santa Barbara, CA* – J. Calambokidis, B. Southall to participate in presentation and discussion on blue whale research/conservation and SOCAL-10 overview to naturalists of whale watch vessels, CINMS staff, and other local interests;
- **19 May 2010:** *Scripps Institute of Oceanography, Sumner Auditorium, San Diego, CA* – B. Southall, J. Hildebrand, J. Calambokidis (possible) to provide SOCAL-10 presentation and Q&A to SIO/NMFS SWFSC communities and jointly coordinated with American Cetacean Society, San Diego chapter;
- **21 May 2010:** Channel Islands National Marine Sanctuary (CINMS) Sanctuary Advisory Council Meeting; Brief summary of SOCAL-10 given and public summary document and link provided;
- **24 June 2010:** *Hopkins Marine Station, Monterey, CA*; B. Southall to provide SOCAL-10 presentation and Q&A to American Cetacean Society, Monterey chapter;
- **7 July 2010:** *California Coastal Commission meeting, Santa Rosa, CA* – B. Southall to participate in Q&A related to consistency determination for SOCAL-10 following 13 May presentation and the preparation of materials for CCC staff in preparation of consistency recommendation;
- **18 July 2010:** *Seymour Marine Discovery Center, Long Marine Laboratory, Santa Cruz, CA*; B. Southall to provide SOCAL-10 presentation and Q&A as part of Science Sunday lecture series;
- **16 August 2010:** *2nd International Conference on the Effects of Sound on Marine Life, Cork, Ireland* – B. Southall to provide intro/keynote lecture to conference, which will include SOCAL-10 overview;
- **18 November 2010:** B. Southall to address Channel Islands National Marine Sanctuary Science Advisory Council (Santa Barbara – am)
- **18 November 2010:** Hubbs-SeaWorld Research Institute, San Diego, CA (p.m.)– B. Southall and others to provide SOCAL-10 overview and quick look results to HSRI, SPAWAR, ACS, and other interests through SWINE forum
- **21-23 November 2010:** NMFS SWFSC, LaJolla, CA – SOCAL-10 follow-up/data analysis (21 Nov) and SOCAL-11 advance planning meeting (22-23 Nov).
- **Other promised/intended follow-up** presentations (late 2010 or early 2011 – some probably bundled) after SOCAL-10 to: NMFS HQ, ACS, CA Coastal Commission, MLML, NPS, UCSC, Cal Academy Sciences, U.S. Marine Mammal Commission.

In addition to the public meetings, and to some extent in preparation for those in May and beyond, we have developed simply-worded, publicly-available, project summaries (1-page overview, 6 and 18-page detailed project descriptions, and frequently asked questions - each is available at the SOCAL-10 centralized site www.sea-

inc.net/SOCAL10. Finally, there will be a project blog (linked from this site and possible to link to other sites as desired), as was a major success for MED-09, for summaries, photos, and (in this case) we expect videos which will be available through a SOCAL-10 YouTube page linked to website and linked to individual blogs).

18.2 SOCAL-10 Public/Media Interaction Plans and Policies

As indicated in the above list, public awareness and transparency of the SOCAL-10 project is an important element of our efforts to which the participants and sponsors are dedicated. Public and media interactions regarding SOCAL-10 will continue to be coordinated by the chief scientist and co-PIs with the resource sponsors. The resource sponsors will provide information and involve appropriate public and legislative affairs personnel within various Navy offices, as appropriate. A press release regarding SOCAL-10 will be developed and coordinated for release in early August 2010 with guidance from the resource sponsors and the involvement and agreement of SOCAL-10 collaborators. Where and how this press release appears will be discussed and agreed upon by the SOCAL-10 chief scientists/co-PIs and the resource sponsors.

Given the nature of SOCAL-10, it is important that we maintain as consistent of a public voice for the project as possible, particularly when speaking with the media but also through the various other public outlets. Thus, it is requested that all public information about the project be coordinated with the SOCAL-10 chief scientist and co-PIs/team leads rather than released by individuals or individual organizations. Anyone interested can certainly provide ideas, information, photos, video, etc, for the SOCAL-10 blog and can prepare an entry if they like, and other options for public information may be possible. However, individuals are asked to refrain from individual posting of information about SOCAL-10 operations, locations, photos, etc. on separate social networking sites. Any photographic information obtained during the course of SOCAL-10 will reference the appropriate NMFS or other permit authorization, as required.

18.3 SOCAL-10 Transmission of results

Shortly following the 2010 field season, a “quick-look” report summarizing SOCAL-10 activities, accomplishments, and lessons-learned will be completed. This will be initiated in preparation for the “hotwash” meeting on 2 October at the end of phase II in San Diego and completed at the SOCAL-10 wrap-up/SOCAL-11 planning meeting in LaJolla 21-23 November 2010. The targeted release of the quick-look report will be discussed and coordinated with the SOCAL-10 team and resource sponsors. It will be a

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public document, but may be specifically provided to various entities and individuals within the Navy, NOAA, and/or other entities (e.g., Marine Mammal Commission; CA Coastal Commission). As noted above, summary briefings following the quick-look report are expected and will also be coordinated among the SOCAL-10 and resource sponsors.

In the longer term, it is hoped and expected that there will be multiple scientific presentations and publications resulting from SOCAL-10. All of these scientific products will be unclassified. Inclusion of team members as contributing authors in these products will be according to the publication policy statement developed and agreed upon within the SOCAL-10 team. All publications and presentations will reference and acknowledge the appropriate permissions/authorizations, participating organizations, and funding entities.