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Independent Observer Report on the 2010 Astokh 4-D Seismic Survey

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Astokh Lease Area 4-D Seismic Survey

Independent Observer Report

Piltun lagoon region, Sakhalin Island, Russian Federation

Observation period: 8 – 22 June 2010

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INTRODUCTION

The appointment of an independent observer (hereafter IO) position was recommended by the Western Gray Whale Advisory Panel (WGWAP) and its Seismic Survey Task Force (SSTF) to evaluate the efficacy of the monitoring and mitigation program (M&M program) developed for the 4-D seismic survey conducted by Sakhalin Energy in the Astokh lease area off northeastern Sakhalin Island from 18 June to 2 July 2010 (for details see the SSTF and WGWAP reports at www.iucn.org/wgwap/). Terms of reference for the IO (see Annex A) called for, *inter alia*, a full report on the implementation of the M&M program, including the documentation of any exceptions or changes to the agreed protocol during the survey. The report was expected to contain sufficient detail to assist the WGWAP in undertaking a full analysis and review of the program. It was also expected to include the IO's overall conclusion on whether the plan had been implemented successfully and recommendations on how to improve future surveys. Specifically, the report was to consist of the following elements:

- an overall summary of the IO schedule, activities and general impressions;
- a detailed summary of observations of each land-based team (*e.g.* acoustics, behavioral stations), including an assessment of efficacy and lessons learned;
- a detailed assessment of how well communication within and between teams did or did not work during the survey; and
- a detailed assessment of the overall efficacy of the agreed protocols.

This report follows that structure.

All observations were made from shore in and near the Piltun field camp on Sakhalin Island between 8 and 22 June 2010. Operations were recorded in rough field notes (transcribed in full as Appendix I). These were then used as the basis for the summaries and assessments as called for in the terms of reference.

LAYOUT AND COMPONENTS OF THE FIELD CAMP

The layout of the Piltun field camp (Fig.1) comprised:

- (a) two onshore observation towers (Fig. 2), from which real-time visual monitoring for whales in the mitigation zones was conducted;
- (b) an acoustics station (Fig. 3), where all data from the buoys along the perimeter monitoring line (herein PML) were processed and where decisions concerning noise base cases were made for dissemination to all parties; and
- (c) the main Base Camp (Fig. 4), where all operations were coordinated (*e.g.* advisories to and from the seismic vessel *Pacific Explorer* and the PML monitoring vessel *Pavel Gordienko*, relays between the towers and the acoustics station).

Although the WGWAP had initially envisioned that an observer be present on the seismic vessel (http://cmsdata.iucn.org/downloads/wgwap_4_report_final.pdf, see Item 10.2) and later concluded that it would be preferable to have the observer aboard the PML monitoring vessel (http://cmsdata.iucn.org/downloads/wgwap_7_report.pdf, see Item 5.2.2), it was finally determined

that the IO should be based on shore at the base camp, noting that this was where “all of the data used to implement the monitoring and mitigation plan, other than observations from the observation vessel of whales in the overlap zone, would be processed and applied in operational decision-making” (http://cmsdata.iucn.org/downloads/wgwap_8_report_final.pdf, Item 4.2.2). The panel also concluded that the IO should be “on-site during observer and safety training prior to going on-site for the survey” and that he would not need to be on-site for the whole survey, “especially if weather delays the survey substantially.” It was anticipated that by two weeks into the planned survey time, the monitoring and mitigation program would be operational and tested. Therefore the final terms of reference called for a minimum of about ten days of observation time (Annex A).

GENERAL SCHEDULE DURING VISIT OF IO

A summary of the activities undertaken during the period the IO was present on Sakhalin Island is given as Table 1. Note that the IO did not visit either of the vessels during operations.

Table 1

Summary of activities that took place during the period 8-22 June 2010

Period	IO activity	Onshore teams	Acoustic team	<i>Pacific Explorer</i> (seismic vessel)	<i>Pavel Gordienko</i> (research vessel)
08-09 June	Observed pre-survey setup	Set-up phase	Telemetry station 9 deployed	In transit to acquisition area	In acquisition area. First buoy deployed R1 on the 8 th .
10 June	Observed pre-survey operations at southern observation tower in morning. Base Camp from 1240	Began operations. Southern tower fog at 0920. North tower communications problems solved	Communications problems solved. Stations 1,3,5,7,9 deployed, PML buoy calibration finished	In transit to acquisition area	Set-up phase
11 June	Observed pre-survey operations at southern observation tower	Operational	Stations 2, 4,6, 8 deployed, all buoys operational	In transit to acquisition area	Communications procedures between vessel and onshore teams established
12 June	Observed pre-survey operations at northern observation tower in morning, acoustics station in afternoon	Operational	Operational but calibration experiment could not be undertaken (see <i>Pacific Explorer</i>)	Streamer issues, could not carry out calibration experiment	Operational
13 June	At base camp	Poor weather, no operations	Problems persist, could not conduct experiment	Logistical problems, could not carry out experiment	Reports of chickenpox, no survey
14 June	Observed Base Camp operations in early morning, southern tower in late morning and northern tower in afternoon	Operational	Batteries in mini-AUR had to be replaced	Weather and technical delays, survey not started	Operational, communications with shore functioning
15 - 17 June	Poor weather, no operations, remained at base camp	Poor weather, no operations	Poor weather, no operations	Poor weather, no operations. SSV Completed 00:46 on 17th	Poor weather, no operations
18 June	Observed operations at southern	Operational, communications	Operational, noise base cases identified	Survey begun, Line 11(B) completed,	Focal follow in morning, worked with

	observation tower	effective		Line 6(A) scheduled, cancelled due to technical issues	<i>Pacific Explorer</i> in afternoon
19 June	Observed operations at acoustics station	Operational, tracked whales in morning, poor visibility (variable fog) in evening	Operational but some communications problems: acoustic station to <i>Pavel Gordienko</i>	Line 2(A) completed, line 28(B)-completed, line 6 has A and B components so line initiated at 19:03 strictly to acquire noise base case, then cancelled at 19:08 due to poor weather conditions (fog)	Worked with <i>Pacific Explorer</i> , needed to take on water, took more time than allocated, problematic
20-21 June	Poor weather, no operations, remained at base camp	Poor weather (fog), no operations	Poor weather (fog), no operations	Poor weather (fog), no operations	Poor weather (fog), no operations
22 June	Observed operations at Base Camp	Fog in morning, some poor weather in afternoon	Operational	Line 26(B) acquired, line 6 B component OK but shutdown for A, moved to start of line 33(B)	Monitored line 6 as shore-based monitoring not possible, 4 observers used during acquisition

INITIAL IMPRESSIONS

It was my impression that the Sakhalin Energy staff and contractors based at the Piltun field camp were intent on following the M&M program fully, including beginning the survey as soon as was feasible. However, in the final phases of set-up and while initial operations problems were being addressed (*i.e.* the “shakedown” phase), delays and technical problems in survey start-up occurred, involving a suite of issues:

- (1) After the initial declaration of “ice-free” conditions, a reported southerly moving ice field required monitoring since if present in the operations area, it would impede deployment of the acoustic monitoring buoys along the PML;
- (2) The rigging aboard *Pacific Explorer* required repair (the initial rigging was only suitable for temperatures far warmer than encountered during the survey, *i.e.* it was inappropriate);
- (3) The mini-AUR buoys for the Sound Source Verification (SSV) experiment (to determine the ensonification radius around *Pacific Explorer*) were deployed with short-life batteries that were only appropriate if the *Pacific Explorer* could begin operations quickly – they had to be replaced on 13 June to allow the SSV experiment to take place;
- (4) A person contracted chickenpox aboard the *Pavel Gordienko* and required medical attention;
- (5) During observations on 12 June, concern was raised over a slight disconnect in day-to-day operations between the shore-based teams (Base Camp, the acoustics station, and the observational towers) and vessel operations (*Pavel Gordienko* and *Pacific Explorer*). Though communications were well established, what specifically was going on during *Pacific Explorer* preparations and deployment was not always clear to those on shore. It was evident that, while pressed for time to begin the survey, *Pacific Explorer* communicated essentially what was happening aboard the vessel and nothing more. Further along in the

survey, more detailed descriptions of how and what was being addressed aboard the vessel during this time were communicated to shore and documented.

Unforeseen practical difficulties are common in all fieldwork and the Sakhalin Energy personnel worked hard to address them. However, the use of inappropriate rigging was clearly avoidable. With respect to the shore/vessel disconnect, it is understandable that each team knows its own tasks and *modus operandi* best. I suggest that in the future, an occasional brief exchange of personnel would help tighten the survey by improving mutual understanding of how the “other side” operates.

DETAILED SUMMARIES OF OBSERVATIONS OF LAND-BASED TEAMS

In this section, I provide a detailed summary of my observations of each land-based team as well as an assessment of efficacy and lessons learned.

North and South observation teams

The observation towers were positioned to allow effective visual monitoring of whales in the area predicted to be the most heavily ensonified by the survey. To enhance the accuracy of theodolite readings (which allow the positions of whales to be determined accurately), a free-standing independent tower within a tower had been constructed (Fig. 2). This allowed the observers to move around the theodolite device without disturbing readings. It also meant that the primary tower structure could be used to provide observers with some shelter from the nearly constant winds in the Piltun area.

Each tower was manned by an experienced scientist and two assistant observers. The general protocol involved a 20 min period of focused observation for whales, once an hour. The lead scientist would ask each of the assistants to concentrate on a specific area of ocean for a specified amount of time until the entire 180° arc from the shoreline had been covered. Data were recorded using a dedicated software system. When informed by the Base Camp of new noise base cases (see ‘Acoustics station’ below), the tower teams adjusted their data collection systems to determine whether a sighted whale was within the appropriate noise base case incursion zone.

IO Assessment

The towers were well constructed and the protocols for monitoring the mitigation zones from shore were sound. Both lead scientists and all assistant observers appeared highly competent and diligent in implementing the agreed protocols. Communication between the teams was efficient and congenial throughout the period of observation. Focal follows were initiated several times while I was observing the work, and these appeared to be effective. For example, on 18 June a whale was sighted on a bearing that would eventually put it in the sound exclusion zone, and a focal follow was initiated. Although technical issues aboard *Pacific Explorer* prevented line acquisition and eventual cancellation of the line, both towers were aware of the situation and were prepared to initiate a shut-down if the need had arisen.

Lessons learned and suggestions for the future

(1) Rotation system. Although additional work was undertaken when the 20 min per hour focused scans were completed (*e.g.* setting wind screens on the tower, fashioning monopods on which to rest binoculars during focused scans), a formalized rotation system could be developed wherein two observers remain passively scanning during the 40 minutes of down time between focused scans,

and rotating the third observer down off the tower, for example. This would allow more opportunity for rest out of the weather, with the increased likelihood of whale detection as a benefit. This would also assist if there were a longer effective working day (see below).

(2) Longer working day (see Appendix I, 10 June). Sakhalin Energy requires that drivers are used to transport workers to and from all posts (observation towers, the acoustics station, etc.). These journeys are usually less than about 15 minutes, but Sakhalin Energy policy limits a driver's working day to 12 hours. The value of such a rule if there is a need for extensive driving is clear. However, effective driving time per day is often only one or two hours. Strict enforcement of this policy requires that the observers must cease work long before sunset (at this time of the year, weather permitting, observations could occur from approximately 0500-2300). On good days, this can slow down the pace of the seismic survey; completion of the survey as quickly as possible is the primary mitigation tool and the survey is not allowed to proceed unless monitoring is occurring. Recognizing the possible difficulties, I would strongly urge that every effort be made to find a practical solution to the driver issue in any future surveys to enable longer working days when sighting conditions are good.

Acoustics station

Located between the North and South observation towers (see Fig. 1), the acoustics station consisted of three major antennae receiving data from the PML buoys and a small enclosure to accommodate the acoustics team and their equipment (Fig. 3). The station was permanently manned by between two and five full-time technicians whose tasks were to:

- (1) process the incoming acoustic signals,
- (2) monitor the PML buoys and
- (3) determine the appropriate noise base cases¹ as needed throughout the survey and transmit the information to Base Camp.

Each time new noise base cases were determined, it was the responsibility of the Base Camp to inform the observation towers and the two vessels (*e.g.* Appendix I, 19 June 1005-1009 hr) and to confirm that the information had been received. In all observed instances this process appeared to work well, with the necessary information conveyed to all posts in a clear and timely manner. For example, on 19 June, as lines changed, the acoustics station produced and transmitted new noise base case information five times throughout the day (0950, 1009, 1416, and 1912 and 1918 hr).

IO Assessment

It was apparent during observations that the acoustics team was knowledgeable and experienced. They were able to explain clearly the processes for determining noise base cases, as well as general marine acoustics theory and how it pertains to marine mammals. Their manner of handling and processing the immense data flows was efficient and well planned. For example, during model selection for the noise base case on which to conduct A line L-2, on 19 June, the acoustics team

¹ Noise base cases were determined via acoustic information gathered from the PML buoys and processed via a custom computer model that used the noise levels received at the buoys to estimate how far across the PML the incursion of sound occurred. This information was then conveyed to Base Camp, and from there to the onshore teams and vessels.

required approximately four minutes from initial receipt of noise data from the PML buoys to selection of the noise base case and reporting of this to the Base Camp (Appendix I, 19 June 1005-1009hr).

Lessons learned and suggestions for the future

(1) Increased frequency of noise base case determinations. Given the competence and efficiency of the acoustics team, it should be feasible to initiate a re-determination of the noise base case midway during a line (*i.e.* well after the initial noise base case has been determined, disseminated, and confirmed by all posts). This may provide a more accurate assessment of sound incursion across the PML. Such a procedure, although more time-intensive than at present (the additional time to process the incoming sound, determine a new noise base case, and disseminate should be on the order of around 5 minutes), would provide an opportunity to determine whether whales that were sighted outside the “old” noise base case incursion zone have moved into the “new” incursion zone (should the need for a new noise base case be agreed), and *vice versa*.

Base Camp

The operations shelter, or Base Camp (Fig. 4), was central to the implementation of the entire M&M program. During the survey, all advisories and updates were routed through Base Camp. Base Camp consisted principally of a communications hub (multiple radios for communications with the vessels and field posts) and a logistics computer for planning acquisition lines (*i.e.* seismic lines to be shot) and processing the information needed for making a variety of decisions in the field. A spare communications system was in place and available for use if needed.

IO Assessment

Base Camp operations ran largely uneventfully and efficiently. However, I did note the lack of an objective (*e.g.* no estimation) spatial software system for planning courses of action during the survey (see below for explanation). Survey operations during 22 June (Appendix I, 22 June, 1546-1706hr) highlight this. Fluctuating visibility conditions that day affected the process of deciding whether to continue surveying A line L-6 past the B component section and into the A component section. When the shore-based observers cannot operate due to fog, as on 22 June, the decision on whether to continue the seismic survey depends on whether the monitoring vessel (*Pavel Gordienko*) is judged by the Base Camp to be able to observe the sound incursion zone across the PML adequately while the seismic vessel surveys into the A component of the line. To determine this, the Base Camp personnel estimated by hand (as opposed to using software-based processes) the expected visible region for observers on the *Pavel Gordienko* on Mapview against the model-estimated incursion zone, the PML and the seismic line. From this approximation they decided whether they believed *Pavel Gordienko* could fulfill its role and the survey could continue.

Lessons learned and suggestions for the future

The simplest way to improve the situation described above would be to install an appropriate GIS/mapping program such as *ArcMap* or *OziExplorer*, as well as suitable protocols, to allow more precise monitoring of vessel positions and expected visibility with respect to the PML, A lines, incursion zones, and change-overs from B to A components of shot lines. Additionally, because of the remoteness of the Astokh survey area, more robust spatial planning systems (requiring stable

power supplies or internet connections) may need to be physically located outside the field camp. This was accomplished during the survey with other planning systems (located in Sakhalin Energy's Yuzhno-Sakhalinsk base of operations), and these appeared to have worked well.

COMMUNICATIONS

The Astokh seismic survey and its associated M&M program had numerous elements that required considerable co-ordination, as well as rapid decision making based on multiple data sources and prompt transmission of those decisions to the full team. Communications thus had to be rapid, clear, and reliable. Sakhalin Energy had obviously worked hard to achieve this. During my direct observation of Base Camp operations, communications with *Pacific Explorer* employed a system of triple redundancy for communications, consisting in descending order of preferred usage: (1) direct radio contact, (2) use of mobile phones to contact the vessel, and finally, if all other systems were engaged or not functioning adequately, (3) a satellite phone. Occasionally messages were relayed by the acoustic team when direct radio contact between the *Pacific Explorer* and base camp was not possible. In general, the systems worked well during my stay (e.g. Appendix I, 22 June between 1546 and 1739hr, including a period when the satellite phone had to be used as backup). Both Base Camp and *Pacific Explorer* were clear about advisories concerning weather, the state of the sound source array, and when and where ramp-ups and full ensonifications were to occur (e.g. Appendix I, 22 June, 1706-1732hr).

It was also my experience that communications among the onshore components of the project worked well. Advisories concerning weather and state of equipment were transmitted in near to real time, and backup systems were deployed in a controlled and competent manner when needed. When a whale or whales were thought to be approaching or entering the shut-down zone, notices were broadcast to all posts, and all parties involved were aware of the situation and prepared for potential shut-down. While no shut-down occurred due to this type of event during my time at the Piltun camp, an example of readiness for such an incident can be found in Appendix I (18 June, 0623-1100hr, with notes following the day's report).

My only experiences of communications difficulty involved Base Camp's attempts to communicate with the PML monitoring vessel, *Pavel Gordienko* (see Appendix I, 19 June, approximately 1155-1918hr). Although the circumstances on that day were unusual (i.e. the vessel needed to take on water and environmental conditions were deteriorating), clear, concise instructions from the head of operations (K. Broker) on when and where *Pavel Gordienko* should begin moving and establish its position were completely ignored. My interpretation is that the expedition leader ignored the instructions because of the likelihood that the survey would be suspended due to the weather. While this is in fact what eventually transpired, such maverick behavior by a vessel captain could lead to serious issues with respect to the implementation and effectiveness of the M&M program.

ASSESSMENT OF OVERALL EFFICACY OF THE M&M PROGRAM

The M&M program for this survey was one of the most complex in the history of the marine seismic industry. The evident attention to detail as outlined above (e.g. regular line-by-line updates on sound incursion into critical areas, close to minute-by-minute position updates to the PML monitoring vessel *Pavel Gordienko*) demonstrated that the people responsible for implementing the program carried out their work in a serious, professional manner. The Astokh survey area is

exceptional in at least two ways: Firstly, it is rare for an extensive overlap to exist between a primary distribution area of an endangered marine mammal species and extensive oil and gas operations, and secondly, the proximity of the whales to shore allows for shore-based monitoring. Though the same monitoring and mitigation protocols will not necessarily be appropriate for application to seismic surveys in other areas, the Astokh survey M&M program (and the cooperative manner in which it was developed, see below) should serve as a benchmark for marine seismic surveys that occur in the vicinity of environmentally sensitive areas for other threatened cetacean populations.

The M&M program represented the result of more than two years of extensive analysis and planning on the part of Sakhalin Energy and the Seismic Survey Task Force of the WGWAP. While this investment of time and resources may appear extreme, there is no way to avoid a substantial investment of this kind to produce effective measures that work as they were designed to. It is my opinion that within the overall goals of a M&M program, be it for fully pelagic or near-shore seismic survey operations, the Astokh 4-D survey (as I was able to observe it from 8–22 June 2010) came as close as possible to creating an environment where a vulnerable population of whales is protected from harmful exposure to operations-associated airgun noise in a practical, deployable way.

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ANNEX A

Independent Observer for Astokh 4-D Seismic Survey – TERMS OF REFERENCE

Sakhalin Energy will conduct a 4-D seismic survey of the Astokh lease area during May-June 2010. Sakhalin Energy and WGAP, primarily via the Seismic Survey Task Force (SSTF), have jointly developed an integrated monitoring and mitigation program to minimize the effects of the survey on western gray whales and to maximize data collection to assist in the planning of similar programs for future seismic surveys. Inevitably, these programs are complex, particularly in remote areas, and require decisions to be taken in the field in real time based on the guidance provided in the monitoring and mitigation plan. Implementation of the plan will require prompt integration of information of a number of types (e.g. acoustic, visual sightings, observed behavior) from a number of sources (buoys, vessels, shore stations).

In order to evaluate the effectiveness of the monitoring and mitigation program, and also to provide a degree of transparency and public confidence, Sakhalin Energy and the SSTF agreed that an independent observer should be present to develop a firsthand report on the effectiveness and implementation of the plan and to provide any recommendations for improvements. The qualifications and duties of the independent observer (IO) are given below.

Qualifications:

- (1) Be able to speak English and communicate on progress with the lead operator offshore.
- (2) Be able to communicate effectively in real time with the crew of the vessel including the senior MMO.
- (3) Have completed the Sakhalin Energy basic safety training program for shore-based personnel or an approved equivalent.
- (4) Be in possession of any Russian documentation needed to undertake the duties outlined in these Terms of Reference.
- (5) Have experience in cetacean fieldwork.
- (6) Have an understanding of the issues surrounding seismic surveys and whales, including knowledge of seismic acquisition operations and procedures.
- (7) Have a good understanding of the monitoring and mitigation plans and the reports that led to their development.
- (8) Have a good understanding of the acoustic data expected to be received and the ability to interpret such data in the light of the monitoring and mitigation plan.
- (9) Be able to monitor the progress of the vessel in the light of A- and B-lines (and any truncation thereof).

Duties and collaboration:

- (1) Comply with all Sakhalin Energy safety requirements.
- (2) Behave courteously and responsibly at all times.
- (3) Arrive on Sakhalin Island in time to complete necessary safety training and then mobilize with the field teams in advance of the start of the survey. Remain on site for at least half of the actual seismic survey (~10 days depending on weather).
- (4) Receive and review, in near real time, visual and acoustic data relevant to implementation of the monitoring and mitigation plan and thus to evaluate compliance with the plan and/or any difficulties in its implementation [the IO will be on shore and will be able to view the acoustic data coming from the real time monitoring buoys].
- (5) Co-operate with the senior MMO and provide advice where appropriate on the implementation of the plan, whilst recognizing the existing decision-making structure [the IO has no authority to start or stop any operations].

- (6) Provide real or near real-time feedback, while in the field during the survey, to IUCN and to Sakhalin Energy about any apparent gross violations of the protocols set forth or other observations of serious concern.
- (7) Present a full report to IUCN on the implementation of the plan and document any exceptions or changes to the protocol should they occur. The documentation should be of sufficient detail to allow for a full analysis and review of the program, including an overall conclusion on the success of the implementation of the plan and recommendations for improvements for future surveys, if appropriate. The report will include:
 - (a) A general summary of IO schedule, activities and general impressions;
 - (b) A detailed summary of observations of each on-land team (e.g., acoustics, behavioral stations), including an assessment of efficacy and lessons learned;
 - (c) A detailed assessment of how well communication did/did not work within and between teams during the survey; and
 - (d) A detailed assessment of the overall efficacy of the protocols established by WGWAP and Sakhalin Energy for the survey.

The report will be authored by the IO and made public by IUCN after acceptance by the Panel. The draft report will be subject to review by Sakhalin Energy to ensure factual accuracy, following a procedure similar to that used for WGWAP reports.

Other:

1. All contractual, travel and financial arrangements will be made by IUCN
2. There are regular scheduled telephone conference calls to shore from the seismic operations in which it is possible that the observer could participate.

APPENDIX I

FULL FIELD NOTES AS TAKEN DURING THE ASTOKH LEASE AREA 4-D SEISMIC SURVEY

08 JUNE

- ~14:00 Arrive at camp.
- General introduction by K. Broker.
- Ride to acoustic station and observational towers (photos taken).
- **Impressions: Very well organized considering conditions of Sakhalin in general. Camp and observational outposts are setup up to execute well despite adverse conditions. General competency of leads seems high.**

09 JUNE

- o Weather: Conditions overcast, quite windy with ~ 25-30 mph gusts.
- 0952 Acoustics: communications logistics between ship and shore are being worked out.
- 1016 Acoustics: acoustic monitoring radio telemetry station 9 deployed; was an opportunity to deploy all acoustics buoys, but because permitting allows operations to begin only after 10 June, this was not attempted.
- 1300 main camp: Communications link (email, etc.) down.
- **Impressions: Possibly add limited flexibility for such occurrences into the permit, as environmental conditions will vary. This will hopefully help in getting the survey underway as soon as is feasible.**

10 JUNE

- o Weather: Conditions sunny with light breeze.
- 0806: Head to South tower.
- 0826 south tower: observed collection of environmental variables, as well as ten degree per minute readings. Execution is professional. Procedure is 20 formal scan with 40 minute passive scanning (*e.g.* a normal non-dictated scan).
- 0848 south tower: Vessel sighted; was walked through recording of vessel.
- ~0920 south tower: Fog noted; formal arc readings abandoned for lack of horizon.
- ~1044 Acoustics station/north tower: Communications problems solved. Consists of three lines of communication, in order of usage:
 - Direct radio contact
 - Mobile phone
 - Satellite phone
 - If required, relay through acoustic camp
- Length of day: Deployment of acoustic monitoring radio telemetry stations along the Perimeter Monitoring Line in an offset pattern (*e.g.* deploy buoys 1, 3, 5, 7, and 9 on 10

June to establish a minimum coverage of 5000 m, and deploy buoys 2, 4, 6, 8, on 11 June (planned) to complete deployment of acoustic monitoring radio telemetry stations and establish a coverage of every 2500 m.

- Buoy deployment:
 - o 9: 0900
 - o 7: 1000
 - o 5: 1100
 - o 3: 1230
- **1240 Base Camp:** Informed by Roberto / Koen of ice field north of northern oil platform; extends from shore to possibly ten km offshore. Currents headed south, but southerly wind holding ice for now. Buoys 1, 3, 5, 7, 9 will be deployed by end of day, establishing minimum of 5000 m coverage. Plan is currently to go ahead with deployment of buoys 2, 4, 6, 8, tomorrow, ice field allowing (photos taken).
- **1330 Base Camp:** Roberto reports PML buoy line calibration is finished. All buoys are working within specified parameters.
- **Impressions: Sakhalin Energy's 12-hour driver limit rule seems to have a hampering effect on observer operations during extended daylight in the spring and summer. Effectively what is happening is observers are driven (they do not drive themselves as per SE's rules) to their posts at the beginning of the day (0530 for example), which effectively limits operations in that day to 1730 hours in the afternoon, while sunlight is still clearly available. The drivers themselves physically drive to the post (~15 minutes maximum) and are ready to drive at any point within those 12 hours, but effectively do not do much of anything in the intervening time; Use of Malme et al. 1984 is usage of a paper that is 26 years old.**

11 JUNE

- o Weather: Conditions sunny, light breeze; warm. Excellent sighting conditions.
- 0800 north tower: survey for ice indicates relatively ice-free conditions, with occasional pieces ~ 15 m in size offshore.
- 0822 north tower: informed last four acoustic monitoring radio telemetry stations are being deployed (8, 6, 4, 2).
- 0908 south tower: No whales.
- 0938 pipeline onshore location (where oil pipeline makes landfall, south of southern tower): surveyed.
- ~1207 distribution team location (varied): 3 whales spotted south of south tower behavior team post. Distribution team has whales spotted, as did the south behavior team.
- 1430 north terminus of distribution team survey locations, south of mouth of Piltun lagoon: surveyed to verify ice-free conditions onshore (was ice-free).
- ~1520 Acoustics station: stopped to check progress of acoustic monitoring radio telemetry stations. All buoys reporting in and operating correctly.

12 JUNE

- Weather: Conditions partially overcast, light southerly breeze.
- ~1100 proceed to north tower; observing operations. Nothing of note to report.
- ~ 1500 Proceed to Acoustics Station; observing operations. *Pacific Explorer* is having streamer issues. Apparently the securing bungee lines are too tight, causing a breakage in the streamer system. This is an issue because the mini-AUR buoys are set and ready for the SSV experiment, but they only have a battery life span of a day-and-a-half. Meaning *Pacific Explorer* must have its systems fixed by 1200 tomorrow (the 13th), OR the batteries on the mini-AURs must be replaced.
- **Impressions: It seems there may be a slight disconnect between the actual day-to-day operations aboard the acoustic vessel, and the day-to-day operations of the shore-based teams. Though this is a natural occurrence in that each team knows their own jobs better than they do the other's, but an occasional exchange of personnel may help tighten the survey even further (e.g. each side gains a respect and appreciation for how the other side operates in the day-to-day conditions of this particular seismic survey). The exchange would not have to be extensive or intensive, just a familiarization between all the parties involved with each other's operations.**

13 JUNE

- Weather: Overcast and windy; fairly cold.
- 0645 Base Camp: Informed by Koen Broker that the batteries on the mini-AURS are being replaced, as *Pacific Explorer* is not ready to begin the SSV experiment.
- ~ 1200 Base Camp: Reports of chicken pox aboard the *Pavel Gordienko* has delayed SSV buoy retrieval.
- **Impressions: Possibly build in contingency days, as it seems the survey may need them; all shore based operations are indicated as ready for the survey to begin.**

14 JUNE

- Weather: Sunny, light westerly breeze. Very nice day.
- 0630 – 0930 Base Camp: Preparations for a late start to seismic operations; Survey seems a bit squeezed at this point.
- 1035 south tower: Impressions of survey are that lead technicians are well prepared; everything going smoothly; performing a focal follow of a whale is competent.
- 1201 south tower: Shore-to-shore communication is effective, e.g. “everyone is on the same page”; shore to *Pavel Gordienko* communications seems to be hitting a snag in the translation; It is not bad, but not as effective as it could be.
- 1201 south tower: South tower notifies north tower of the 1035 whale sighting; whales moving in that direction. Communication effective.
- 1330 north tower: observations of operations in north tower indicate more of the same, e.g. good teamwork.

15 JUNE

- Weather and technical issues preclude anything of note.

16 JUNE

- Weather and technical issues preclude anything of note.

17 JUNE

- Weather and technical issues preclude anything of note.

18 JUNE

- o Weather: partly foggy with fog on horizon, 4-5 km visibility.
- 0610 South tower: Survey has begun, observations in progress. Acoustics offset initially **Base+ 2**.
- 0623 South tower: Line 11 noise base case is tuned to **High + 4**.
- 0623 South tower: Whale sighted; tracking/ focal follow initiated.
- 0623-0800 South tower: Base checking communications about every 20 minutes.
- 0800 South tower: tracking same whale, focal follow continues; whale headed north, South tower notifies North tower of movement.
- 0820 South tower: Whale continues to head north, South tower continues track.
- 0900 South tower: Focal follow of whale discontinued as whale heads north (not in A zone); day has become clear though a bit hazy; focused scan initiated.
- ~0925 South tower: scan complete.
- 1005 South tower: Focused scan initiated; Base communicates with *Pavel Gordienko* to remain stationary and perform a focal follow. Communication is effective, though again, don't know if a language barrier or otherwise prevents more efficient communications.
- ~1025 South tower: focused scan picks up whale, focal follow initiated; weather remains clear.
- 1050 South tower: Scan continues; North tower prepared for "hand-off" of whale.
- 1051 South tower: *Pavel Gordienko* instructed to be 2 km south of *Pacific Explorer*, and 1 km east of the Perimeter Monitoring Line; told to sail south and scan for whale, and if present, to initiate a focal follow.
- 1054 South tower: *Pavel Gordienko* begins scan south.
- 1112 South tower: Focused scan started; fog bank slowly moving in.
- 1204 South tower: Fog rolling in from south.
- ~1234 South tower: Fog clearing.
- 1304 South tower: Focused scan initiated.
- ~1324 South tower: End focused scan.
- 1400 South tower: A line number 6 is tuned to **High +1**, estimated start time 15:40.

- 1400 South tower: Base repeats instructions to towers, strictly to be clear about who is doing what when.
- 1405 South tower: Focused scan started.
- 1425 South tower: End focused scan.
- 1434 South tower: South tower instructed to communicate any sightings over the next 1 hour, 50 minutes to *Pavel Gordienko*.
- *Pacific Explorer* ramp-up begin.
- 1518 South tower: *Pacific Explorer* getting ready to start line.
- 1518 South tower: Base -> *Pavel Gordienko*: requests position confirmation and requests *Pavel Gordienko* to begin survey 1km in front of *Pacific Explorer*.
- 1520 South tower: Base requests conditions update from South tower (good); whale sighted as well.
- 1544 South tower: A line cancelled (tech problems?).
- 1620 South tower: focused scan initiated; issues communicated with *Pavel Gordienko*.
- 1640 South tower: End focused scan.
- **Note: the 1520 whale sighting most likely would have triggered an A zone shutdown, though this did not happen because of technical issues aboard *Pacific Explorer*, all parties involved were aware of this impending shutdown potentiality, and were prepared for it.**

19 JUNE

- o Weather: partly cloudy.
- 0824 Acoustics station (herein acoustics): observations for duration of day.
- 0824 Acoustics: Acoustics -> Base Camp: logistics discussed involving *Pavel Gordienko*'s position prior to beginning of the next A line, line L-2.
- 0838 Acoustics: Base -> *Pavel Gordienko*: advises *Pavel Gordienko* to begin scans for whales.
- 0856 Acoustics: Acoustics station informs base of ship positions in preparation for line acquisition.
- 0902 Acoustics: Base checks behavior stations status.
- 0915 Acoustics: Appears to be too much communication between acoustics and *Pavel Gordienko* (*Gordienko* will not stop talking).
- 0919 Acoustics: Base-> Acoustics: Expected beginning of line is in: 45 minutes.
- 0920 Acoustics: *Pacific Explorer* to test single gun firing after which ramp-up will start.
- 0921 Acoustics: Base -> *Pavel Gordienko*: Positional fine-tuning (making sure *Pavel Gordienko* is in the right position before start of line acquisition).
- 0922 Acoustics: Base -> South tower: Check for sightings (none).

- 0923 Acoustics: Acoustics-> Base: communicates SSV predictions: **1.2 km for 180 Db, 530 m for 190 db.**
- 0940 Acoustics: Acoustics -> *Pacific Explorer*: Communications are not quite working yet; switch to 16, nothing.
- 0945 Acoustics: Acoustics -> Base: Base advised to inform *Pacific Explorer* to let Base know when line starts, and for Base to subsequently call Acoustics when this is known (e.g. back up system of communication initiated, and worked adequately).
- 0947 Acoustics: Base attempts to reach *Pacific Explorer* via VHF (nothing), switches to phone call.
- 0950 Acoustics: Noise base case: **High +1.**
- 0950 Acoustics: North Tower -> Base: Question about cases, informed that the initial case will be **High +1**, as well as informed that this will be tuned within 10 minutes of the start of the line.
- 0957 Acoustics: Base -> North Tower: Requests information on *Pavel Gordienko* Positioning.
- 0959 Acoustics: Base -> South tower: Requests visibility update (variable to the south, can see *Pavel Gordienko* east of the Perimeter Monitoring Line.
- 1001 Acoustics: *Pacific Explorer* -> Base: Advises 1 minute, 20 seconds to start of line 2.
- 1002 Acoustics: Base -> Acoustics: advises acoustics of start of line.
- 1002 Acoustics: Base -> Distribution teams: teams advised of start of A line L-2, and to begin surveys in 5 minutes.
- 1003 Acoustics: *Pacific Explorer* -> All positions: A line L-2 started, estimated line time: 1 hour, 50 minutes.
- 1003 Acoustics: Base -> *Pacific Explorer*: Info repeated back, and to all stations; *Pacific Explorer* advised that North behavior station currently has slightly reduced visibility conditions.
- 1003 Acoustics: *Pacific Explorer* advises that *Pavel Gordienko* take over observations in the north if needed.
- 1005 Acoustics: Base -> *Pavel Gordienko*: Informed of shooting; *Pavel Gordienko* confirms receipt of communication.
- 1005 Acoustics: Acoustics team inputting data.
- 1009 Acoustics: Acoustics -> Base: Noise base case tuned to **Base +3 for line 2.**
- 1009 Acoustics: Base -> towers: Base relays noise base case to both towers (towers confirm receipt of communication).
- 1011 Acoustics: Base -> *Pavel Gordienko*: Base informs *Pavel Gordienko* of noise base case (*Pavel Gordienko* confirms receipt of communication).
- 1011 Acoustics: Base -> *Pacific Explorer*: Base informs *Pacific Explorer* of noise base case (*Pacific Explorer* confirms receipt of communication).

- 1012 Acoustics: North tower -> South Tower: Informs South tower of whale headed south, close to shore (e.g. not in A zone).
- 1017 Acoustics: Roberto confers how the real time tracking works, with the dashed line (limit) vs. model estimate (solid), vs. real time signal received.
- 1035 Acoustics: North tower-> South tower: Still tracking whale, checks for “pick-up” of whale by South tower (has South tower confirmed sighting this whale); whale is moving South and offshore; North tower advises they have a whale as well, moving north.
- 1036 Acoustics: Base -> South tower: Check status of whale’s position relative to A zone (not close), estimated 5 km south of tower’s position.
- 1038 Acoustics: Acoustics team covers status of all acoustic monitoring radio telemetry station buoys; reiterates that one can be removed if needed, and still maintain the 5 km needed for the survey to continue (mildly aberrant behavior seen in buoys, nothing extreme).
- 1044 Acoustics: North tower -> South tower: Continues tracking whale south. Advises “hand-off” in next 30 minutes.
- 1059 Acoustics: Base ->North tower: requests environmental status update; North tower advises that they can see to and past *Pavel Gordienko* (e.g. past the Perimeter Monitoring Line); status of whales: Tower advises whale from 1044 continues to head south; base requests position of *Pacific Explorer* in relation to North tower, is informed *Pacific Explorer* is Southeast of tower.
- 1107 Acoustics: *Pacific Explorer* is now broadside of Acoustics station.
- 1110 Acoustics: Base -> South tower: requests environmental update, as southern distribution team reports rain at distribution observation point 12 (South tower reports no rain).
- 1129 Acoustics: *Pavel Gordienko* reaches end of line (determined via the A.I.S. system within the acoustics station).
- 1137 Acoustics: *Pacific Explorer* informs line will be finished in 12 minutes (was in Russian).
- 1140 Acoustics: *Pacific Explorer* reports 5minutes left in line, relays plans for rest of the day.
- 1144 Acoustics: *Pavel Gordienko* -> Base: question of how much time is left on line.
- 1145 Acoustics: *Pacific Explorer* -> *Pavel Gordienko*: advises 5 minutes left (yes, *Pacific Explorer* said “5 minutes left” here).
- 1150 (11:50:44) Acoustics: *Pacific Explorer* -> All stations: ***Pacific Explorer* advises line 2 is finished**; proceeding in turn, and then plans to proceed to line 28 (a B line).
- 1151 Acoustics: Base -> Distribution team (Sergei): requests position (is at Station 9).
- 1151 Acoustics: Base -> *Pavel Gordienko*: requests *Pavel Gordienko* hold position.
- 1152 Acoustics: Base -> Distribution team (Sergei): Requests team finish scan at station 9, and then proceed to station 11 (team confirms receipt of request).

- 1155-1158 Acoustics: Base -> *Pavel Gordienko*: Requests status of *Pavel Gordienko*; advised that vessel needs to take water; base agrees and asks *Pavel Gordienko* to take water, but stresses need to be at buoy station R6 by 1800 (position optimal for the acquisition of the next A line), also advises *Pavel Gordienko* to continue scans and if whales are found, to initiate focal follows; *Pavel Gordienko* advises that water needs priority over focal follows; Base agrees, but (again) stresses that *Pavel Gordienko* must be at buoy station R6 by 1800; base informs *Pavel Gordienko* that they will inform Marine Department of water status aboard vessel.
- 1158 Acoustics: Base-> North tower: Requests scans continue, and to communicate any sightings to *Pavel Gordienko* (North tower confirms receipt of communication).
- ~1200-1400, while *Pacific Explorer* acquires B line 28, lunch, etc. taken.
- 1352 Acoustics: Back at acoustics station.
- 1409 (14:09:20) Acoustics: *Pacific Explorer* -> All positions: informs operations for acquisition of B line 28 will begin in 5 minutes, 20 seconds.
- 1414 (14:14:21) Acoustics: *Pacific Explorer* -> All positions: **Advises start of acquisition of B line 28.**
- 1414 (14:14:21) Acoustics: Base -> Distribution teams: Requests start of scans.
- 1415 Acoustics: Base -> Towers: Reiterating start of line to towers (Towers confirm receipt of communication).
- ~1416 Acoustics: Acoustics->Base Camp: Acoustics team advises noise base case of **Base + 3** (using tuned model for line 11, which was Base + 3).
- 1430 Acoustics: K. Broker stops by Acoustics station to see how operations are progressing.
- 1436 Acoustics: Towers -> Towers: check in with each other.
- 1553 Acoustics: Base -> *Pavel Gordienko*: Requests update on water intake.
- 1612 Acoustics: North tower <-> Base <-> *Pavel Gordienko*: No end of line communicated yet. Need status update.
- 1628 Acoustics: *Pacific Explorer* -> All positions: Advises completion of line 28; turn is expected to take 2 hours, 4 minutes.
- 1629 Acoustics: Base -> Distribution teams: request positional update, and requests movement to station 11, and to relay the same (appropriate) instructions to other distribution team.
- 1632 Acoustics: *Pavel Gordienko* -> Base: Reiterates need for taking on water.
- 1632 Acoustics: Base -> South tower: requests visibility update (North-Northeast pretty good, South-Southeast ~ 8 km, Perimeter monitoring line visible).
- 1634 Acoustics: Base -> *Pavel Gordienko*: Requests location (1km from R1? (yes)); Max speed requested (0.21 nm?).
- 1635 Acoustics: *Pavel Gordienko* -> Base: Will confer with captain and relay message to Base regarding water uptake.

- 1642 Acoustics: *Pavel Gordienko* -> Base: Water uptake issue continues.
- 1646 Acoustics: Base -> *Pavel Gordienko*: Vessel needs 1.5 hours of water uptake, but survey can only spare 1 hour. Requests *Pavel Gordienko* cease pumping in 1 hour maximum and proceed to buoy station R6.
- 1654 Acoustics: *Pavel Gordienko* -> Base: Confirms that vessel will cease pumping at 1800, and will head to buoy station R6; Base confers that if vessel is late, then to proceed North to stay ahead of *Pacific Explorer*.
- 1701 Acoustics: Base -> Towers: Confers next line will begin at 1830 (line A 6), with a noise base case of **High +1**, reiterates that acoustics will tune model and have revised noise base case within ten minutes.
- 1737 Acoustics: North tower -> Base: Advises fog moving into survey area; Base requests survey continue for time being, but asks to remain advised as to situation Re: fog.
- 1741 Acoustics: Base -> *Pavel Gordienko*: Advises *Pavel Gordienko* about fog moving into survey area.
- 1749 Acoustics: Distribution team-> Base: Visibility decreasing, around 1.5 km; Base requests team stay at station 11 for the time being.
- 1750 Acoustics: Base-> Distribution team: Requests team wait 20 minutes, and then move to distribution team station 11.
- 1751 Acoustics: Base -> North tower: Requests visibility update (visibility now at zero); North tower checks with South tower, and confers with Base regarding current visibility conditions (deteriorating).
- 1754 Acoustics: Base -> *Pavel Gordienko*: Requests positional update to ensure movement south towards buoy station R6.
- 1755 Acoustics: Base -> *Pacific Explorer*: Radio check (failed); *Pacific Explorer* possibly out of range.
- 1759 Acoustics: Acoustics -> Base: Advises Base that *Pavel Gordienko* has not moved.
- 1800 Acoustics: Base -> *Pavel Gordienko*: Requests movement update, it appears vessel may be moving (no).
- 1801 Acoustics: Base -> *Pacific Explorer*: Advises *Pacific Explorer* of low visibility in survey area.
- 1803 Acoustics: Base -> *Pacific Explorer*: confers with lead MMO regarding weather conditions and whereabouts of *Pavel Gordienko*.
- 1805 Acoustics: *Pacific Explorer* -> Base: Conversation was drowned out by Russians in background, but sounded like logistics regarding the A zone.
- 1808 Acoustics: Base -> Towers: standby regarding fog.
- 1813 Acoustics: Base-> Distribution teams: Standby until 1900, if fog persists, advised to return to Base.
- 1814 Acoustics: Acoustics -> Base: Advises Bases, based on AIS system, that *Pavel Gordienko* has not moved.

- 1814 - 1821 Acoustics: Base -> *Pavel Gordienko* (conversation):
 - Base -> *Pavel Gordienko*: “Are you moving?”
 - *Pavel Gordienko*: “There is fog.”
 - Base: “What is your location and speed?”
 - *Pavel Gordienko*: “7.5 nm, bearing 150 degrees.”
 - Base: “*Pavel Gordienko* began moving when?”
 - *Pavel Gordienko*: “10 minutes ago.”
- ~1821 Acoustics: Acoustics reports *Pavel Gordienko* as 2 km north of buoy R1 (or approximately 60 m from where they have been taking on water all afternoon).
- ~1821 Acoustics: *Pacific Explorer* -> All positions: Advisement of beginning of ramp-up.
- 1822 Acoustics: Base-> Acoustics: Requests advisement: is Acoustics station in radio silence or not (almost), and where is *Pavel Gordienko*?
- 1822 Acoustics: AIS confirms *Pavel Gordienko* now moving at 6 nm.
- 1828 Acoustics: Base -> Acoustics: Requests advisement of when *Pacific Explorer* is broadside of buoy station R6. Acoustics advises Base that it will take 1 to 2 minutes of sample to make noise base case adjustment.
- 1832 Acoustics: Note: Since southern line six has “A and B” components, with only A zone sections in the north (e.g. probable Perimeter Monitoring Line interaction in the north), then the line can be started, if only to acquire the noise base case scenario.
- 1834 Acoustics: Observation team -> Base: Advised that fog persists, heading back to Base.
- 1835 Acoustics: *Pavel Gordienko* -> Base: advised that vessel has passed R1.
- 1835 Acoustics: Acoustics -> Base: Confirms if *Igor Maximov* (scout ship) has surveyed line 6 within the past 6 hours (yes). Proposed to take first 1 to 2 minutes of data, as *Pacific Explorer* reports decent visibility in the short term.
- 1837 Acoustics: *Pacific Explorer* -> Base: Advises variable fog conditions encountered. Calls base to discuss options.
- 1845 Acoustics: Base -> Acoustics: Line acquisition will move ahead in the short term in order to tune model, but advises line acquisition is highly unlikely.
- 1845 Acoustics: Base -> South tower: Requests environmental update; South tower reports total fog; Base requests North tower environmental update; North tower reports total fog.
- 1847 Acoustics: *Pavel Gordienko* -> Base: Advises visibility has dropped to under 2km.
- 1848 Acoustics: Base -> Acoustics: Advised to take first 2 minutes of line to select noise base case, and then the line will be shut down. Acoustics now under radio silence.
- 1859 Acoustics: *Pavel Gordienko* -> Base: now passing buoy station R3.
- 1901 Acoustics: *Pacific Explorer* -> Acoustics / Base: Now in position and acquiring line.
- 1902 Acoustics: Base -> Towers: Requests visibility update; North tower: none, South tower: none.

- 1904 Acoustics: *Pacific Explorer* -> Acoustics: Advises based on model in place, that 5 minutes of line before shut down should be enough to select noise base case.
- 1905 Acoustics: Acoustics -> Base: Corrects *Pacific Explorer* and advises that acoustics already has enough data to select noise base case.
- 1905 Acoustics: Base -> *Pacific Explorer*: Advises insufficient visibility, instructs vessel to shut down.
- 1906 Acoustics: *Pacific Explorer* -> All stations: Shut down confirmed.
- 1906 Acoustics: Base -> Towers: Advises observations are cancelled for the day due to insufficient visibility.
- 1908 Acoustics: Base -> *Pavel Gordienko*: Advised to stay in position.
- 1908 Acoustics: Acoustics is processing data.
- 1910 Acoustics: Base -> Acoustics: Plans for tomorrow discussed.
- 1912 Acoustics: Noise base case **Base + 2** selected for line 6.
- 1918 Acoustics: Advises that line 15 (the B line to be acquired next) will use noise base case of **High + 1**, because line 11, next closest line, uses this noise base case as well.
- ~1918 Acoustics: Base -> *Pavel Gordienko* (Conversation):
 - Base: "Please advise as to why it took *Pavel Gordienko* so long to begin movement."
 - *Pavel Gordienko* [pause]: "Vessel was pulling anchor."
 - Base: "For 20 minutes?"
 - *Pavel Gordienko*: "Yes."

20 JUNE

- Weather: Heavy fog precludes any surveys.

21 JUNE

- Weather: Heavy fog precludes any surveys.

22 JUNE

- Weather: Morning fog precludes shore observations of lines. B lines acquired.
- 1232: Shooting B line 26.
- 1256 Base Camp: *Pacific Explorer* -> Base:
 - Does *Pavel Gordienko* have the visibility to tend the PML?
 - Depends of noise base case
 - Use of noise base case from line 6 (shot 19 June), at base + 2, may be used to initially tune model
- 1259 Base Camp: Base -> *Pacific Explorer*: Logistics continue, current visibility is ~ 1km, e.g. not possible regarding line 6 under current conditions.

- 1434: Fog clearing, maybe 2-3km (reported from acoustics post).
- 1445: Line 26 finished.
- 1445 Base Camp: Acoustics -> Base:
 - o Logistics concerning visibility regarding A line.
- 1500: Reliance on vessel instead of shore based monitoring hinges on vessel's ability to judge where whale is with relation to the A zone, and well as in-shore facing visibility.
- 1500 Base Camp: Base -> *Pavel Gordienko*: Instructs *Pavel Gordienko* to stay 2km in front of *Pacific Explorer*.
- 1502 Base Camp: *Pacific Explorer* -> All posts: Line start in 1 hour, 59 minutes.
- 1546 Base Camp: *Pacific Explorer* -> Base: 1 hour until line start, ramp up scheduled for 25 minutes from now.
- 1546 Base Camp: *Pacific Explorer* -> Base: visibility has decreased to 1km.
- 1611 Base Camp: Base -> Acoustics: Requests whereabouts of *Pacific Explorer*.
- 1522 Discussion arose of where to position *Pavel Gordienko* in relation to the PML in order to ensure a 1km visibility of the PML as well as the noise base case. K. Broker suggests moving *Pavel Gordienko* 500 meters west of the PML in order to cover both. **Note:** while this is not specifically enumerated in the rules, there is no specifically enumerated rule regarding this.
- 1635 Base Camp: *Pacific Explorer* -> Base: advised that line will start in 10 minutes.
- 1641 Base Camp: Base -> *Pavel Gordienko*: request visibility update (1.5km variable to 1km).
- 1645 line 12 start, 1:57 in length; visibility 5km North; Noise base case Base + 3 (relayed by acoustics at 1652, below).
- 1647 Base Camp: Base -> *Pavel Gordienko*: Advises use of four observers during this line.
- 1652 Base Camp: Acoustics -> Base: Noise base case is Base +3.
- 1653 Base Camp: Base -> *Pavel Gordienko*: Advises course to sail: West of line action), R6 west to R5 and R4, afterward, 800 meters west of R3, R2, R1.
- 1659 *Pacific Explorer* South of *Pavel Gordienko*.
- 1701 Base Camp: Base -> *Pavel Gordienko*: Will advise *Pavel Gordienko* when to begin moving.
- 1706 Base Camp: *Pavel Gordienko* -> Base: Visibility has dropped to 200 – 300 meters.
- 1707 Base Camp: Base -> Acoustics: Requests advisement of distance between *Pacific Explorer* and *Pavel Gordienko* (2km).
- 1707 Base Camp: Base -> *Pavel Gordienko*: Advised to begin moving north, and to keep updated as to visibility.

- 1708 Base Camp: Base -> *Pacific Explorer*: Advised to be prepared to shut down at the B component to A component transition point because of visibility concerns (*Pacific Explorer* confirms).
- 1712 Base Camp: Base -> Acoustics: Requests monitoring *Pacific Explorer*'s location in relation to the B component to A component transition point.
- 1713 Base Camp: *Pavel Gordienko* -> Base: Advised that visibility has decreased to 100 meters; Base confirms and requests a shutdown at the B component to A component transition point (*Pacific Explorer* confirms).
- 1714 Base Camp: Base -> *Pacific Explorer*: VHF radio has failed; Base switches to cell phone to continue communications (successful).
- 1716 Base Camp: Acoustics -> Base: advises that *Pacific Explorer* is 2.4km from transition point.
- 1719 Base Camp: *Pavel Gordienko* -> Base: Visibility has increased, base advises shutdown will proceed as planned; requests *Pavel Gordienko* move to East of the PML.
- 1724 Base Camp: Acoustics -> Base: ~ 1km from shutdown point (*e.g.* the B component to A component transition point).
- 1724 Base Camp: *Pacific Explorer* -> Base: ~ 10 minutes from transition point.
- 1729 Base Camp: Acoustics -> Base: ~ 500 meters from transition point.
- 1730 Base Camp: *Pavel Gordienko* -> Base: requests advisement concerning position (1km East of PML).
- 1731 Base Camp: *Pacific Explorer* -> Base: advises shut down is within 1 minute.
- 1731 Base Camp: Acoustics -> Base: advises that acoustics' coordinates are in agreement with *Pacific Explorer*'s coordinates.
- 1732 Base Camp: *Pacific Explorer* -> All positions: Shut down confirmed.
- 1739 Base -> *Pacific Explorer*: Advises to proceed to line 33 (B line); *Pacific Explorer* agrees and confirms, advises 3 hour, 20 min transit time.

End transcript

Figure 1. Spatial layout of Piltun camp.

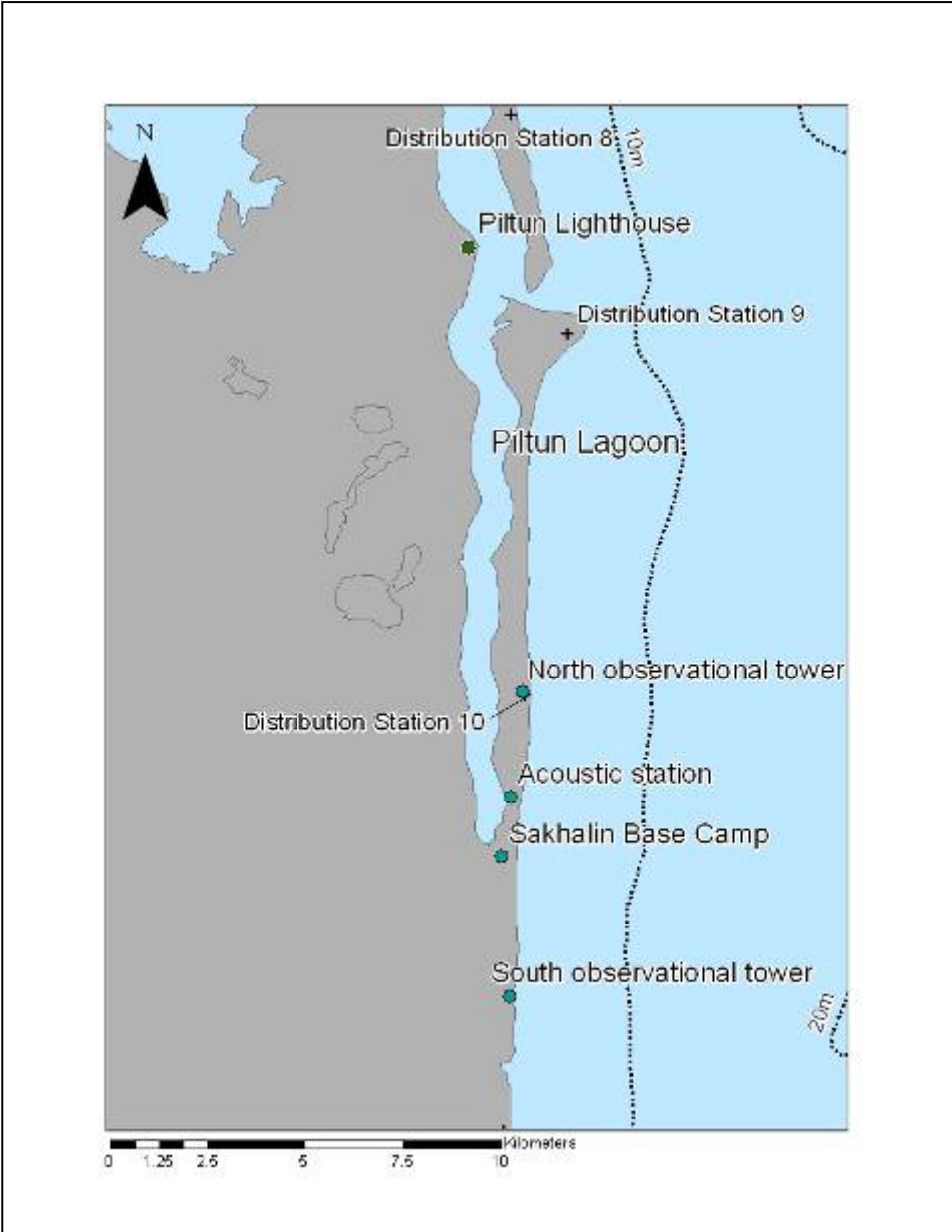


Figure 2. Shore-based behavioral observation team tower. Note second tower within first, designed to balance and steady theodolite readings.



Figure 3. Acoustics station. Note antennae on hill and forward of station.



Figure 4. Piltun Base Camp

