



INCIDENTAL HARASSMENT AUTHORIZATION

The Lamont-Doherty Earth Observatory (Lamont-Doherty), Columbia University, P.O. Box 1000, 61 Route 9W, Palisades, New York 10964-8000, is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1371(a)(5)(D)), to harass small numbers of marine mammals incidental to marine geophysical surveys conducted by the R/V *Marcus G. Langseth (Langseth)* in the Southeast Pacific Ocean between August 2016 and July 2017, when adhering to the following terms and conditions.

1. This Incidental Harassment Authorization (IHA) is valid for a period of one year between August 1, 2016 and July 31, 2017.
2. This IHA is valid only for specified activities associated with the *Langseth's* seismic survey operations as specified in Lamont-Doherty's IHA application and environmental analysis. This IHA is valid in the Southeast Pacific Ocean, located approximately within the exclusive economic zone of Chile, between 18° and 44°S as specified in Lamont-Doherty's application and the National Science Foundation's environmental analysis.
3. General Conditions
 - (a) A copy of this IHA must be in the possession of Lamont-Doherty, its designees, and work crew personnel, including the Captain of the *Langseth*, operating under the authority of this IHA.
 - (b) The species authorized for taking, by Level A and/or Level B harassment, are limited to those described in Table 1 (below).
 - (c) The taking by serious injury or death of any of the species described in Table 1 (below) of this IHA; the taking by Level A harassment of any of the species listed in Table 1 as being authorized for Level B harassment taking only; or any taking of any other species of marine mammal not described in Table 1, is prohibited.
 - (d) Any prohibited taking of marine mammals, as described in 3(c), may result in the modification, suspension, or revocation of this IHA.
 - (e) During seismic survey activities, if Lamont-Doherty encounters any marine mammal species that are not listed in Condition 3(b) for authorized taking, and those marine mammal species are likely to be exposed to sound pressure levels greater than or equal to 160 decibels (dB) re: 1 μ Pa, then the Lamont-Doherty must alter speed or course or shutdown seismic survey airguns to avoid take.



- (f) The methods authorized for incidental taking of marine mammals by harassment are limited to the operation of the airgun array (with a total capacity of 6,600 in³ (or smaller)) as described in the IHA application, and the operation of the sub-bottom profiler and/or the multibeam echosounder that may occur during the 10 nautical miles of transit that may occur between seismic survey locations, as described in the IHA application. Operation of the sub-bottom profiler or the multibeam echosounder independent of the airguns is not authorized, with the exception of the 10 nautical miles of transit that may occur between seismic survey locations as described above.
- (g) Lamont-Doherty shall conduct briefings between the ship's Captain and crew, and the marine mammal monitoring team, prior to the start of all seismic surveys, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

4. Mitigation Measures

The holder of this Authorization is required to implement the following mitigation measures:

- (a) Visual Observers: Lamont-Doherty shall utilize two, National Marine Fisheries Service-qualified, vessel-based Protected Species Visual Observers (visual observers) to watch for and monitor marine mammals near the seismic source vessel during daytime airgun operations (from nautical twilight-dawn to nautical twilight-dusk) and before and during start-ups of airguns, whether day or night.
 - i. At least one visual observer will be on watch during meal times and restroom breaks.
 - ii. Observer shifts will last no longer than four hours at a time.
 - iii. Visual observers will also conduct monitoring while the *Langseth* crew deploy and recover the airgun array and streamers from the water.
 - iv. When feasible, visual observers will conduct observations during daytime periods when the seismic system is not operating for comparison of sighting rates and behavioral reactions during, between, and after airgun operations.
 - v. The *Langseth*'s vessel crew will also assist in detecting marine mammals, when practicable. Visual observers will have access to reticle binoculars (7x50 Fujinon), and big-eye binoculars (25x150).
- (b) Exclusion Zones: Lamont-Doherty shall establish a 180-decibel (dB) or 190-dB exclusion zone, for cetaceans and pinnipeds respectively, before initiating the airgun subarray (6,660 in³); and a 180-dB or 190-dB exclusion zone, for cetaceans and pinnipeds respectively, for the single airgun (40 in³). Observers will use the

predicted radius distance for the 180-dB or 190-dB exclusion zones for cetaceans and pinnipeds. See Table 2 (attached) for minimum radial distances required for shutdown zones.

- (c) Visual Monitoring at the Start of Airgun Operations: Lamont-Doherty shall monitor the entire extent of the exclusion zones for at least 30 minutes (day or night) prior to the ramp-up of airgun operations after a shutdown, and shall delay airgun operations if the visual observer sees a cetacean within the 180-dB exclusion zone or a pinniped within the 190-dB exclusion zone, until the marine mammal(s) has left the area.
 - i. If the visual observer sees a marine mammal that surfaces, then dives below the surface, the observer shall wait 30 minutes. If the observer sees no marine mammals during that time, he/she should assume that the animal has moved beyond the 180-dB exclusion zone for cetaceans or 190-dB exclusion zone for pinnipeds.
 - ii. If for any reason the visual observer cannot see the full 180-dB exclusion zone for cetaceans or the 190-dB exclusion zone for pinnipeds for the entire 30 minutes (*i.e.*, rough seas, fog, darkness), or if marine mammals are near, approaching, or within the respective zone, the *Langseth* may not resume airgun operations.
 - iii. If one airgun is already running at a source level of at least 180 dB re: 1 μ Pa or 190 dB re: 1 μ Pa, the *Langseth* may start the second gun – and subsequent airguns – without observing relevant exclusion zones for 30 minutes, provided that the observers have not seen any marine mammals near the relevant exclusion zones (in accordance with Condition 4(b)).
- (d) Ramp-Up Procedures: Lamont-Doherty shall implement a “ramp-up” procedure when starting the airguns at the beginning of seismic operations, or any time after the entire array has been shut down (see Appendix 2 of this Authorization).
 - i. The smallest gun shall be started first and airguns shall be added in a sequence such that the source level of the array will increase in steps not exceeding approximately 6 dB per 5-minute period.
 - ii. During ramp-up, observers will monitor the exclusion zone; if marine mammals are sighted, a course/speed alteration, power-down, or shutdown will be implemented as though the full array were operational.
- (e) Speed or Course Alteration: Lamont-Doherty shall alter speed or course during seismic operations if a marine mammal, based on its position and relative motion, appears likely to enter the relevant exclusion zones. If speed or course alteration is not safe or practicable, or if after alteration the marine mammal still appears likely

to enter the exclusion zone, Lamont-Doherty will implement further mitigation measures, such as a shutdown.

- (f) Power-Down Procedures: Lamont-Doherty shall power-down the airguns if a visual observer detects a marine mammal within, approaching, or entering the relevant exclusion zones (see Appendix 2 of this Authorization). A “power-down” means reducing the number of operating airguns to a single operating 40 in³ airgun, thereby minimizing the exclusion zone to the degree that the animal(s) is outside of it.
- (g) Resuming Airgun Operations after a Power-Down:
 - i. Following a power-down and subsequent animal departure, the *Langseth* may resume airgun operations at full power. Initiation of airgun operations at full power requires that observers can effectively monitor the full exclusion zones described in Condition 4(b).
 - ii. Airgun activity will not resume until observers have visually observed the marine mammal exiting the exclusion zone (for airgun operations at full power) and have determined that the animal is not likely to return to the exclusion zone, or, the animal has not been seen within the exclusion zone for 15 minutes (for species with shorter dive durations, e.g., small odontocetes and pinnipeds) or 30 minutes (for species with longer dive durations, e.g., mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales).
 - iii. Following a power-down, if a marine mammal(s) approach the smaller designated exclusion zone (for a single 40 in³ airgun), Lamont-Doherty shall completely shut down the airguns.
- (h) Shutdown Procedures: Lamont-Doherty shall shutdown the airgun(s) if a visual observer detects a marine mammal within, approaching, or entering the exclusion zone for the single airgun (see Appendix 2 of this Authorization). A “shutdown” means that the *Langseth* turns off all operating airguns.
- (i) Resuming Airgun Operations after a Shutdown: Following a shutdown, if the observer has visually confirmed that the marine mammal has departed the 180-dB zone or the 190-dB zone (for cetaceans and pinnipeds, respectively) within a period of less than or equal to 8 minutes after the shutdown, the *Langseth* may resume airgun operations at full power. If the observer has not seen the animal depart the 180-dB zone for cetaceans or the 190-dB zone for pinnipeds, the *Langseth* shall not resume airgun activity until 15 minutes has passed for species with shorter dive times (*i.e.*, small odontocetes and pinnipeds) or 30 minutes has passed for species with longer dive durations (*i.e.*, mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked

whales). The *Langseth* will follow the ramp-up procedures described in Condition 4(d).

- (j) Survey Operations at Night: The *Langseth* may continue marine geophysical surveys into night and low-light hours if the Holder of the Authorization initiates these segment(s) of the survey when the observers can view and effectively monitor the full relevant exclusion zones.
 - i. The Holder shall not initiate airgun array operations from a shut-down position at night or during low-light hours (such as in dense fog or heavy rain) when the visual observers cannot view and effectively monitor the full relevant exclusion zones.
- (k) Mitigation Airgun: The *Langseth* may operate a small-volume airgun (*i.e.*, mitigation airgun) during turns and maintenance at approximately one shot per minute.
 - i. The *Langseth* shall not operate the small-volume airgun for longer than three hours in duration during turns.
 - ii. During turns or brief transits between seismic tracklines, one airgun would continue to operate.
- (l) Special Procedures for Concentrations of Large Whales: The *Langseth* will power-down the array and avoid concentrations of large whales if possible (*i.e.*, avoid exposing concentrations of these animals to sounds greater than 160 dB re: 1 μ Pa). For purposes of this IHA, a “concentration” of whales will consist of six or more individuals visually sighted that do not appear to be traveling (*e.g.*, feeding, socializing, etc.). The *Langseth* will follow the procedures described in Condition 4(g) for resuming operations after a power down.

5. Monitoring Requirements

The holder of this Authorization is required to conduct marine mammal monitoring during seismic surveys.

- (a) Passive Acoustic Monitoring: Lamont-Doherty shall utilize the passive acoustic monitoring (PAM) system, to the maximum extent practicable, to detect and allow some localization of marine mammals around the *Langseth* during all airgun operations and during most periods when airguns are not operating:
 - i. One visual observer and/or bioacoustician will monitor the PAM system at all times, in shifts no longer than 6 hours.
 - ii. A bioacoustician shall design and set up the PAM system and be present to operate or oversee the PAM system, and will be available when technical issues occur during the survey.

- (b) The PAM observer shall do and record the following when an animal is detected by the PAM system:
 - i. Notify the visual observer immediately of a vocalizing marine mammal so a power-down or shutdown can be initiated, if required;
 - ii. Enter the information regarding the vocalization into a database. The data to be entered include: an acoustic encounter identification number; whether it was linked with a visual sighting; date; time when first and last heard and whenever any additional information was recorded; position; water depth when first detected, bearing if determinable; species or species group (*e.g.*, unidentified dolphin, sperm whale, monk seal); types and nature of sounds heard (*e.g.*, clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.); and any other notable information.
- (c) Recording Visual Detections: Visual observers shall record the following information when they have sighted a marine mammal:
 - i. Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (*e.g.*, none, avoidance, approach, paralleling, etc., and including responses to ramp-up), and behavioral pace; and
 - ii. Time, location, heading, speed, activity of the vessel (including number of airguns operating and whether in state of ramp-up or shut-down), Beaufort sea state and wind force, visibility, and sun glare.
 - iii. The data listed under 5(c)(i) and 5(c)(ii) shall be recorded at the start and end of each observation watch and during a watch whenever there is a change in one or more of the variables.

6. Reporting

This Authorization requires the Holder of this Authorization to:

- (a) Submit a draft report on all activities and monitoring conducted under the IHA within 90 calendar days of the completion of the *Langseth's* cruise, or, within 60 calendar days prior to the issuance of any subsequent IHA for this project, whichever comes first. A final report shall be prepared and submitted within 30 days following resolution of comments on the draft report from NMFS. This report must contain the informational elements described below:
 - i. Dates, times, locations, heading, speed, weather, sea conditions (including Beaufort sea state and wind force), and associated activities during all seismic operations and marine mammal sightings.

- ii. Species, number, age/size/sex (if determinable), location, distance from the vessel, and behavior of any marine mammals, as well as associated seismic activity (number of shutdowns), observed throughout all monitoring activities.
 - iii. An estimate of the number (by species) of marine mammals with known exposures to the seismic activity (based on visual observation) at received levels greater than or equal to 160 dB re: 1 μ Pa and/or 180 dB re 1 μ Pa for cetaceans and 190-dB re 1 μ Pa for pinnipeds and a discussion of any specific behaviors those individuals exhibited.
 - iv. An estimate of the number (by species) of marine mammals that may have been exposed (based on modeling results and accounting for animals at the surface but not detected [i.e., $g(0)$ values] and for animals present but underwater and not available for sighting [i.e., $f(0)$ values]) to the seismic activity at received levels greater than or equal to 160 dB re: 1 μ Pa and/or 180 dB re 1 μ Pa for cetaceans and 190-dB re 1 μ Pa for pinnipeds.
 - v. A description of the implementation and effectiveness of: (A) mitigation measures of the IHA; and (B) the terms and conditions of the Biological Opinion's Incidental Take Statement (attached), including confirmation of the implementation of each Term and Condition, as well as any conservation recommendations, and description of effectiveness for minimizing adverse effects of the action on Endangered Species Act-listed marine mammals.
- (b) Reporting Injured or Dead Marine Mammals:
- i. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as an injury (Level A harassment) to marine mammal species for which Level A harassment is not authorized, serious injury, or mortality, Lamont-Doherty shall immediately cease the specified activities and report the incident to the NMFS Office of Protected Resources via phone (301-427-8401) and email. Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with Lamont-Doherty to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Lamont-Doherty may not resume their activities until notified by NMFS. The report must include the following information:
 - 1. Time and date of the incident;
 - 2. Description of the incident;
 - 3. Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
 - 4. Description of all marine mammal observations and active sound source use in the 24 hours preceding the incident;
 - 5. Species identification or description of the animal(s) involved;

6. Fate of the animal(s); and
7. Photographs or video footage of the animal(s).

- ii. In the event that Lamont-Doherty discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown, and the death is relatively recent (e.g., in less than a moderate state of decomposition), Lamont-Doherty shall immediately report the incident to the NMFS Office of Protected Resources, via phone (301-427-8401) and email. The report must include the same information identified in 6(b)(i) of this IHA. NMFS will work with Lamont-Doherty to determine whether additional mitigation measures or modifications to the activities are appropriate.
- iii. In the event that Lamont-Doherty discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in this IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Lamont-Doherty shall report the incident to the NMFS Office of Protected Resources, via phone (301-427-8401) and email. The report must include the same information identified in 6(b)(i) of this IHA. In the case of an injured marine mammal, Lamont-Doherty shall notify the NMFS Office of Protected Resources immediately upon discovery; in the case of a dead marine mammal, Lamont-Doherty shall notify the NMFS Office of Protected Resources within 24 hours of the discovery. Lamont-Doherty shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. NMFS will work with Lamont-Doherty to determine whether additional mitigation measures or modifications to the activities are appropriate.

7. Endangered Species Act Biological Opinion and Incidental Take Statement
Lamont-Doherty is required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to the Endangered Species Act Biological Opinion issued to the National Science Foundation and NMFS' Office of Protected Resources, Permits and Conservation Division. A copy of this Authorization and the Incidental Take Statement must be in the possession of all contractors and protected species observers operating under the authority of this Authorization.

Dated:



Donna Wieting,
Director, Office of Protected Resources,
National Marine Fisheries Service.

AUG 01 2016

Table 1. Authorized take numbers by species during the northern, central, and southern seismic surveys in the southeast Pacific Ocean in 2016/2017.

Species	Level A Take ¹	Level B Take	Total Take
Southern right whale	0	225	225
Pygmy right whale	0	120	120
Humpback whale	0	143	143
Common (dwarf) minke whale	0	75	75
Antarctic minke whale	0	150	150
Bryde's whale	0	43	43
Sei whale	0	126	126
Fin whale	75	293	368
Blue whale	49	257	306
Sperm whale	0	184	184
Dwarf sperm whale	117	776	893
Pygmy sperm whale	75	546	621
Cuvier's beaked whale	75	477	552
Shepard's beaked whale	0	120	120
Pygmy beaked whale	0	143	143
Gray's beaked whale	69	294	363
Blainville's beaked whale	35	192	227
Hector's beaked whale	0	52	52
Gray's beaked whale	69	294	363
Andrew's beaked whale	0	52	52
Strap-toothed beaked whale	0	52	52
Spade-toothed beaked whale	0	52	52
Southern bottlenose whale	0	102	102
Chilean dolphin	172	958	1,130
Rough-toothed dolphin	105	490	595
Common bottlenose dolphin	303	1,654	1,957
Striped dolphin	1,093	6,096	7,189
Short-beaked common dolphin	11,581	66,723	78,304
Long-beaked common dolphin	665	3,605	4,270
Dusky dolphin	539	3,232	3,771
Peale's dolphin	172	958	1,130
Hourglass dolphin	0	200	200
Southern right whale dolphin	149	985	1,134
Risso's dolphin	557	3,093	3,650
Pygmy killer whale	0	185	185
False killer whale	0	279	279
Killer whale	0	76	76
Short-finned pilot whale	0	1,500	1,500
Long-finned pilot whale	0	116	116
Burmeister's porpoise	722	4,309	5,031
Juan Fernandez fur seal	0	150	150
South American fur seal	998	5,760	6,758
South American sea lion	10,445	59,580	70,025
Southern elephant seal	0	160	160

¹The Level A estimates are overestimates of predicted impacts to marine mammals as the estimates do not take into consideration the required mitigation measures for shutdowns or power downs if a marine mammal is likely to enter the 180 or 190 dB exclusion zone while airguns are active.

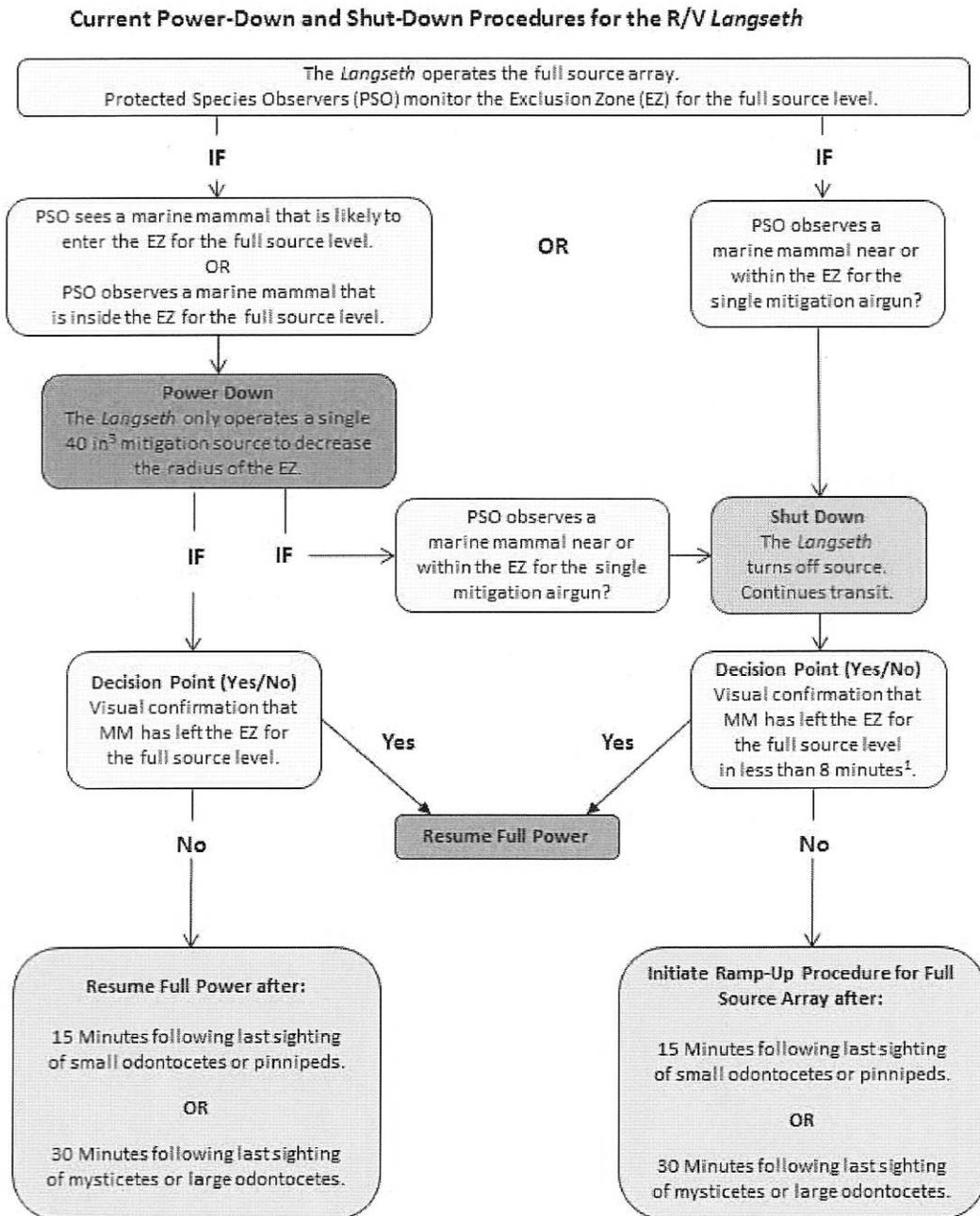
Table 2. Minimum radial distances required for shutdown zones.

Source and Volume (in ³)	Tow Depth (m)	Water Depth (m)	Predicted RMS Distances ¹ (m)	
			190 dB	180 dB
Single Bolt airgun (40 in ³)	9 or 12	< 100	100 ²	100 ²
		100 to 1,000	100	100
		> 1,000	100	100
36-Airgun Array (6,600 in ³)	9	< 100	591	2,060
		100 to 1,000	429	1,391
		> 1,000	286	927
36-Airgun Array (6,600 in ³)	12	< 100	710	2,480
		100 to 1,000	522	1,674
		> 1,000	348	1,116

¹ Predicted distances based on information presented in Lamont-Doherty's application.

² NMFS required Lamont-Doherty to expand the exclusion zone for the mitigation airgun to 100 m (328 ft) in shallow water.

Appendix 1: Ramp-up, power down, and shut-down procedures for the *Langseth*.



¹ Ramp-Up Procedures

For a given survey, Lamont-Doherty would calculate a specified period based on the 180-dB exclusion zone radius in relation to the average planned speed of the *Langseth* while surveying. Lamont-Doherty has used similar periods (8-10 minutes) for previous surveys. Ramp up will not occur if a marine mammal or sea turtle has not cleared the exclusion zone for the full array.

Date: November 2015