State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawaii 96813

May 27, 2022

Board of Land and Natural Resources
Honolulu, Hawaii

Request for Authorization and Approval to Issue Two Papahānaumokuākea Marine National Monument Research Permits to Ms. Allison Fundis, Ocean Exploration Trust, for Access to State Waters to Conduct Seafloor Mapping and to Operate the Exploration Vessel (E/V) Nautilus as a Platform for Various Principal Investigators within the Waters of the Northwestern Hawaiian Islands

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of two Papahānaumokuākea Marine National Monument Research Permits to Ms. Allison Fundis, Ocean Exploration Trust, pursuant to §187 A-6, Hawai 'i Revised Statutes (HRS), Chapter 13-60.5, Hawai 'i Administrative Rules (HAR), and all other applicable laws and regulations.

The Research Permits, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument, including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nihoa Island
- Necker Island (Mokumanamana)
- French Frigate Shoals (Lalo)
- Gardner Pinnacles (‘Ōnūnui,‘Ōnūiki)
- Laysan Island (Kamole)
- Maro Reef (Kamokuokamohoali‘i)

Note: Activities will also occur in deepwater environments (>100m) in the expanded area of PMNM.

The activities covered under this permit would be scheduled to occur between July 1, 2022 to October 25, 2022. Expedition dates may vary between 2022-2023 if unforeseen interruptions or delays occur; schedule may be subject to change.

INTENDED ACTIVITIES

The proposed activities are to operate the exploration vessel (E/V) Nautilus, a 224' research vessel within the boundaries of Papahānaumokuākea Marine National Monument to provide an at-sea research platform for Principal Investigators (PIs) to conduct research within PMNM. Research scientists aboard the vessel would work under separate permits from the vessel. The Nautilus would transport and support researchers working and traveling within PMNM. Additionally, high-resolution mapping and seafloor characterization would be conducted where such data does not currently exist within PMNM. This activity would utilize the ship-based multibeam sonar and sub-bottom profiler to collect seafloor mapping data within the expanded and original boundaries of PMNM. This is the same system utilized on similar Nautilus expeditions to PMNM, conducted previously in 2021 and 2018, in federal waters or the expanded areas of the monument (most recent permit: PMNM-2021-021 Fundis). Additionally, the researchers would deploy an uncrewed mapping vehicle equipped with an EM2040 (200-400kHz) multibeam sonar that will acquire similar data at depths between 5- and 500-meters depth and no closer to shore or fringing reefs than 500 meters. A National Geographic Society Deep Ocean Drop Camera would also be utilized to capture video of the sea floor.

Specific objectives are as followed:

- Utilize the E/V Nautilus to provide a data collection platform for PIs to conduct research activities working under separate permits from the vessel

- Use ship-based multibeam sonar and sub-bottom profilers to collect seafloor mapping data where such data does not currently exist within both the original and expanded PMNM boundaries

- Deploy an uncrewed mapping vehicle equipped with multibeam sonar to acquire seafloor mapping data at depths between 5-500 meters

- Use an underway CTD (UCTD) to collect conductivity, temperature, and depth information at various locations

- When use of a UCTD is inhibited, use Expendable Bathythermographs (XBTs) to obtain sound velocity profiles to calibrate the multibeam system and ensure accurate bathymetric mapping

- Utilize National Geographic Society Deep Ocean Drop Cameras to capture video of the sea floor at the deepest parts of the ocean

<u>Purpose and Need</u>

E/V Nautilus will support permitted scientific research that will help assess and characterize the health and biodiversity of the fauna within the Monument in addition to collecting bathymetric data (seafloor mapping data) which will contribute to a greater understanding of the structure of the seafloor within the boundaries of PMNM, which can ultimately inform future research and management needs. Researchers will fill gaps in existing seafloor mapping data and characterize

benthic ecosystems, which is part of the National Ocean Mapping, Exploration, and Characterization (NOMEC) strategy. This project has applied science objectives that are also consistent with a number of other NOAA mission priorities. NOAA's long-term Healthy Oceans goals requires students that will improve our understanding of marine ecosystems in order to develop management measures to ensure sustainability in the face of both human and climate impacts. The findings from the project will have direct and immediate benefit to the Monument staff in informing their efforts to protect shallow and deepwater habitats within PMNM. Additionally, the acquired seafloor mapping data will be applied to NOAA nautical charts and will be made publicly available except as provided for in the National Historic Preservation Act.

This project will also provide continued education and outreach opportunities for PMNM and local communities. In 2021, Ocean Exploration Trust and representatives of the Papahānaumokuākea Native Hawaiian Cultural Working Group collaborated to begin to address the overdue need for expeditions to be conducted in Hawai'i to reflect collaborative approaches inclusive of Hawaiian worldview. As a result, the 2021 PMNM expedition aboard Nautilus included co-developed outreach and education opportunities including: (1) Hawaiian naming of expeditions, (2) supporting storytelling through development of promotional video in Hawaiian highlighting Hawaiian worldviews ocean exploration, (3) broadening outreach to the local Department of Education, charter, and kula kaiapuni networks, and (4) supporting live ship-to-shore broadcasts in Hawaiian and English, which included supporting a paid internship position for a Native Hawaiian student and a paid position for a Cultural Working Group representative to be on board for the expedition as a Hawaiian language correspondent and cultural liaison. Ocean Exploration Trust and PMNM collaborators continue to work together to build on this partnership to make more opportunities available for local students, educators, and researchers. This project will allow for this partnership to leverage additional expeditions within PMNM and provide opportunities for local students and educators.

Research and Sampling Methods

E/V Nautilus will transit to the Monument from Honolulu and operate within the Monument for various permitted research activities, which may include seafloor mapping operations with the vessel and an autonomous mapping vehicle, oceanographic data collection, SCUBA diving and related small boat operations, and supporting the transport of FWS personnel for authorized FWS land-based operations. Crew activities may include small boat operations, SCUBA, or snorkeling, as necessary for emergency operations, vessel maintenance, or support of research activities. All planned small boat and permitted SCUBA research activities will be conducted during daylight hours.

Researchers plan to conduct mapping within the expanded boundary of the Monument as well as the southern half the of original Monument where high-resolution seafloor data does not already exist. E/V Nautilus has two scientific sonars that are configured to operate simultaneously without interference: a 30 kHz multibeam system, and a 3.5 kHz chirp sub-bottom profiler sonar. The multibeam is used to map broad swaths for bathymetry and water column feature detection (e.g., gaseous seeps) and the sub-bottom profiler provides data useful for interpreting seafloor geology.

Ship-based Mapping

Ship-based mapping surveys will be conducted with the Kongsberg EM302 multibeam echosounder installed in the hull of E/V Nautilus. This is the same system utilized on similar Nautilus expeditions to PMNM, conducted previously in 2021 and 2018, in federal waters or the expanded areas of the monument (most recent permit: PMNM-2021-021 Fundis), as well as during those previously conducted by NOAA Ship Okeanos Explorer. The system is capable of mapping the seafloor at depths between 100 and 7,000 meters while the ship cruises at 8-10 knots. Figure 1 depicts the general potential survey locations for ship-based multibeam surveys in water depths >200 meters within the original boundary (yellow), priority areas within the expanded boundary (purple), and potential area of operation within the expanded boundary (green). Surveys will prioritize areas of the seafloor not already mapped at high resolution. The specific survey sites within the expanded and original boundaries of the Monument will be refined based on the final E/V Nautilus 2022 schedule (which is pending based on the approval of other PMNM permit applications related to the expeditions the mapping would take place on (see Timeline section below)).

Uncrewed Surface Vessel (DriX) Mapping

Uncrewed surface vessel mapping surveys will be conducted utilizing an iXBlue DriX vehicle. DriX is a versatile uncrewed vehicle capable of mapping depths between 5 and 500 meters for deployments up to 7 days while operating at 7 knots. The vehicle has exceptional line-keeping capabilities in a variety of sea states and in currents. DriX operations will occur during daytime hours and within sight of operators aboard Nautilus. Additionally, a Zodiac will be on standby to recover DriX should the need arise.

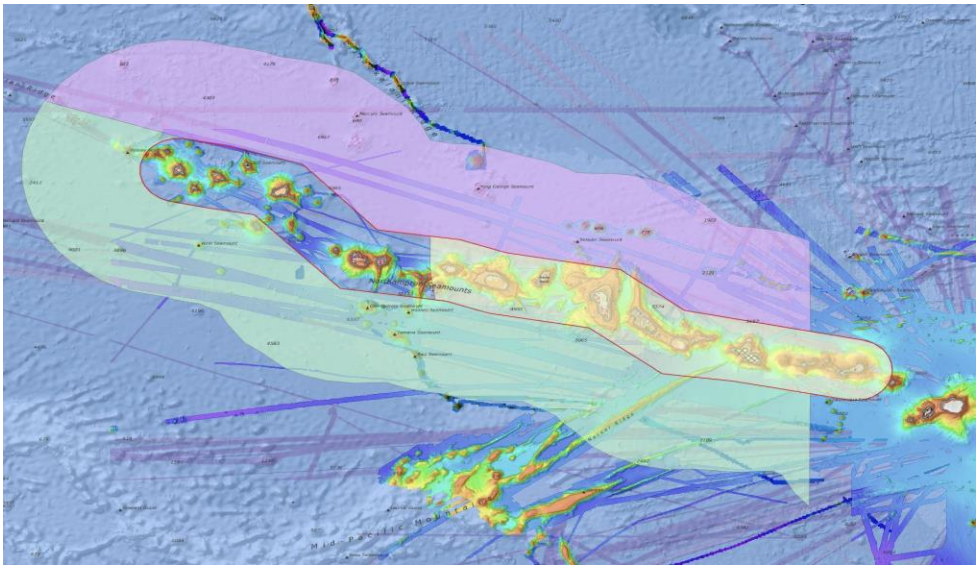


Figure 1- potential survey locations for ship-based multibeam surveys

Figures 2, 3, and 4 show survey locations for the uncrewed vehicle system (DriX) surveys in <500 meters between Nihoa and Gardner Pinnacles, Nihoa and Twin Banks, and between Twin Banks and Gardner Pinnacles, respectively. Mapping data from the DriX will be collected with a Kongsberg EM2040 multibeam echosounder. This system is the same system that is used by many NOAA vessels for shallow water survey work. The system operates at frequencies between 200 -

400 kHz. Sources operating at frequencies above 200 kHz produce sound that is outside the functional hearing ranges of marine mammals, and therefore the potential for this equipment to result in any impact on marine mammals is highly unlikely. DriX mapping will take place during daylight hours only, limited to depths between 5 and 500 m and no closer to shore or fringing reef than 500 m. DriX Mapping operations will be supervised by representatives of NOAA's Office of Coast Survey and will follow established procedures.

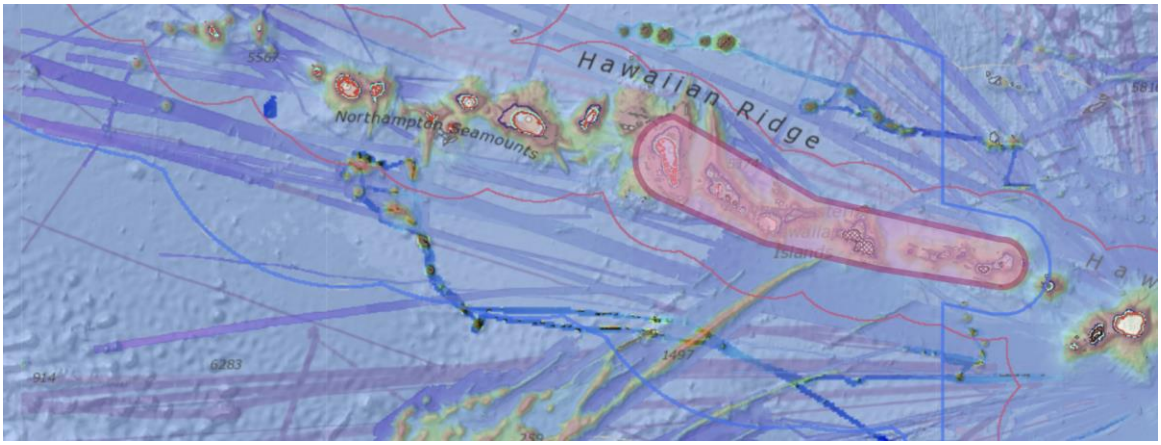


Figure 2- general survey location for uncrewed vehicle system surveys between Nihoa and Gardner Pinnacles

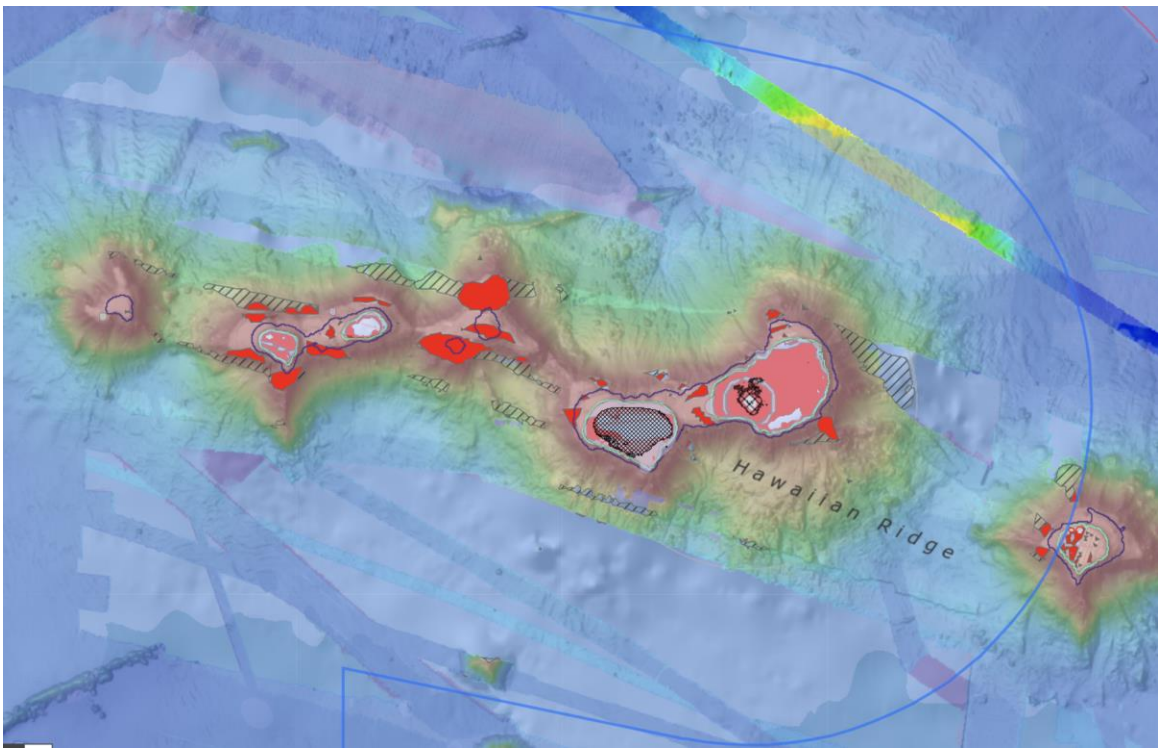


Figure 3- targeted survey locations for uncrewed vehicle system surveys between Nihoa and Twin Banks

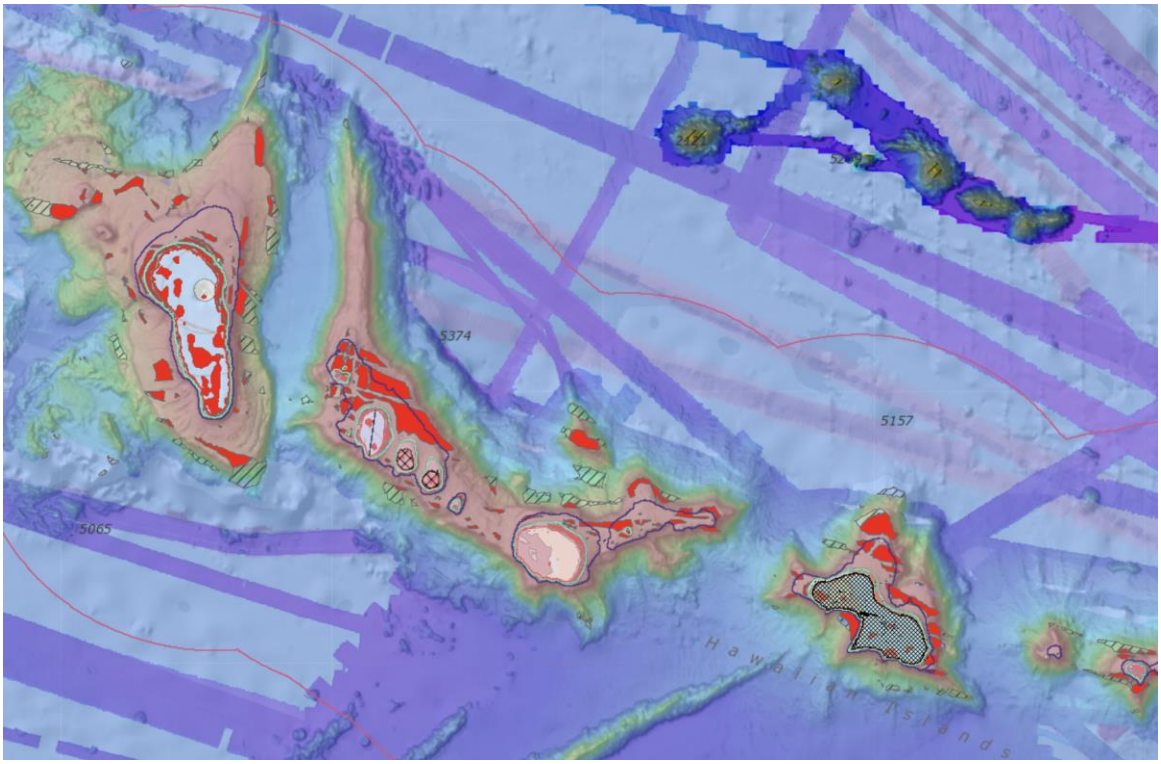


Figure 4- targeted survey locations for uncrewed vehicle system surveys between Twin Banks and Gardner Pinnacles

Underway CTD

Accurate measurements of sound speed as a function of depth down to approximately 500 meters are needed every 3-6 hours during multibeam sonar mapping operations. These sound speed measurements are essential for ray-tracing calculations used by the EM302 multibeam sonar system to collect accurate bathymetry and backscatter data. To obtain these essential data, the Nautilus can either use an XBT or the underway CTD (UCTD) equipped with a sound velocity probe. The Nautilus uses the UCTD as much as possible rather than conducting XBTs, since UCTD does not leave anything in the ocean after gathering the measurements. This is limited to daylight hours and favorable weather conditions.

The UCTD (http://www.oceanscience.com/Products/UnderwayCTD/Underway-CTD.aspx) is manufactured by Teledyne Ocean science is a piece of equipment used to gather conductivity/temperature/depth (CTD) measurements or sound velocity measurements while the ship is moving. This instrument is mounted on the stern railing and has a reusable probe that is dropped through the water column then retrieved by rewinding the line onto a motorized spool. The unit would not touch the seafloor. The unit is equipped with a CTD probe. The UCTD can obtain water column profiles down to over 500 meters while the ship is moving at 8 knots. 8-10 knots is the ship's normal ocean mapping survey speed, so the UCTD can sample the water column while continuously mapping. The ship also obtains sound velocity profiles using expendable probes (XBTs). XBTs are expensive consumable supplies and leave behind zinc and copper waste in the ocean due to the one- time use of each probe. OET has installed the UCTD in order to minimize the use of XBTs while still gathering essential sound velocity profile data needed every 3-6 hours while mapping in order to accurately collect high quality multibeam sonar data.

Expendable Bathythermographs (XBTs)
Expendable Bathythermographs (XBTs) XBTs are deployed to obtain sound velocity profiles to calibrate the multibeam system and ensure accurate bathymetric mapping when the researchers cannot conduct a UCTD. The XBT type is the Deep Blue probe produced by Lockheed Martin Sippican. A single Deep Blue XBT is 8.5 in. length x 2 in. width and weighs 2.53 lbs. It consists of a plastic spool, hair thin copper wire (< 1mm width), zinc weight, thermistor (comprised of two short wires (< 8.5 in. length)) and is contained in a plastic housing. XBTs will only be prioritized over Underway CTD casts if the sea-state/conditions do not allow for deployments or if the Underway CTD becomes inoperable for an unforeseeable reason.

National Geographic Society Deep Ocean Drop Cameras
The National Geographic Society Deep Ocean Dropcam, developed by National Geographic Exploration Technology Lab, is an efficient way to capture video of the sea floor (Turchik et al., 2015). It is a high-definition camera encased in a pressure housing rated to go to the deepest part of the ocean, with onboard lights to illuminate the scene. The camera is weighted with ~25lbs of sand and free falls to the sea floor, where it is programmed to record for a number of hours. When recording is complete, the burn wire connecting it to the weight dissolves, and it freely floats to the surface for recovery by the ship. The ballast consists of store-bought, organic and sterile sand in a biodegradable cotton pillowcase and hemp line. The researchers plan to periodically and opportunistically deploy these during deep-water seafloor mapping surveys in water depths 500 meters or deeper. Between July and October, they anticipate approximately 8 drop camera deployments or less.

Timeline:

(Note: Schedule may be subject to change)

The schedule for E/V Nautilus is dependent on the review of other pending research and special use permit requests submitted by Ocean Exploration Trust and the National Geographic Society. The notional schedule in the scenario all permit requests are approved by the co-Trustees is noted in the table below; schedule may be subject to change. For cruise legs that are co-sponsored between NOAA OE and the National Geographic Society, E/V Nautilus will be used overnight to map under NOAA OE funding and support National Geographic-funded activities during daytime hours. Estimated dates within the boundaries of PMNM are the maximum for each cruise leg and are likely to be less given transit time between sites and the Port of Honolulu. In the event some project permits included in the schedule below are not approved by the co-Trustees, Ocean Exploration Trust would request to consolidate NOAA OE-funded mapping efforts into an additional dedicated mapping cruise in PMNM.

July 15 - August 8, 2022: Ship-based mapping surveys + Uncrewed surface vessel mapping surveys
On the first expedition leg, the researchers plan to dedicate 24 hours/day to conducting mapping surveys within the Monument. During this time, they will deploy the uncrewed surface vessel DriX during daytime hours to map areas between 5-500 meters deep and at least 500 meters away from the nearest shoreline or fringing reef. Overnight, they will utilize the hull-mounted multibeam

sonar aboard Nautilus to collect high-resolution bathymetry data in areas that are deeper than 200 meters, within the original boundary as well as within the expanded boundary of the Monument. The National Geographic Drop Cameras are not expected to be utilized often and are largely aboard as a back-up operation should we be delayed in seafloor mapping survey operations.

August 14 - October 25, 2022: Ship-based mapping surveys + other permitted activities
On the subsequent expedition legs (n=4, 2 wks. ea.), the researchers plan to conduct ship-based mapping operations 12 hours per day in the overnight hours. Daytime operations will be dedicated to facilitating other permitted activities submitted through separate permit applications to the co-Trustees (e.g., National Geographic Society special use projects), using the E/V Nautilus as their platform. Should some or not all those separate activities occur, Ocean Exploration Trust would transition a portion or all of the mapping efforts in this timeframe to be 24/7 (with fewer days at sea) and with priority mapping surveys taking place within the expanded area of the Monument.

Note: Schedule may be subject to change

(est) DATES	(est) # OF DAYS IN PMNM	EXPEDITION ACTIVITY	PIs OF PENDING PERMIT APPLICATIONS
7/16-8/8	21	OET Mapping (NOAA OE, NOAA OCS)	Fundis, Mayer, Armstrong
8/8-8/13	0	port: Honolulu	
8/14-8/28	12	OET Mapping (NOAA OE) Nat Geo snorkeling (Nat Geo)	Fundis, Mayer, Armstrong Hoffman-Kunt & Miller
8/28-8/29	0	port: Honolulu	
8/30-9/13	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Nunez-Lendo & Leonardo
9/13-9/14	0	port: Honolulu	
9/15-9/29	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Agustines
9/29-9/30	0	port: Honolulu	
10/1-10/8	5	Nat Geo snorkeling/SCUBA (Nat Geo)	Hoffman-Kunt, Miller, Agustines
10/8-10/9	0	port: Honolulu	
10/10-10/24	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Dunnavant

The activities described above may require the following regulated activities to occur in State waters:

☒ Anchoring a vessel

☒ Discharging or depositing any material or matter into the Monument

The applicant would abide by the following PMNM Best Management Practices (BMPs), or any other BMPs that apply to their activities, while conducting the aforementioned activities within the PMNM: Marine Alien Species Inspection standards for Maritime Vessels (BMP #001), Human Hazards to Seabirds Briefing (BMP #003), Best Management Practices for Boat Operations and Diving Activities (BMP #004) Marine Wildlife Viewing Guidelines (BMP #010), Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011), Rodent Prevention and Inspection Standards for Permitted Vessels (BMP #018), Draft BMPs to Minimize the Spread of Chondria tumulosa (BMP #020).

Ocean Exploration Trust has a long history of scientific exploration that is sensitive to cultural and historic places and resources. The researchers will not touch or disturb any historic sites without proper permission and permitting, and do not intend to include any such activities on these expeditions. Activities aboard E/V Nautilus will be respectful of the natural, historical, and cultural resources of PMNM. All expedition participants and crew will receive a cultural briefing from PMNM, OHA, or designated representative in advance of the expedition to ensure all parties understand the cultural significance of PMNM to Native Hawaiians. Ocean Exploration Trust ensures everyone onboard E/V Nautilus understands that Native Hawaiians consider all natural resources as cultural resources and that both are provided with the utmost respect during our expeditions.

The researchers expect that mapping operations will have no effect on the cultural, natural, and historic resources nor the ecological integrity of the Monument. Multibeam mapping has already taken place in the region with no detected effects on PMNM resources. All ship-based mapping will take place in deepwater and at considerable distances from emergent land and DriX Mapping operations will be supervised by representatives of NOAA's Office of Coast Survey and will follow established procedures that are highly unlikely to impact marine wildlife. Multibeam mapping has already taken place in the region with no detected effects on PMNM resources Both systems that are to be utilized are routinely used by this exploration vessel and have provided invaluable scientific data for marine researchers and managers, including numerous National Marine Sanctuaries. An assessment of potential impacts on marine mammals using best available information has been conducted, along with proposed safeguards to reduce any potential impacts. OET has a Marine Mammals and Sea Turtle standard operating procedure for navigators/mappers and the vessel crew to follow based on NOAA's National Marine Fisheries Service and Office of National Marine Sanctuaries vessel operating guidelines.

Multibeam systems are focused sonar arrays that use "selective angular directivity" and transmit "very short pulses at limited ping rates" (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the potential sound exposure level as well as decrease the probability of the animals being subjected to temporary threshold shift (TTS) intensity levels. The National Science Foundation's 2011 document "Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey" provides a detailed analysis of potential impacts of seismic, multibeam, and sub-bottom sonars on sea turtles and marine mammals. Seismic surveys have the most potential impact and are not proposed in this permit application.

The document evaluates deep water multibeam systems ranging from 12-95 kHz. The EM302 operates at 30 kHz so falls within the frequency, source levels, pulse lengths and beam widths evaluated by this report. The SBP on the Nautilus is of the same type evaluated in the report. With respect to multibeam echosounders (MBES) and sub bottom profilers (SBP), the following direct excerpts are conclusions of this document regarding the potential impact on sea turtles, mysticetes, odontocetes, and pinnipeds:

Sea Turtles: "Operation of the MBES, SBP, or pingers is not expected to affect sea turtles, because the associated frequency ranges are above the known hearing range of sea turtles. The SBP operates at 3.5 kHz with a maximum source output of 222 dB re 1 µPa-m. Thus, the frequency range of the SBP is outside the known detection range of sea turtles based on available data. As a result, sea turtles are not expected to be capable of hearing the higher frequency sounds produced by SBPs. Furthermore, the intermittent and narrow downward-directed nature of the MBES and SBP as emitted from the transiting seismic vessel would result in no more than one or two brief ping exposures."

Mysticetes: "During the proposed marine seismic surveys, the pings from the MBES, SBP, and pingers would be very short (<1-64 ms). Thus, a given mammal would not receive many of the downward-directed MBES or SBP pings as the vessel passes by. In the case of the MBESs that operate at 30 kHz or higher, their operating frequencies are too high to have any effects on mysticete behavior. Source levels of the SBPs, another type of echosounder, are lower (maximum source level 222 dB re 1 microPa [rms]) than those of the MBES discussed above. Thus, there is even less likelihood of TTS occurring through exposure to SBP sounds, even in an animal that is briefly near the source. The SBP is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals, particularly mysticetes, move away in response to the approaching higher-power sources or the vessel itself before the mammals are close enough for there to be any possibility of effects from the SBP's less-intense sounds. The possibility of PTS through exposure to MBES or SBP sounds is considered negligible and PTS is not expected to occur. Burkhardt et al. (2008) concluded that immediate direct injury was possible only if a cetacean dived under the vessel into the immediate vicinity of the transducer. Furthermore, PTS (or any injury or pathological effect) has never been demonstrated for any marine mammal exposed to echosounders such as the proposed MBESs and SBPs."

Odontocetes: "In summary, sounds from all the MBESs would be readily audible to most and possibly all odontocetes when animals are within the narrow angular extent of the intermittent sound beam. As with baleen whales, odontocete communications will not be masked appreciably by MBES, SBP, or pinger signals given their low duty cycles, the brief period (i.e., seconds) when an individual mammal would potentially be within the downward-directed MBES or SBP beam from a transiting vessel, and the relatively low source level of a pinger. Operation of MBESs, SBPs, and pingers is not likely to impact odontocetes. The project MBESs, SBPs, and pingers are not expected to induce TTS. The possibility of PTS through exposure to MBES or SBP sounds is considered negligible."

Pinnipeds: "The SBPs associated with the proposed marine seismic activities operate in the MF range of approximately 3.5 kHz with a maximum source output of 222 dB re 1 µPa-m (rms). The frequency range of the SBPs is within the frequency band audible to pinnipeds. Masking effects

due to MBES, SBP, or pinger signals are expected to be minimal or non-existent. Thus, brief exposure of pinnipeds to small numbers of signals from the MBES or SBP would not result in a take by harassment as defined by NMFS and the ESA. The project MBESs, SBPs, and pingers are not expected to induce TTS. Although the MBESs, SBPs, and pingers can presumably be heard by pinnipeds, their operation is not likely to affect pinnipeds. The intermittent and narrow downward-directed nature of the MBESs and SPBs would result in no more than one or two brief ping exposures of any individual pinniped given the movement and speed of the vessel and animal; such brief exposure to this sound is not expected to cause injury or PTS based on results of limited studies of some pinniped species."

Nautilus sonars will be turned on before the ship enters into the Monument. The researchers will minimize turning the system on and off as a precautionary measure to avoid possible startling of the animals. When the multibeam system is turned off in the Monument, the flexible "soft start" mode will be used to restart the multibeam. The soft start mode is a delay function, starting the sonar transmissions at a low output level and then gradually increasing to the level required for optimal bathymetry data collection. The soft start modes can either be set at -10 or -20 decibels with a 0 to 15 minute ramp up time to the desired power. We can select -10 dB, -20 dB or maximum transmit power. Maximum transmit power is recommended by Kongsberg for maximizing the mapping swath coverage. In the deepest operating mode the EM302 is 243 dB re 1 microPa. When operating in shallow modes the decibels are 238 dB re 1 microPa.

The Deep Blue XBT contains no chemical solutions. The very fine wire connecting the XBT probe to the ship is extremely easy to break by hand once the probe reaches maximum depth. The minimal tensile strength of the wire should represent a minimal entanglement risk for species of concern. The potential for XBT deployments to impact ESA-listed species was the topic of an informal consultation request from the Monument to NMFS during the permit review for the past expeditions. The Monument's determination was that the Falkor's use of XBTs may affect, but is not likely to adversely affect, Hawaiian monk seals, green sea turtles, hawksbill sea turtles, leatherback sea turtles, olive ridley sea turtles, North Pacific loggerhead sea turtles, MHI Insular false killer whales, humpback whales, sperm whales, fin whales, blue whales, sei whales, and north pacific right whales. The researchers expect the same determination would be made with respect to the deployment of XBTs by the Nautilus. They expect to use a maximum of 75 XBTs during the expeditions. This number will very likely be significantly reduced by prioritizing and using Underway CTD casts instead.

<u>Informal ESA Consultation on the 2022 Research Expedition of the Ocean Exploration Trust Vessel Nautilus in the Pacific Islands Region</u>

The following information was provided in the 2021 Informal ESA Consultation on the 2022 Research Expedition of the Ocean Exploration Trust Vessel Nautilus in the Pacific Islands Region when evaluating the risk of exposure to elevated noise levels for protected species from the sonars being utilized for mapping. Based on the below information, the vessel will employ mitigation measures such as (or similar to) the following previous guidance including having bridge watchstanders that will carefully monitor for the presence of marine protected species, and will follow established best management practices to minimize disturbance. If cetacean species are present within 400 m of the ship, the vessel will stop until the animals depart the area, but the

mapping sonars will continue transmitting to avoid startle responses.

The proposed action includes the operation of multibeam bathymetric mapping sonar system. The Nautilus is equipped with a multi-beam mapping system – the Kongsberg EM 302, which has an operating frequency of 30 kHz. This system emits very short high intensity sound pulses into the marine environment when operated. The EM 302 emits sound at a root-mean-square sound pressure level of 214 dB re 1 μPa (NOAA 2020). The effects on marine life from exposure to high intensity noise vary with the frequency, intensity, and duration of the sound source, and the physiology and hearing characteristics of the exposed animal. Exposure to very high levels of sound at frequencies within the animal's range of hearing can cause soft tissue injuries that could directly result in fatality. Exposure to lower levels may cause injury in the form of permanent hearing damage, also referred to as permanent threshold shift (PTS). Exposure to even lower levels may cause behavioral effects that include temporary threshold shifts (TTS), temporarily masking communications and/or acoustic environmental cues, alteration of ongoing behaviors, and areal avoidance.

Exposure to impulsive in-water sounds at ≥ 160 dB re 1 μPa is the threshold for the onset of TTS and behavioral disturbance for all marine mammals. Exposure to impulsive in-water sounds at ≥ 175 dB re 1 μPa is the threshold for the onset of TTS and behavioral disturbance for all sea turtles (NMFS 2018). Because the sonar system used in this action is considered an impulsive source, the 160 dB re 1 μPa threshold for the onset of TTS and behavioral disturbance will apply, and significant exposure above that level at a frequency within a marine mammal's hearing range will be considered an adverse impact. Because the threshold of effect is lower for marine mammals than for sea turtles, our in depth analysis will focus on the 160 dB level.

Accurately predicting the 160 dB re 1 μPa isopleth from any sound source is difficult, but particularly so for multibeam sonar. Using the simplest example, that of an unfocused, omni-directional single point source in unbounded homogenous water, sound will disperse from the source in a spherical pattern. In addition to source level and frequency, the distance for which different decibel levels are experienced away from the source is also dependent on a number of other factors that include density, salinity, and the amount of suspended solids in the water. Entering the sound information for the EM 302 and other pertinent information from the proposed action into the spreadsheet calculator from our Marine Mammal Acoustic Technical Guidance (NMFS 2018, available online at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance), results in an estimated distance from the sonar source to the 160 dB isopleth of 373 meters.

Multibeam systems are not simple omni-directional point sources but rather are focused sonar arrays that use "selective angular directivity" and furthermore transmit "very short pulses at limited ping rates" (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the potential sound exposure level as well as decrease the probability of the animals being subjected to TTS threshold intensity levels. Exposure time is estimated by ØR/V where Ø is the longitudinal transmitting lobe aperture in radians, R is the range from the source to the animal, and V is the speed of the ship. The aperture of Nautilus' EM 302 system is 1.0°, yielding a Ø value of 0.01 rads. The ship will be mapping at 8 knots. At the maximum 373 m distance, the exposure times for a stationary animal caught in the ensonification plane of the EM 302 will be 0.46 seconds.

Submerged animals caught in the ensonification volume as the ship passes would be only briefly subjected to the elevated sound levels occurring inside the transmitter beam pattern. Furthermore, the narrow fan-shaped beam pattern of Nautilus' system provide ample possibilities for animals to quickly escape the sound. The only possible scenario for more extended exposure would be if the animal were to start moving in the exact direction and speed as the ship, which is unlikely.

Transmit pulse forms and rates are yet two other differences that distinguish multibeam sonar from other types of sonar and acoustic sources and further reduce their potential threat to marine mammals. Sound is not transmitted continuously from these systems but rather in extremely short pulses (i.e., pings). Ping durations obtained from the EM302 are very brief, between 0.7 to 5.0 milliseconds. The ping rate is depth dependent, at 400 m the ping rate is 30 pings/min, and decreases to 3.6/min at 4000 m. Based on these rates, when the ship is mapping in 250 m of water, any submerged ESA-listed animal caught in the ensonification volume will be subjected to a 0.7 millisecond ping every 1 second. When the ship is mapping in 4000 m, an animal would be exposed to a 5.0 millisecond ping every 15 seconds.

The National Science Foundation's (NSF) 2011 document "Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey" provides a detailed analysis of potential impacts of multibeam sonars on sea turtles and marine mammals. The document evaluates deep-water multibeam systems ranging from 12-95 kHz. The EM302 operates at 30 kHz, and thus falls within the frequency, source levels, pulse lengths and beam widths evaluated by this report. With respect to multibeam echosounders, the following direct excerpts are conclusions of this document regarding the potential impact on sea turtles, "Operation of the multibeam systems is not expected to affect sea turtles, because the associated frequency ranges are above the known hearing range of sea turtles", which are most sensitive to frequencies between 200 – 700 Hz (NSF 2011). The NSF programmatic goes on to state that, "Furthermore, the intermittent and narrow downward-directed nature of the multibeam systems as emitted from the transiting seismic vessel would result in no more than one or two brief ping exposures."

REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application was posted on the Monument web site in the spring of 2022, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy

MMB Agency Reviewer Questions and Applicant Responses:

1. **Please explain the benefit for the Monument from the National Geographic Drop Camera deployments. On page 16 you state, "We plan to periodically and opportunistically deploy these during deep-water seafloor mapping surveys……". Would the benefit of the activity**

be greater if the deployments were mapped out to represent particular features or some other method of determining when best to deploy the cameras?

Response: We will deploy drop cameras over areas that we map on this mission in order to ground-truth mapping data collected using acoustic technologies (i.e., multibeam sonar and sub-bottom profiler), as well as collect some basic visual information on the deep-water biology and geology of the region. The primary scientific objective of this mission is to map seafloor areas within the Monument that have not been previously mapped using acoustic technologies. Maps developed through these acoustic technologies provide continuous information on depth, topography, and whether the bottom is soft/hard. Information derived from such maps is typically used to plan more detailed follow-on investigations using deep-water submersibles or remotely operated vehicles. While we will unfortunately not be able to deploy our remotely operated vehicles on this mission, the drop cameras offer a low-cost alternative to getting a first glance view of what the seafloor looks like, which will help ground-truth mapping data, and thereby help better plan future visual surveys in the Monument. Furthermore, the visual data collected by the drop cameras will provide basic information on the deep-water biology and geology of unexplored Monument areas.

2. **Recommend that you specify a maximum of 8 drop camera deployments, rather than stating that you anticipate approximately 8 drop camera deployments or less.**

Response: We are happy to revise the language to specify maximum deployments but would request to deploy up to 15 camera deployments. We anticipate spending up to 69 days mapping in the Monument, during which we will map substantial seafloor areas. Being able to deploy the camera up to 15 times would provide us with more flexibility.

Environmental Compliance:

NEPA / HEPA: (check-one)

☒ Categorical Exclusion / Exempt Class: 5
☐ EA
☐ EIS

Other Consultations: (ESA/MMPA Section 7; NHPA Section 106, etc.)

- **For OET lead operations aboard the vessel under permit PMNM-2022-007**
    - An informal review of all aforementioned activities following section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. 1855(b)) is currently underway. The outcome of this review may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.
    - An informal consultation under Section 7 of Endangered Species Act of 1973 with NMFS was completed on 1/06/2022. NMFS concurred that issuances of permit PMNM-2021-21 may affect, but is not likely to adversely affect, the following designated and proposed ESA critical habitats and listed species: Hawaiian monk seals (Neomonachus schauinslandi), green sea turtles (Chelonia mydas), hawksbill sea turtles (Eretmochelys imbricata), North Pacific loggerhead sea turtles (Caretta caretta), olive ridley sea turtles

(Lepidochelys olivacea), leatherback sea turtles (Dermochelys coriacea), Main Hawaiian Islands false killer whale (Pseudorca crassidens), sperm whales (Physeter macrocephalus), fin whales (Balaenoptera physalus), blue whales (Balaenoptera musculus), sei whales (Balaenoptera borealis), North Pacific right whales (Eubalaena japonica), scalloped hammerhead sharks (Sphryna lewini), oceanic whitetip shark (Carcharinus longimanus), giant manta rays (Manta birostris) or critical habitat for the Hawaiian monk seal and Main Hawaiian Islands insular false killer whale.

- On April 8, 2022 an additional request for informal consultation under Section 7 of Endangered Species Act of 1973 with NMFS was submitted for NOAA's Office of Coast Survey plans to conduct hydrographic research in the waters surrounding Nihoa, French Frigate Shoals and Gardner Pinnacles not covered in the original consultation. The outcome of this consultation may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.

- **For National Geographic lead research (apart from the National Geographic Society Deep Ocean Dropcam) aboard the vessel under permit PMNM-2022-009**

  - Proposed permit activities are still under MMB agency review. Following agency review a complete list of all required supplemental consultations will be identified and completed as necessary prior to access into the Monument.

The Department has made an exemption determination for this permit in accordance with Chapter 343, HRS, and Chapter 11-200.1, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200.1 HAR, FOR TWO PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMITS TO MS. ALLISON FUNDIS, OCEAN EXPLORATION TRUST, FOR ACCESS TO STATE WATERS TO CONDUCT SEAFLOOR MAPPING AND TO OPERATE THE EXPLORATION VESSEL (E/V) NAUTILUS AS A PLATFORM FOR VARIOUS PRINCIPLE INVESTIGATORS WITHIN THE WATERS OF THE NORTHWESTERN HAWAIIAN ISLANDS UNDER PERMIT PMNM-2022-007 AND PMNM-2022-008)

Has Applicant been granted a permit from the State in the past? Yes ☐ No ☒

If so, please summarize past permits:

Have there been any a) violations: Yes ☐ No ☒
b) Late/incomplete post-activity reports: Yes ☐ No ☒

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

STAFF OPINION:

DAR staff is of the opinion that Applicant has properly demonstrated valid justifications for their application and should be allowed to enter the NWHI State waters and to conduct the activities

therein as specified in the application with certain special instructions and conditions, which are in addition to the Papahanaumokuakea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION:

The MMB is of the opinion that the Applicant has met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by NOAA, USFWS, ONMS, DAR, DOFAW and OHA staff.

RECOMMENDATION:

Based on the attached proposed declaration of exemption prepared by the department after consultation with and advice of those having jurisdiction and expertise for the proposed permit actions:

1. That the Board declare that the actions which are anticipated to be undertaken under this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.

2. Upon the finding and adoption of the department's analysis by the Board, that the Board review and accept the declaration of exemption for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200.1, HAR.

3. That the Board authorize and approve two Research Permits to Ms. Allison Fundis, Ocean Exploration Trust, for Access to State Waters to Conduct Seafloor Mapping and to Operate the Exploration Vessel (E/V) Nautilus as a Platform for Various Principal Investigators within the Waters of the Northwestern Hawaiian Islands, with the following special conditions:

    a. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.

    b. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.

    c. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocols or BMP attached to this permit.

d. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.

e. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State Marine Refuge.

f. If there is any Hawaiian monk seal or any other protected species in the area when performing any permitted activity shall cease until the animal(s) depart the area, except as permitted for specific management of that species.

g. No fishing is allowed in State Waters except as authorized under State law for subsistence, traditional and customary practices by Native Hawaiians.

h. The permittee is required to follow all applicable Federal, State, and County laws with respect to the COVID-19 emergency response that apply at the time of departure and return. In issuance of this permit, the State of Hawaii is not otherwise monitoring or regulating permittee's compliance with COVID-19 laws and is not responsible for the health and safety of crew members, researchers or other occupants of the vessel associated with this permit.

Respectfully submitted,

Brian J. Neilson, Administrator
Division of Aquatic Resources

APPROVED FOR SUBMITTAL

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

Attachments:

1) Declaration of Exemption ("DE") from the Preparation of an Environmental Assessment under the Authority of Chapter 343, HRS & Chapter 11-200.1 HAR
2) PMNM Application
3) CIS Form (to be attached at the BLNR Meeting on May 27, 2022)

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

May 27, 2022

TO: Division of Aquatic Resources File

THROUGH: Suzanne D. Case, Chairperson

FROM: Brian J. Neilson, Administrator
Division of Aquatic Resources

SUBJECT:

DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200.1 HAR, FOR TWO PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMITS TO MS. ALLISON FUNDIS, OCEAN EXPLORATION TRUST, FOR ACCESS TO STATE WATERS TO CONDUCT SEAFLOOR MAPPING AND OPERATE THE EXPLORATION VESSEL (E/V) NAUTILUS AS A PLATFORM FOR VARIOUS PRINCIPLE INVESTIGATORS WITHIN THE WATERS OF THE NORTHWESTERN HAWAIIAN ISLANDS UNDER PERMITS PMNM-2022-007 AND PMNM-2022-008.

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200.1, HAR:

Project Title: Two Papahānaumokuākea Marine National Monument Research Permits to Ms. Allison Fundis, Ocean Exploration Trust, for Access to State Waters to Conduct Seafloor mapping and to Operate the Exploration Vessel (E/V) Nautilus as a Platform for Various Principal Investigators within the Waters of the Northwestern Hawaiian Islands.

Permit Numbers: PMNM-2022-007 and PMNM-2022-008

Project Description: Operate the exploration vessel (E/V) Nautilus, a 224’ research vessel within the boundaries of Papahānaumokuākea Marine National Monument to provide an at-sea research platform for Principal Investigators (PIs) and to conduct high-resolution mapping and seafloor characterization where such data does not currently exist within PMNM.

The Research Permits, as described below, would allow entry and activities to occur in Papahānaumokuākea Marine National Monument, including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following sites:

- Nihoa Island
- Necker Island (Mokumanamana)
- French Frigate Shoals (Lalo)
- Gardner Pinnacles (ʻŌnūnui,ʻŌnūiki)
- Laysan Island (Kamole)
- Maro Reef (Kamokuokamohoaliʻi)

Note: Activities will also occur in deepwater environments (>100m) in the expanded area of PMNM.

The activities covered under this permit would be scheduled to occur between July 1, 2022 to October 25, 2022. Expedition dates may vary between 2022-2023 if unforeseen interruptions or delays occur; schedule may be subject to change.

INTENDED ACTIVITIES

The proposed activities are to operate the exploration vessel (E/V) Nautilus, a 224' research vessel within the boundaries of Papahānaumokuākea Marine National Monument to provide an at-sea research platform for Principal Investigators (PIs) to conduct research within PMNM. Research scientists aboard the vessel would work under separate permits from the vessel. The Nautilus would transport and support researchers working and traveling within PMNM. Additionally, high-resolution mapping and seafloor characterization would be conducted where such data does not currently exist within PMNM. This activity would utilize the ship-based multibeam sonar and sub-bottom profiler to collect seafloor mapping data within the expanded and original boundaries of PMNM. This is the same system utilized on similar Nautilus expeditions to PMNM, conducted previously in 2021 and 2018, in federal waters or the expanded areas of the monument (most recent permit: PMNM-2021-021 Fundis). Additionally, the researchers would deploy an uncrewed mapping vehicle equipped with an EM2040 (200-400kHz) multibeam sonar that will acquire similar data at depths between 5- and 500-meters depth and no closer to shore or fringing reefs than 500 meters.

Specific objectives are as followed:

- Utilize the E/V Nautilus to provide a data collection platform for PIs to conduct research activities working under separate permits from the vessel

- Use ship-based multibeam sonar and sub-bottom profilers to collect seafloor mapping data where such data does not currently exist within both the original and expanded PMNM boundaries

- Deploy an uncrewed mapping vehicle equipped with multibeam sonar to acquire seafloor

mapping data at depths between 5-500 meters.

- Use an underway CTD (UCTD) to collect conductivity, temperature, and depth information at various locations

- When use of a UCTD is inhibited, use Expendable Bathythermographs (XBTs) to obtain sound velocity profiles to calibrate the multibeam system and ensure accurate bathymetric mapping

- Utilize National Geographic Society Deep Ocean Drop Cameras to capture video of the sea floor at the deepest parts of the ocean

Purpose and Need

E/V Nautilus will support permitted scientific research that will help assess and characterize the health and biodiversity of the fauna within the Monument in addition to collecting bathymetric data (seafloor mapping data) which will contribute to a greater understanding of the structure of the seafloor within the boundaries of PMNM, which can ultimately inform future research and management needs. Researchers will fill gaps in existing seafloor mapping data and characterize benthic ecosystems, which is part of the National Ocean Mapping, Exploration, and Characterization (NOMEC) strategy. This project has applied science objectives that are also consistent with a number of other NOAA mission priorities. NOAA's long-term Healthy Oceans goals requires students that will improve our understanding of marine ecosystems in order to develop management measures to ensure sustainability in the face of both human and climate impacts. The findings from the project will have direct and immediate benefit to the Monument staff in informing their efforts to protect shallow and deepwater habitats within PMNM. Additionally, the acquired seafloor mapping data will be applied to NOAA nautical charts and will be made publicly available except as provided for in the National Historic Preservation Act.

This project will also provide continued education and outreach opportunities for PMNM and local communities. In 2021, Ocean Exploration Trust and representatives of the Papahānaumokuākea Native Hawaiian Cultural Working Group collaborated to begin to address the overdue need for expeditions to be conducted in Hawai'i to reflect collaborative approaches inclusive of Hawaiian worldview. As a result, the 2021 PMNM expedition aboard Nautilus included co-developed outreach and education opportunities including: (1) Hawaiian naming of expeditions, (2) supporting storytelling through development of promotional video in Hawaiian highlighting Hawaiian worldviews ocean exploration, (3) broadening outreach to the local Department of Education, charter, and kula kaiapuni networks, and (4) supporting live ship-to-shore broadcasts in Hawaiian and English, which included supporting a paid internship position for a Native Hawaiian student and a paid position for a Cultural Working Group representative to be on board for the expedition as a Hawaiian language correspondent and cultural liaison. Ocean Exploration Trust and PMNM collaborators continue to work together to build on this partnership to make more opportunities available for local students, educators, and researchers. This project will allow for this partnership to

leverage additional expeditions within PMNM and provide opportunities for local students and educators.

Research and Sampling Methods
E/V Nautilus will transit to the Monument from Honolulu and operate within the Monument for various permitted research activities, which may include seafloor mapping operations with the vessel and an autonomous mapping vehicle, oceanographic data collection, SCUBA diving and related small boat operations, and supporting the transport of FWS personnel for authorized FWS land-based operations. Crew activities may include small boat operations, SCUBA, or snorkeling, as necessary for emergency operations, vessel maintenance, or support of research activities. All planned small boat and permitted SCUBA research activities will be conducted during daylight hours.

Researchers plan to conduct mapping within the expanded boundary of the Monument as well as the southern half the of original Monument where high-resolution seafloor data does not already exist. E/V Nautilus has two scientific sonars that are configured to operate simultaneously without interference: a 30 kHz multibeam system, and a 3.5 kHz chirp sub-bottom profiler sonar. The multibeam is used to map broad swaths for bathymetry and water column feature detection (e.g., gaseous seeps) and the sub-bottom profiler provides data useful for interpreting seafloor geology.

Ship-based Mapping
Ship-based mapping surveys will be conducted with the Kongsberg EM302 multibeam echosounder installed in the hull of E/V Nautilus. This is the same system utilized on similar Nautilus expeditions to PMNM, conducted previously in 2021 and 2018, in federal waters or the expanded areas of the monument (most recent permit: PMNM-2021-021 Fundis), as well as during those previously conducted by NOAA Ship Okeanos Explorer. The system is capable of mapping the seafloor at depths between 100 and 7,000 meters while the ship cruises at 8-10 knots. Figure 1 depicts the general potential survey locations for ship-based multibeam surveys in water depths >200 meters within the original boundary (yellow), priority areas within the expanded boundary (purple), and potential area of operation within the expanded boundary (green). Surveys will prioritize areas of the seafloor not already mapped at high resolution. The specific survey sites within the expanded and original boundaries of the Monument will be refined based on the final E/V Nautilus 2022 schedule (which is pending based on the approval of other PMNM permit applications related to the expeditions the mapping would take place on (see Timeline section below)).

Uncrewed Surface Vessel (DriX) Mapping
Uncrewed surface vessel mapping surveys will be conducted utilizing an iXBlue DriX vehicle. DriX is a versatile uncrewed vehicle capable of mapping depths between 5 and 500 meters for deployments up to 7 days while operating at 7 knots. The vehicle has exceptional line-keeping capabilities in a variety of sea states and in currents. DriX operations will occur during daytime hours and within sight of operators aboard Nautilus. Additionally, a Zodiac will be on standby to recover DriX should the need arise.

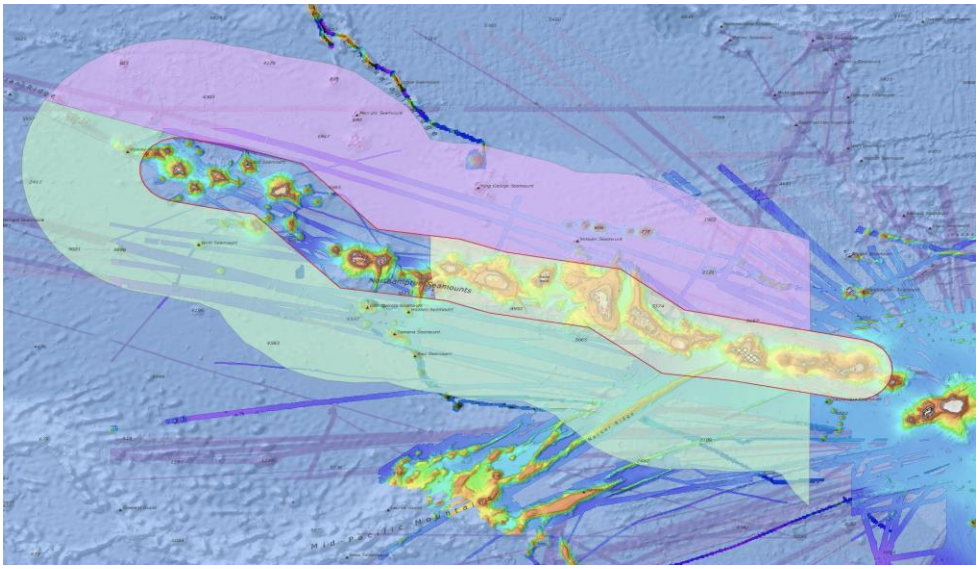


Figure 1- potential survey locations for ship-based multibeam surveys

Figures 2, 3, and 4 show survey locations for the uncrewed vehicle system (DriX) surveys in <500 meters between Nihoa and Gardner Pinnacles, Nihoa and Twin Banks, and between Twin Banks and Gardner Pinnacles, respectively. Mapping data from the DriX will be collected with a Kongsberg EM2040 multibeam echosounder. This system is the same system that is used by many NOAA vessels for shallow water survey work. The system operates at frequencies between 200 - 400 kHz. Sources operating at frequencies above 200 kHz produce sound that is outside the functional hearing ranges of marine mammals, and therefore the potential for this equipment to result in any impact on marine mammals is highly unlikely. DriX mapping will take place during daylight hours only, limited to depths between 5 and 500 m and no closer to shore or fringing reef than 500 m. DriX Mapping operations will be supervised by representatives of NOAA's Office of Coast Survey and will follow established procedures.

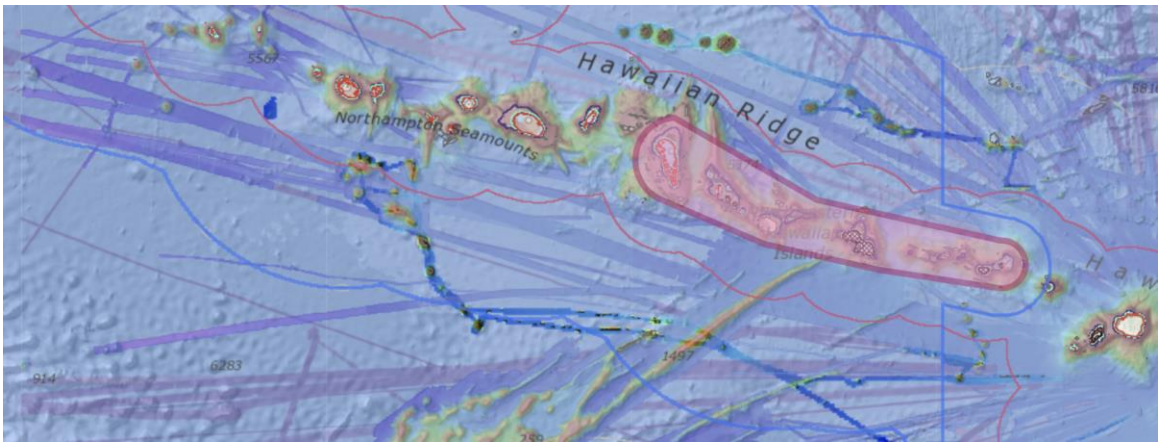


Figure 2- general survey location for uncrewed vehicle system surveys between Nihoa and Gardner Pinnacles

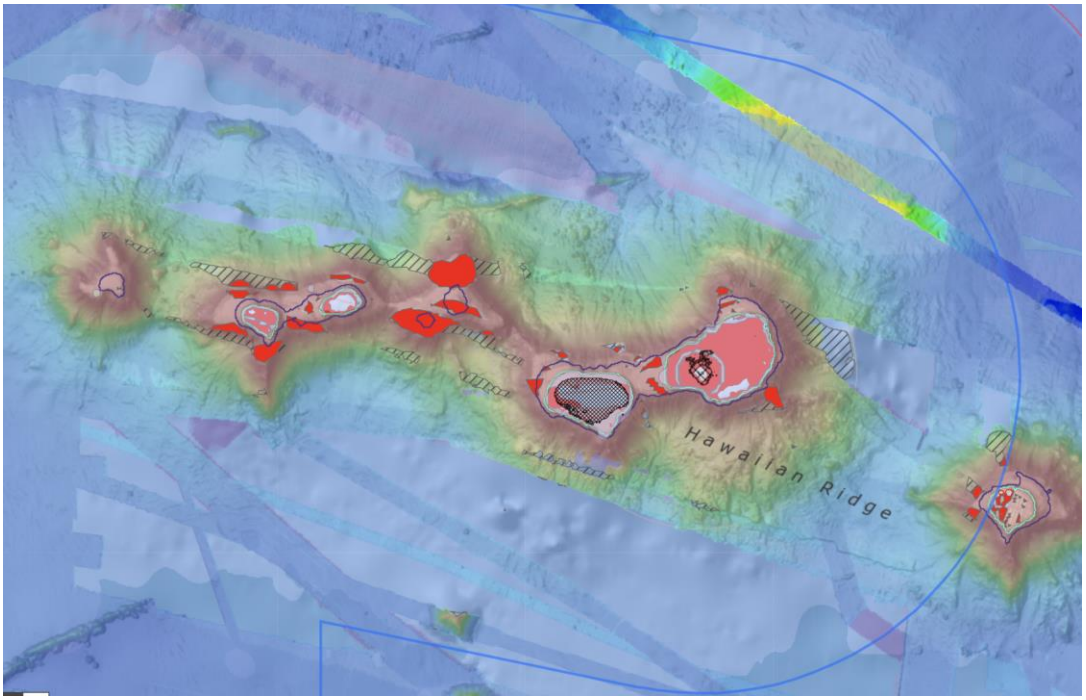


Figure 3- targeted survey locations for uncrewed vehicle system surveys between Nihoa and Twin Banks

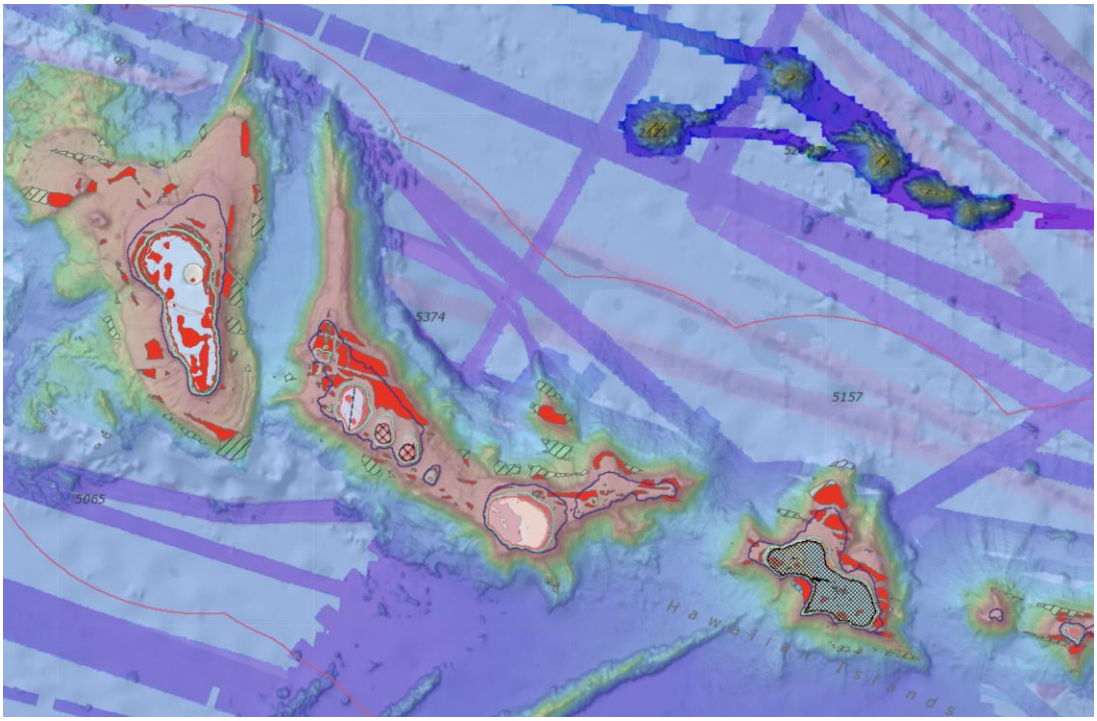


Figure 4- targeted survey locations for uncrewed vehicle system surveys between Twin Banks and Gardner Pinnacles

Underway CTD
Accurate measurements of sound speed as a function of depth down to approximately 500 meters are needed every 3-6 hours during multibeam sonar mapping operations. These sound speed measurements are essential for ray-tracing calculations used by the EM302 multibeam sonar system to collect accurate bathymetry and backscatter data. To obtain these essential data, the Nautilus can either use an XBT or the underway CTD (UCTD) equipped with a sound velocity probe. The Nautilus uses the UCTD as much as possible rather than conducting XBTs, since UCTD does not leave anything in the ocean after gathering the measurements. This is limited to daylight hours and favorable weather conditions.

The UCTD (http://www.oceanscience.com/Products/UnderwayCTD/Underway-CTD.aspx) is manufactured by Teledyne Ocean science is a piece of equipment used to gather conductivity/temperature/depth (CTD) measurements or sound velocity measurements while the ship is moving. This instrument is mounted on the stern railing and has a reusable probe that is dropped through the water column then retrieved by rewinding the line onto a motorized spool. The unit would not touch the seafloor. The unit is equipped with a CTD probe. The UCTD can obtain water column profiles down to over 500 meters while the ship is moving at 8 knots. 8-10 knots is the ship's normal ocean mapping survey speed, so the UCTD can sample the water column while continuously mapping. The ship also obtains sound velocity profiles using expendable probes (XBTs). XBTs are expensive consumable supplies and leave behind zinc and copper waste in the ocean due to the one-time use of each probe. OET has installed the UCTD in order to minimize the use of XBTs while still gathering essential sound velocity profile data needed every 3-6 hours while mapping in order to accurately collect high quality multibeam sonar data.

Expendable Bathythermographs (XBTs)
Expendable Bathythermographs (XBTs) XBTs are deployed to obtain sound velocity profiles to calibrate the multibeam system and ensure accurate bathymetric mapping when the researchers cannot conduct a UCTD. The XBT type is the Deep Blue probe produced by Lockheed Martin Sippican. A single Deep Blue XBT is 8.5 in. length x 2 in. width and weighs 2.53 lbs. It consists of a plastic spool, hair thin copper wire (< 1mm width), zinc weight, thermistor (comprised of two short wires (< 8.5 in. length)) and is contained in a plastic housing. XBTs will only be prioritized over Underway CTD casts if the sea-state/conditions do not allow for deployments or if the Underway CTD becomes inoperable for an unforeseeable reason.

National Geographic Society Deep Ocean Drop Cameras
The National Geographic Society Deep Ocean Dropcam, developed by National Geographic Exploration Technology Lab, is an efficient way to capture video of the sea floor (Turchik et al., 2015). It is a high-definition camera encased in a pressure housing rated to go to the deepest part of the ocean, with onboard lights to illuminate the scene. The camera is weighted with ~25lbs of sand and free falls to the sea floor, where it is programmed to record for a number of hours. When recording is complete, the burn wire connecting it to the weight dissolves, and it freely floats to the surface for recovery by the ship. The ballast consists of store-bought, organic and sterile sand in a biodegradable cotton pillowcase and hemp line. The researchers plan to periodically and opportunistically deploy

these during deep-water seafloor mapping surveys in water depths 500 meters or deeper. Between July and October, they anticipate approximately 8 drop camera deployments or less.

Timeline

(Note: Schedule may be subject to change)

The schedule for E/V Nautilus is dependent on the review of other pending research and special use permit requests submitted by Ocean Exploration Trust and the National Geographic Society. The notional schedule in the scenario all permit requests are approved by the co-Trustees is noted in the table below; schedule may be subject to change. For cruise legs that are co-sponsored between NOAA OE and the National Geographic Society, E/V Nautilus will be used overnight to map under NOAA OE funding and support National Geographic-funded activities during daytime hours. Estimated dates within the boundaries of PMNM are the maximum for each cruise leg and are likely to be less given transit time between sites and the Port of Honolulu. In the event some project permits included in the schedule below are not approved by the co-Trustees, Ocean Exploration Trust would request to consolidate NOAA OE-funded mapping efforts into an additional dedicated mapping cruise in PMNM.

July 15 - August 8, 2022: Ship-based mapping surveys + Uncrewed surface vessel mapping surveys

On the first expedition leg, the researchers plan to dedicate 24 hours/day to conducting mapping surveys within the Monument. During this time, they will deploy the uncrewed surface vessel DriX during daytime hours to map areas between 5-500 meters deep and at least 500 meters away from the nearest shoreline or fringing reef. Overnight, they will utilize the hull-mounted multibeam sonar aboard Nautilus to collect high-resolution bathymetry data in areas that are deeper than 200 meters, within the original boundary as well as within the expanded boundary of the Monument. The National Geographic Drop Cameras are not expected to be utilized often and are largely aboard as a back-up operation should we be delayed in seafloor mapping survey operations.

August 14 - October 25, 2022: Ship-based mapping surveys + other permitted activities

On the subsequent expedition legs (n=4, 2 wks. ea.), the researchers plan to conduct ship-based mapping operations 12 hours per day in the overnight hours. Daytime operations will be dedicated to facilitating other permitted activities submitted through separate permit applications to the co-Trustees (e.g., National Geographic Society special use projects), using the E/V Nautilus as their platform. Should some or not all those separate activities occur, Ocean Exploration Trust would transition a portion or all of the mapping efforts in this timeframe to be 24/7 (with fewer days at sea) and with priority mapping surveys taking place within the expanded area of the Monument.

Note: Schedule may be subject to change

(est) DATES	(est) # OF DAYS IN PMNM	EXPEDITION ACTIVITY	PIs OF PENDING PERMIT APPLICATIONS
7/16-8/8	21	OET Mapping (NOAA OE, NOAA OCS)	Fundis, Mayer, Armstrong
8/8-8/13	0	port: Honolulu	
8/14-8/28	12	OET Mapping (NOAA OE) Nat Geo snorkeling (Nat Geo)	Fundis, Mayer, Armstrong Hoffman-Kunt & Miller
8/28-8/29	0	port: Honolulu	
8/30-9/13	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Nunez-Lendo & Leonardo
9/13-9/14	0	port: Honolulu	
9/15-9/29	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Agustines
9/29-9/30	0	port: Honolulu	
10/1-10/8	5	Nat Geo snorkeling/SCUBA (Nat Geo)	Hoffman-Kunt, Miller, Agustines
10/8-10/9	0	port: Honolulu	
10/10-10/24	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Dunnavant

The activities described above may require the following regulated activities to occur in State waters:

☒ Anchoring a vessel

☒ Discharging or depositing any material or matter into the Monument

The applicant would abide by the following PMNM Best Management Practices (BMPs), or any other BMPs that apply to their activities, while conducting the aforementioned activities within the PMNM: Marine Alien Species Inspection standards for Maritime Vessels (BMP #001), Human Hazards to Seabirds Briefing (BMP #003), Best Management Practices for Boat Operations and Diving Activities (BMP #004) Marine Wildlife Viewing Guidelines (BMP #010), Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011), Rodent Prevention and Inspection Standards for Permitted Vessels (BMP #018), Draft BMPs to Minimize the Spread of Chondria tumulosa (BMP #020).

Ocean Exploration Trust has a long history of scientific exploration that is sensitive to cultural and historic places and resources. The researchers will not touch or disturb any historic sites without proper permission and permitting, and do not intend to include any such activities on these expeditions. Activities aboard E/V Nautilus will be respectful of the natural, historical, and cultural resources of PMNM. All expedition participants and crew will receive a cultural briefing from PMNM, OHA, or designated representative in advance of the expedition to ensure all parties understand the cultural significance of PMNM to Native Hawaiians. Ocean Exploration Trust ensures everyone onboard E/V Nautilus understands that Native Hawaiians consider all natural resources as cultural resources and that both are provided with the utmost respect during our expeditions.

The researchers expect that mapping operations will have no effect on the cultural, natural, and historic resources nor the ecological integrity of the Monument. Multibeam mapping has already taken place in the region with no detected effects on PMNM resources. All ship-based mapping will take place in deepwater and at considerable distances from emergent land and DriX Mapping operations will be supervised by representatives of NOAA's Office of Coast Survey and will follow established procedures that are highly unlikely to impact marine wildlife. Multibeam mapping has already taken place in the region with no detected effects on PMNM resources Both systems that are to be utilized are routinely used by this exploration vessel and have provided invaluable scientific data for marine researchers and managers, including numerous National Marine Sanctuaries. An assessment of potential impacts on marine mammals using best available information has been conducted, along with proposed safeguards to reduce any potential impacts. OET has a Marine Mammals and Sea Turtle standard operating procedure for navigators/mappers and the vessel crew to follow based on NOAA‘s National Marine Fisheries Service and Office of National Marine Sanctuaries vessel operating guidelines.

Multibeam systems are focused sonar arrays that use "selective angular directivity" and transmit "very short pulses at limited ping rates" (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the potential sound exposure level as well as decrease the probability of the animals being subjected to temporary threshold shift (TTS) intensity levels. The National Science Foundation's 2011 document "Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey" provides a detailed analysis of potential impacts of seismic, multibeam, and sub-bottom sonars on sea turtles and marine mammals. Seismic surveys have the most potential impact and are not proposed in this permit application. The document evaluates deep water multibeam systems ranging from 12-95 kHz. The EM302 operates at 30 kHz so falls within the frequency, source levels, pulse lengths and beam widths evaluated by this report. The SBP on the Nautilus is of the same type evaluated in the report. With respect to multibeam echosounders (MBES) and sub bottom profilers (SBP), the following direct excerpts are conclusions of this document regarding the potential impact on sea turtles, mysticetes, odontocetes, and pinnipeds:

Sea Turtles: "Operation of the MBES, SBP, or pingers is not expected to affect sea turtles, because the associated frequency ranges are above the known hearing range of sea turtles. The SBP operates at 3.5 kHz with a maximum source output of 222 dB re 1 μPa-m. Thus, the frequency range of the SBP is outside the known detection range of sea turtles based on available data. As a result, sea turtles

are not expected to be capable of hearing the higher frequency sounds produced by SBPs. Furthermore, the intermittent and narrow downward-directed nature of the MBES and SBP as emitted from the transiting seismic vessel would result in no more than one or two brief ping exposures."

Mysticetes: "During the proposed marine seismic surveys, the pings from the MBES, SBP, and pingers would be very short (<1-64 ms). Thus, a given mammal would not receive many of the downward-directed MBES or SBP pings as the vessel passes by. In the case of the MBESs that operate at 30 kHz or higher, their operating frequencies are too high to have any effects on mysticete behavior. Source levels of the SBPs, another type of echosounder, are lower (maximum source level 222 dB re 1 microPa [rms]) than those of the MBES discussed above. Thus, there is even less likelihood of TTS occurring through exposure to SBP sounds, even in an animal that is briefly near the source. The SBP is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals, particularly mysticetes, move away in response to the approaching higher-power sources or the vessel itself before the mammals are close enough for there to be any possibility of effects from the SBP's less-intense sounds. The possibility of PTS through exposure to MBES or SBP sounds is considered negligible and PTS is not expected to occur. Burkhardt et al. (2008) concluded that immediate direct injury was possible only if a cetacean dived under the vessel into the immediate vicinity of the transducer. Furthermore, PTS (or any injury or pathological effect) has never been demonstrated for any marine mammal exposed to echosounders such as the proposed MBESs and SBPs."

Odontocetes: "In summary, sounds from all the MBESs would be readily audible to most and possibly all odontocetes when animals are within the narrow angular extent of the intermittent sound beam. As with baleen whales, odontocete communications will not be masked appreciably by MBES, SBP, or pinger signals given their low duty cycles, the brief period (i.e., seconds) when an individual mammal would potentially be within the downward-directed MBES or SBP beam from a transiting vessel, and the relatively low source level of a pinger. Operation of MBESs, SBPs, and pingers is not likely to impact odontocetes. The project MBESs, SBPs, and pingers are not expected to induce TTS. The possibility of PTS through exposure to MBES or SBP sounds is considered negligible."

Pinnipeds: "The SBPs associated with the proposed marine seismic activities operate in the MF range of approximately 3.5 kHz with a maximum source output of 222 dB re 1 µPa-m (rms). The frequency range of the SBPs is within the frequency band audible to pinnipeds. Masking effects due to MBES, SBP, or pinger signals are expected to be minimal or non-existent. Thus, brief exposure of pinnipeds to small numbers of signals from the MBES or SBP would not result in a take by harassment as defined by NMFS and the ESA. The project MBESs, SBPs, and pingers are not expected to induce TTS. Although the MBESs, SBPs, and pingers can presumably be heard by pinnipeds, their operation is not likely to affect pinnipeds. The intermittent and narrow downward-directed nature of the MBESs and SPBs would result in no more than one or two brief ping exposures of any individual pinniped given the movement and speed of the vessel and animal; such brief exposure to this sound is not expected to cause injury or PTS based on results of limited studies of some pinniped species."

Nautilus sonars will be turned on before the ship enters into the Monument. The researchers will minimize turning the system on and off as a precautionary measure to avoid possible startling of the

animals. When the multibeam system is turned off in the Monument, the flexible "soft start" mode will be used to restart the multibeam. The soft start mode is a delay function, starting the sonar transmissions at a low output level and then gradually increasing to the level required for optimal bathymetry data collection. The soft start modes can either be set at -10 or -20 decibels with a 0 to 15 minute ramp up time to the desired power. We can select -10 dB, -20 dB or maximum transmit power. Maximum transmit power is recommended by Kongsberg for maximizing the mapping swath coverage. In the deepest operating mode the EM302 is 243 dB re 1 microPa. When operating in shallow modes the decibels are 238 dB re 1 microPa.

The Deep Blue XBT contains no chemical solutions. The very fine wire connecting the XBT probe to the ship is extremely easy to break by hand once the probe reaches maximum depth. The minimal tensile strength of the wire should represent a minimal entanglement risk for species of concern. The potential for XBT deployments to impact ESA-listed species was the topic of an informal consultation request from the Monument to NMFS during the permit review for the past expeditions. The Monument's determination was that the Falkor's use of XBTs may affect, but is not likely to adversely affect, Hawaiian monk seals, green sea turtles, hawksbill sea turtles, leatherback sea turtles, olive ridley sea turtles, North Pacific loggerhead sea turtles, MHI Insular false killer whales, humpback whales, sperm whales, fin whales, blue whales, sei whales, and north pacific right whales. The researchers expect the same determination would be made with respect to the deployment of XBTs by the Nautilus. They expect to use a maximum of 75 XBTs during the expeditions. This number will very likely be significantly reduced by prioritizing and using Underway CTD casts instead.

Informal ESA Consultation on the 2022 Research Expedition of the Ocean Exploration Trust Vessel Nautilus in the Pacific Islands Region

The following information was provided in the 2021 Informal ESA Consultation on the 2022 Research Expedition of the Ocean Exploration Trust Vessel Nautilus in the Pacific Islands Region when evaluating the risk of exposure to elevated noise levels for protected species from the sonars being utilized for mapping. Based on the below information, the vessel will employ mitigation measures such as (or similar to) the following previous guidance including having bridge watchstanders that will carefully monitor for the presence of marine protected species, and will follow established best management practices to minimize disturbance. If cetacean species are present within 400 m of the ship, the vessel will stop until the animals depart the area, but the mapping sonars will continue transmitting to avoid startle responses.

The proposed action includes the operation of multibeam bathymetric mapping sonar system. The Nautilus is equipped with a multi-beam mapping system – the Kongsberg EM 302, which has an operating frequency of 30 kHz. This system emits very short high intensity sound pulses into the marine environment when operated. The EM 302 emits sound at a root-mean-square sound pressure level of 214 dB re 1 μPa (NOAA 2020). The effects on marine life from exposure to high intensity noise vary with the frequency, intensity, and duration of the sound source, and the physiology and hearing characteristics of the exposed animal. Exposure to very high levels of sound at frequencies within the animal's range of hearing can cause soft tissue injuries that could directly result in fatality. Exposure to lower levels may cause injury in the form of permanent hearing damage, also referred to

as permanent threshold shift (PTS). Exposure to even lower levels may cause behavioral effects that include temporary threshold shifts (TTS), temporarily masking communications and/or acoustic environmental cues, alteration of ongoing behaviors, and areal avoidance.

Exposure to impulsive in-water sounds at ≥ 160 dB re 1 μPa is the threshold for the onset of TTS and behavioral disturbance for all marine mammals. Exposure to impulsive in-water sounds at ≥ 175 dB re 1 μPa is the threshold for the onset of TTS and behavioral disturbance for all sea turtles (NMFS 2018). Because the sonar system used in this action is considered an impulsive source, the 160 dB re 1 μPa threshold for the onset of TTS and behavioral disturbance will apply, and significant exposure above that level at a frequency within a marine mammal's hearing range will be considered an adverse impact. Because the threshold of effect is lower for marine mammals than for sea turtles, our in depth analysis will focus on the 160 dB level.

Accurately predicting the 160 dB re 1 μPa isopleth from any sound source is difficult, but particularly so for multibeam sonar. Using the simplest example, that of an unfocused, omni-directional single point source in unbounded homogenous water, sound will disperse from the source in a spherical pattern. In addition to source level and frequency, the distance for which different decibel levels are experienced away from the source is also dependent on a number of other factors that include density, salinity, and the amount of suspended solids in the water. Entering the sound information for the EM 302 and other pertinent information from the proposed action into the spreadsheet calculator from our Marine Mammal Acoustic Technical Guidance (NMFS 2018, available online at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance), results in an estimated distance from the sonar source to the 160 dB isopleth of 373 meters.

Multibeam systems are not simple omni-directional point sources but rather are focused sonar arrays that use "selective angular directivity" and furthermore transmit "very short pulses at limited ping rates" (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the potential sound exposure level as well as decrease the probability of the animals being subjected to TTS threshold intensity levels. Exposure time is estimated by ØR/V where Ø is the longitudinal transmitting lobe aperture in radians, R is the range from the source to the animal, and V is the speed of the ship. The aperture of Nautilus' EM 302 system is 1.0°, yielding a Ø value of 0.01 rads. The ship will be mapping at 8 knots. At the maximum 373 m distance, the exposure times for a stationary animal caught in the ensonification plane of the EM 302 will be 0.46 seconds.

Submerged animals caught in the ensonification volume as the ship passes would be only briefly subjected to the elevated sound levels occurring inside the transmitter beam pattern. Furthermore, the narrow fan-shaped beam pattern of Nautilus' system provide ample possibilities for animals to quickly escape the sound. The only possible scenario for more extended exposure would be if the animal were to start moving in the exact direction and speed as the ship, which is unlikely.

Transmit pulse forms and rates are yet two other differences that distinguish multibeam sonar from other types of sonar and acoustic sources and further reduce their potential threat to marine mammals. Sound is not transmitted continuously from these systems but rather in extremely short pulses (i.e.,

pings). Ping durations obtained from the EM302 are very brief, between 0.7 to 5.0 milliseconds. The ping rate is depth dependent, at 400 m the ping rate is 30 pings/min, and decreases to 3.6/min at 4000 m. Based on these rates, when the ship is mapping in 250 m of water, any submerged ESA-listed animal caught in the ensonification volume will be subjected to a 0.7 millisecond ping every 1 second. When the ship is mapping in 4000 m, an animal would be exposed to a 5.0 millisecond ping every 15 seconds.

The National Science Foundation's (NSF) 2011 document "Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey" provides a detailed analysis of potential impacts of multibeam sonars on sea turtles and marine mammals. The document evaluates deep-water multibeam systems ranging from 12-95 kHz. The EM302 operates at 30 kHz, and thus falls within the frequency, source levels, pulse lengths and beam widths evaluated by this report. With respect to multibeam echosounders, the following direct excerpts are conclusions of this document regarding the potential impact on sea turtles, "Operation of the multibeam systems is not expected to affect sea turtles, because the associated frequency ranges are above the known hearing range of sea turtles", which are most sensitive to frequencies between 200 – 700 Hz (NSF 2011). The NSF programmatic goes on to state that, "Furthermore, the intermittent and narrow downward-directed nature of the multibeam systems as emitted from the transiting seismic vessel would result in no more than one or two brief ping exposures."

REVIEW PROCESS:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application was posted on the Monument Web site in the spring of 2022, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy

MMB Agency Reviewer Questions and Applicant Responses:

1. **Please explain the benefit for the Monument from the National Geographic Drop Camera deployments. On page 16 you state, "We plan to periodically and opportunistically deploy these during deep-water seafloor mapping surveys……". Would the benefit of the activity be greater if the deployments were mapped out to represent particular features or some other method of determining when best to deploy the cameras?**

Response: We will deploy drop cameras over areas that we map on this mission in order to ground-truth mapping data collected using acoustic technologies (i.e., multibeam sonar and sub-bottom profiler), as well as collect some basic visual information on the deep-water biology and geology of

the region. The primary scientific objective of this mission is to map seafloor areas within the Monument that have not been previously mapped using acoustic technologies. Maps developed through these acoustic technologies provide continuous information on depth, topography, and whether the bottom is soft/hard. Information derived from such maps is typically used to plan more detailed follow-on investigations using deep-water submersibles or remotely operated vehicles. While we will unfortunately not be able to deploy our remotely operated vehicles on this mission, the drop cameras offer a low-cost alternative to getting a first glance view of what the seafloor looks like, which will help ground-truth mapping data, and thereby help better plan future visual surveys in the Monument. Furthermore, the visual data collected by the drop cameras will provide basic information on the deep-water biology and geology of unexplored Monument areas.

2. **Recommend that you specify a maximum of 8 drop camera deployments, rather than stating that you anticipate approximately 8 drop camera deployments or less.**

Response: We are happy to revise the language to specify maximum deployments but would request to deploy up to 15 camera deployments. We anticipate spending up to 69 days mapping in the Monument, during which we will map substantial seafloor areas. Being able to deploy the camera up to 15 times would provide us with more flexibility.

Environmental Compliance:

NEPA / HEPA: (check-one)

☒ Categorical Exclusion / Exempt Class: 5
☐ EA
☐ EIS

Other Consultations: (ESA/MMPA Section 7; NHPA Section 106, etc.)

- **For OET lead operations aboard the vessel under permit PMNM-2022-007**

  - An informal review of all aforementioned activities following section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. 1855(b)) is currently underway. The outcome of this review may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.

  - An informal consultation under Section 7 of Endangered Species Act of 1973 with NMFS was completed on 1/06/2022. NMFS concurred that issuances of permit PMNM-2021-21 may affect, but is not likely to adversely affect, the following

designated and proposed ESA critical habitats and listed species: Hawaiian monk seals (Neomonachus schauinslandi), green sea turtles (Chelonia mydas), hawksbill sea turtles (Eretmochelys imbricata), North Pacific loggerhead sea turtles (Caretta caretta), olive ridley sea turtles (Lepidochelys olivacea), leatherback sea turtles (Dermochelys coriacea), Main Hawaiian Islands false killer whale (Pseudorca crassidens), sperm whales (Physeter macrocephalus), fin whales (Balaenoptera physalus), blue whales (Balaenoptera musculus), sei whales (Balaenoptera borealis), North Pacific right whales (Eubalaena japonica), scalloped hammerhead sharks (Sphryna lewini), oceanic whitetip shark (Carcharinus longimanus), giant manta rays (Manta birostris) or critical habitat for the Hawaiian monk seal and Main Hawaiian Islands insular false killer whale.

- On April 8, 2022 an additional request for informal consultation under Section 7 of Endangered Species Act of 1973 with NMFS was submitted for NOAA's Office of Coast Survey plans to conduct hydrographic research in the waters surrounding Nihoa, French Frigate Shoals and Gardner Pinnacles not covered in the original consultation. The outcome of this consultation may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.

- **For National Geographic lead research (apart from the National Geographic Society Deep Ocean Dropcam) aboard the vessel under permit PMNM-2022-009**

  - Proposed permit activities are still under MMB agency review. Following agency review a complete list of all required supplement consultations will be identified and completed as necessary prior to access into the Monument.

Has Applicant been granted a permit from the State in the past? Yes ☐ No ☒

If so, please summarize past permits:

Have there been any a) violations: Yes ☐ No ☒
b) Late/incomplete post-activity reports: Yes ☐ No ☒

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

Consulted Parties: The permit application was sent out for review and comment to the following scientific and cultural entities: Hawaii Division of Aquatic Resources, Hawaii Division of Forestry

and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Exemption Determination: After reviewing §11-200.1-15, HAR, including the criteria used to determine significance under §11-200.1-13, HAR, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit have been evaluated as a single action. Since this permit involves an activity that is precedent to a later planned activity, i.e., the same methodology used throughout the permit period, the categorical exemption determination here will treat all planned activities as a single action under §11-200.1-10, HAR.

2. The General Exemption Type #5 for Basic Data Collection, Research and Experimental Management with no Serious or Major Environmental Disturbance Appears to Apply. §11-200.1-16 (a) (1) and §11-200.1-16 (a) (2), HAR, exempts the class of actions that involve "basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource." This exemption type has been interpreted to include the capturing data on environmental parameters related to climatic changes on undersea environments, and biological sampling for undescribed species, such as those being proposed.

The proposed activities here appear to fall squarely under the general exemption type identified under HAR §11-200.1-16 (a) (1) and §11-200.1-16 (a) (2), as described under the revised 2020 DLNR Exemption List (Concurred on by the Environmental Council on November 10, 2020), under the general exemption type #5 (Part 1), items #1, #2, and #15, which includes, respectively, "conducting surveys or collecting data on existing environmental conditions (e.g., noise, air quality, water flow, water quality, etc.)", "non-destructive data collection and inventory, including field, aerial and satellite surveying and mapping" and "game and non-game wildlife surveys, vegetation and rare plant surveys, aquatic life surveys, inventory studies, new transect lines, photographing, recording, sampling, collection, culture, and captive propagation".

The applicant would abide by the PMNM Best Management Practices (BMPs) as listed in earlier section above while conducting the aforementioned activities within the PMNM. Please see pgs. 12-14 for the Informal ESA Consultation on the 2022 Research Expedition of the Ocean Exploration Trust Vessel Nautilus in the Pacific Islands Region for the evaluation of the risk of exposure to elevated noise levels for protected species from the sonars being utilized for mapping. Based on the information provided, the vessel will employ mitigation measures such as (or similar to) the following previous guidance including having bridge watchstanders that will carefully monitor for the presence of marine protected species, and will follow established best management practices to minimize

disturbance. If cetacean species are present within 400 m of the ship, the vessel will stop until the animals depart the area, but the mapping sonars will continue transmitting to avoid startle responses.

As discussed below, no significant disturbance to any environmental resource is anticipated. Thus, so long as the below considerations are met, the general exemption types should include the action now contemplated.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if "the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment." §11-200.1-15 (d), HAR. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. §11-200.1-13, HAR.

Significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potentially sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any anticipated indirect or cumulative impacts that would occur as a result of these activities.

Since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably have a Minimal or No Significant Effect on the Environment. Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all research activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200.1 HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.

Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

NOTE: ***This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).***

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.

- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.

- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
nwhipermit@noaa.gov
PHONE: (808) 725-5800 FAX: (808) 455-3093

SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.

Papahānaumokuākea Marine National Monument
Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Allison Fundis, Chief Operating Officer
Affiliation: Ocean Exploration Trust
Permit Category: Research
Proposed Activity Dates:
July 15-August 8, 2022 (ship-based mapping + uncrewed vehicle mapping);
August 14-October 25, 2022 (ship-based mapping)
Proposed Method of Entry (Vessel/Plane): Vessel
Proposed Locations: Deepwater (>100m) expanded area of PMNM; Shallow water (<100m) within original PMNM boundary; TBD offshore - Nihoa Island, Necker Island, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island.

Estimated number of individuals (including Applicant) to be covered under this permit:
Up to 58 individuals over the course of 5 expedition legs

Estimated number of days in the Monument:
*TBD, up to 69**

(est) DATES port-to-port	EST DAYS IN PMNM UNDER THIS PERMIT REQUEST*	EXPEDITION	PENDING PERMIT APPLICATIONS
7/16-8/8	**21**	**OET Mapping (NOAA OE, NOAA OCS)**	**Fundis, Mayer, Armstrong**
8/8-8/13	0	port: Honolulu	
8/14-8/28	**12**	**OET Mapping (NOAA OE)** Nat Geo snorkeling (Nat Geo)	**Fundis, Mayer, Armstrong** Hoffman-Kunt & Miller
8/28-8/29	0	port: Honolulu	
8/30-9/13	**12**	**OET Mapping (NOAA OE)** Nat Geo SCUBA (Nat Geo)	**Fundis, Mayer, Armstrong** Nunez-Lendo & Leonardo
9/13-9/14	0	port: Honolulu	

9/15-9/29	**12**	**OET Mapping (NOAA OE)** Nat Geo SCUBA (Nat Geo)	**Fundis, Mayer, Armstrong** Agustines
9/29-9/30	0	port: Honolulu	
10/1-10/8	0	Nat Geo SCUBA (Nat Geo)	Hoffman-Kunt, Miller, Agustines
10/8-10/9	0	port: Honolulu	
10/10-10/24	**12**	**OET Mapping (NOAA OE)** Nat Geo SCUBA (Nat Geo)	**Fundis, Mayer, Armstrong** Dunnavant
total	*69*		

**The number of days Ocean Exploration Trust will map within PMNM is dependent on pending permits for other projects. If all projects Ocean Exploration Trust and National Geographic Society have submitted permit applications for are approved, the above schedule will be implemented. Should any of those permit applications not receive permit approvals, the OET-led mapping days in PMNM would be condensed into fewer cruises and result in fewer days within PMNM. The days requested under this permit application are highlighted in blue.*

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

Conduct high-resolution mapping and seafloor characterization where such data does not currently exist within the Monument and continue Ocean Exploration Trust's collaboration with PMNM and representatives of the Papahānamokuākea Cultural Working Group to address the need for expeditions conducted in Hawai'i to reflect collaborative approaches inclusive of Hawaiian worldview.

b.) To accomplish this activity we would ….

Utilize the ship-based multibeam sonar and sub-bottom profiler to collect seafloor mapping data where such data does not already exist within the expanded and original boundaries of PMNM. This is the same system utilized on previous Nautilus expeditions to PMNM (2021, 2018). Additionally, we will deploy an uncrewed mapping vehicle equipped with an EM2040 (200-400kHz) multibeam sonar that will acquire similar data at depths between 5 and 500 meters depth and no closer to shore or fringing reef than 500 meters.

c.) This activity would help the Monument by …

Providing PMNM with data that will contribute to a greater understanding of the structure of the seafloor within the boundaries of PMNM, which can ultimately inform future research and management needs. We will fill in gaps in existing seafloor mapping data and characterize benthic ecosystems, which is part of the National Ocean Mapping, Exploration, and Characterization (NOMEC) strategy. This project has applied science objectives that are also consistent with a number of other NOAA mission priorities. NOAA's long-term Healthy Oceans goals requires students that will improve our understanding of marine ecosystems in order to

develop management measures to ensure sustainability in the face of both human and climate impacts. The findings from the project will have direct and immediate benefit to the Monument staff in informing their efforts to protect shallow and deepwater habitats within PMNM. Additionally, the acquired seafloor mapping data will be applied to NOAA nautical charts and will be made publicly available except as provided for in the National Historic Preservation Act.

This project will also provide continued education and outreach opportunities for PMNM and local communities. In 2021, Ocean Exploration Trust and representatives of the Papahānaumokuākea Native Hawaiian Cultural Working Group collaborated to begin to address the overdue need for expeditions to be conducted in Hawai'i to reflect collaborative approaches inclusive of Hawaiian worldview. As a result, the 2021 PMNM expedition aboard Nautilus included co-developed outreach and education opportunities including: (1) Hawaiian naming of expeditions, (2) supporting storytelling through development of promotional video in Hawaiian highlighting Hawaiian worldviews ocean ocean exploration, (3) broadening outreach to the local Department of Education, charter, and kula kaiapuni networks, and (4) supporting live ship-to-shore broadcases in Hawaiian and English, which included supporting a paid internship position for a Native Hawaiian student and a paid position for a Cultural Working Group representative to be on board for the expedition as a Hawaiian language correspondent and cultural liaison. Ocean Exploration Trust and PMNM collaborators continue to work together to build on this partnership to make more opportunities available for local students, educators, and researchers. This project will allow for this partnership to leverage additional expeditions within PMNM and provide opportunities for local students and educators.

Other information or background:
Ocean Exploration Trust is a Connecticut-based 501(c)(3) nonprofit that owns and operates exploration vessel (E/V) Nautilus and has experience conducting expeditions within PMNM (2018, 2021) in collaboration with NOAA Office of National Marine Sanctuaries and NOAA Ocean Exploration. The expeditions that will be covered under this permit would include support from NOAA Ocean Exploration, NOAA Office of Coast Survey, and National Geographic Society.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Allison Fundis
Title: Chief Operating Officer

1a. Intended field Principal Investigator (See instructions for more information):
Dr. Larry Mayer
CAPT Andy Armstrong (ret)

2. Mailing address (street/P.O. box, city, state, country, zip):
Ocean Exploration Trust
SEE ORIGINAL APPLICATION FOR CONTACT INFO
SEE ORIGINAL APPLICATION FOR CONTACT INFO

Phone:
SEE ORIGINAL APPLICATION FOR CONTACT INFO (Fundis)
SEE ORIGINAL APPLICATION FOR CONTACT INFO (Mayer)
SEE ORIGINAL APPLICATION FOR CONTACT INFO (Armstrong)

Fax: N/A

Email:
(Fundis) SEE ORIGINAL APPLICATION FOR CONTACT INFO
(Mayer) SEE ORIGINAL APPLICATION FOR CONTACT INFO
(Armstrong) SEE ORIGINAL APPLICATION FOR CONTACT INFO

For students, major professor's name, telephone and email address:

3. Affiliation (institution/agency/organization directly related to the proposed project):
Ocean Exploration Trust (Fundis)
University of New Hampshire, Center for Coastal and Ocean Mapping (Mayer)
NOAA/University of New Hampshire, Joint Hydrographic Center (Armstrong)

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):

July 15 - August 8, 2022 (one expedition leg)
Ship-based mapping surveys + Uncrewed surface vessel mapping surveys
26 people:

Dwight Coleman (Expedition Leader)
Larry Mayer (Scientist)
Andy Armstrong (Scientist, NOAA OCS)
Kara Sanford (Scientist)
Kainalu Steward (Science Intern)
TBD (Science Intern)
Annie Hartwell (Navigator)
Lynette Davis (Navigator)
TBD (Navigator)
Erin Heffron (Mapping Specialist)
Nova West (Video Engineer)
TBD (Video Engineer)
Robert Waters (Engineer)
Timothy Burbank (Data Engineer)
Madison Dapevich (Communications Specialist)
Brandon Rodriguez (Educator)
Katie Doyle (Educator)
Airlie Picket (USV Specialist)
TBD USV Specialists (x6)
TBD PMNM Resource Monitor
TBD PMNM Cultural Working Group representative

August 14 - October 25, 2022 (4 separate expedition legs)
Ship-based mapping surveys + other permitted activities
32 people:

Allison Fundis (Expedition Lead)
Samantha Wishnak (Expedition Lead)
Robert Ballard (Scientist)
TBD Scientists (x6)
Annie Hartwell (Navigator/Mapper)
Renato Kane (Navigator/Mapper)
Erin Heffron (Navigator/Mapper)
TBD Navigator/Mapper (x2)
Julian Race (Data Engineer)
Justin Lowe (Data Engineer)
Stephen Matter (Video Engineer)

Marley Parker (Video Engineer)
David Robertson (Video Engineer)
TBD Video Engineer (x2)
TBD Communications Specialists (x3)
TBD PMNM Resource Monitor (x4)
TBD PMNM Cultural Working Group representative (x4)

Section B: Project Information

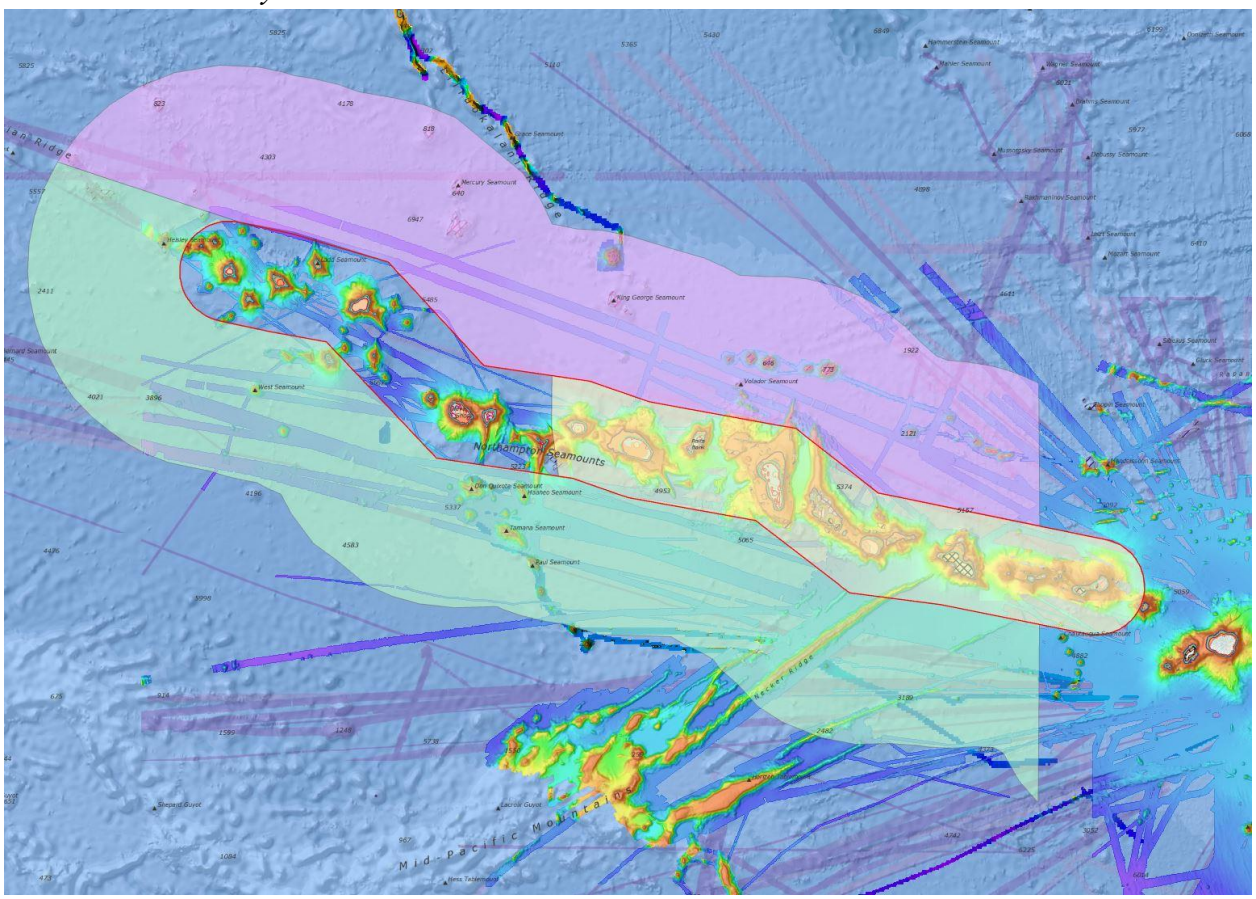
5a. Project location(s):		**Ocean Based**	
X Nihoa Island	☐ Land-based	**X** Shallow water	**X** Deep water
X Necker Island (Mokumanamana)	☐ Land-based	**X** Shallow water	**X** Deep water
X French Frigate Shoals	☐ Land-based	**X** Shallow water	**X** Deep water
X Gardner Pinnacles	☐ Land-based	**X** Shallow water	**X** Deep water
X Maro Reef	☐ Land-based	**X** Shallow water	**X** Deep water
X Laysan Island	☐ Land-based	**X** Shallow water	**X** Deep water
☐ Lisianski Island, Neva Shoal	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Pearl and Hermes Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Midway Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Kure Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
X Monument Expansion Area			
☐ Other			

NOTE: Shallow water is defined by water less than 100 meters in depth.

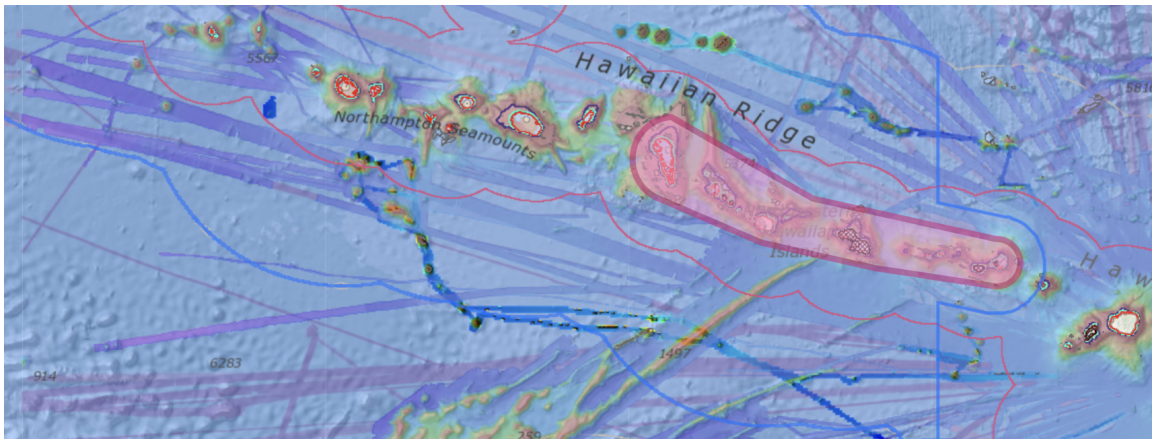
☐ Remaining ashore on any island or atoll (with the exception of Sand Island,at Midway Atoll and field camp staff on other islands/atolls) between sunset and sunrise.

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

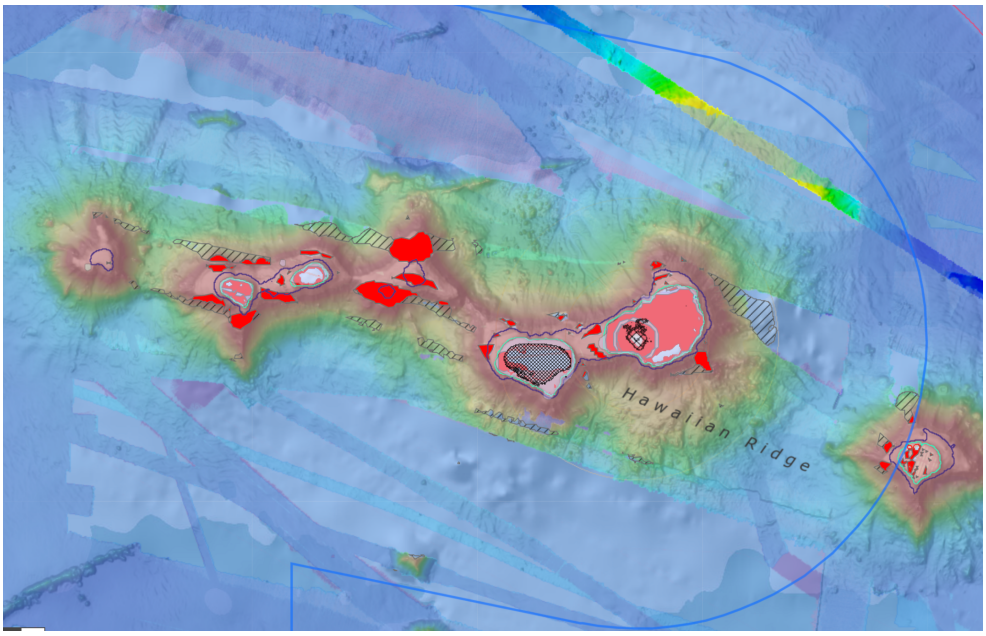
Location Description:
We aim to conduct ship-based multibeam mapping within the expanded boundary of the Monument as well as the southern half of the original boundary where high-resolution seafloor data does not already exist.



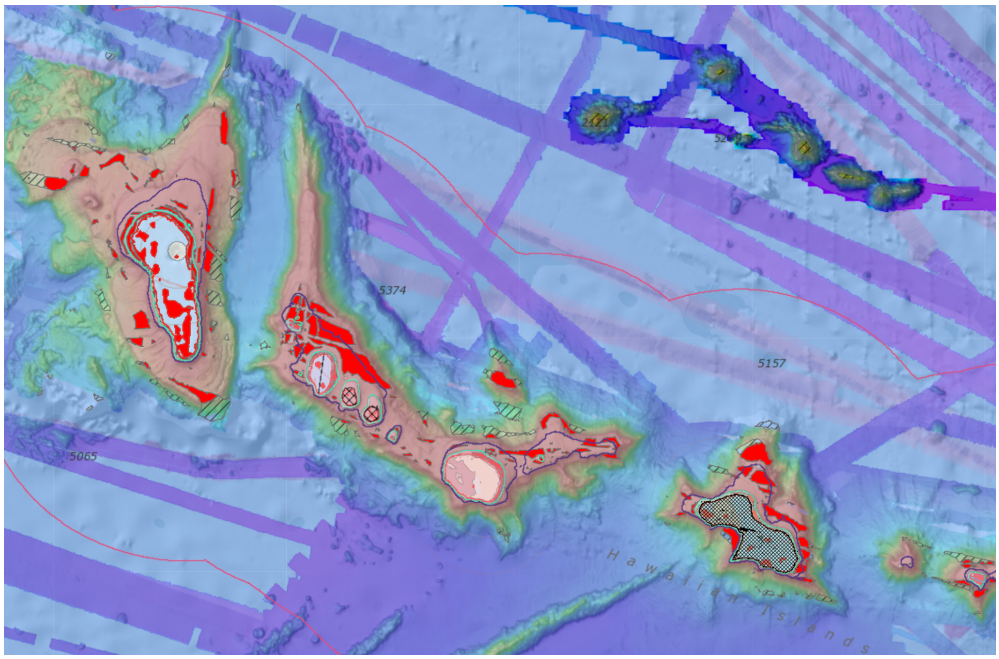
*Map showing the general **potential survey locations for ship-based multibeam surveys** in water depths >200 meters within the original boundary (yellow), priority areas within the expanded boundary (purple), and potential area of operation within the expanded boundary (green). Surveys will prioritize areas of the seafloor not already mapped at high resolution. The specific survey sites within the expanded and original boundaries of the Monument will be refined based on the final E/V Nautilus 2022 schedule (which is pending based on the approval of other PMNM permit applications related to the expeditions the mapping would take place on).*



*Map showing the general survey **locations for uncrewed vehicle system (DriX) surveys** in water depths <500 meters at and between Nihoa and Gardner Pinnacles. Surveys will prioritize areas not already mapped at high-resolution with vehicles, vessels, or LiDAR (see next two maps for detail).*



*Map showing the **targeted survey locations (red) for uncrewed vehicle system (DriX) surveys** in water depths <500 meters at and between Nihoa and Twin Banks. Areas in red are priority targets for the uncrewed vehicle system surveys (in collaboration with NOAA Office of Coast Survey).*



*Map showing the **targeted survey locations (red) for uncrewed vehicle system (DriX) surveys** in water depths <500 meters at and between Twin Banks and Gardner Pinnacles. Areas in red are priority targets for the uncrewed vehicle system surveys (in collaboration with NOAA Office of Coast Survey).*

5b. Check all applicable regulated activities proposed to be conducted in the Monument:
☐ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
☐ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
X Anchoring a vessel
☐ Deserting a vessel aground, at anchor, or adrift
X Discharging or depositing any material or matter into the Monument
☐ Touching coral, living or dead
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource
☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
☐ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

OET has no plans to anchor E/V Nautilus in PMNM and would only do so in the unlikely event of a ship emergency and loss of propulsion/power requiring the anchor to be dropped for the safety of the vessel and those onboard.

6. Purpose/Need/Scope *State purpose of proposed activities:*

These expeditions will involve mapping areas of Papahānamokuākea Marine National Monument that have not already been mapped at high-resolution. Acquiring this data is important for directly contributing to a better understanding of the formation of deep-water and shallow-water terrain of the NWHI; contributing new data to nautical charts and informing navigation in these areas; aiding in the continued collection of data for PMNM to inform current and future management needs; and contributing to national and international priorities to obtain high resolution maps of the seafloor, especially in areas needing protection.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species beyond the protocols provided in PMNM Best Management Practices (https://www.papahanaumokuakea.gov/permit/bestmanagement.html)? Yes ☐ No X

If so, please list the species you specifically intend to target.

For a list of terrestrial species protected under the Endangered Species Act visit:
http://www.fws.gov/endangered/
For a list of marine species protected under the Endangered Species Act visit:
http://www.nmfs.noaa.gov/pr/species/esa/
For information about species protected under the Marine Mammal Protection Act visit:
http://www.nmfs.noaa.gov/pr/laws/mmpa/

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?

Ocean Exploration Trust has a long history of scientific exploration that is sensitive to cultural and historic places and resources. We do not touch or disturb any historic sites without proper permission and permitting, and do not intend to include any such activities on these expeditions. Activities aboard E/V Nautilus will be respectful of the natural, historical, and cultural resources

of PMNM. All expedition participants and crew will receive a cultural briefing from PMNM, OHA, or designated representative in advance of the expedition to ensure all parties understand the cultural significance of PMNM to Native Hawaiians. Ocean Exploration Trust ensures everyone onboard E/V Nautilus understands that Native Hawaiians consider all natural resources as cultural resources and that both are provided with the utmost respect during our expeditions.

Ship-based Mapping

Mapping information will be collected with a sub-bottom profiler and EM302 multibeam echosounder (the same system previously used by E/V Nautilus, R/V Falkor, and NOAA ship Okeanos Explorer in PMNM). We expect that mapping operations will have no effect on the cultural, natural, and historic resources nor the ecological integrity of the Monument. Multibeam mapping has already taken place in the region with no detected effects on PMNM resources. All ship-based mapping will take place in deepwater and at considerable distances from emergent land. Nautilus has two scientific sonars that are configured to operate simultaneously without interference: a 30 kHz multibeam system, and a 3.5 kHz chirp sub-bottom profiler sonar. The multibeam is used to map broad swaths for bathymetry and water column feature detection (e.g., gaseous seeps) and the sub-bottom profiler provides data useful for interpreting seafloor geology. Both systems are routinely used by this exploration vessel and have provided invaluable scientific data for marine researchers and managers, including numerous National Marine Sanctuaries. Each of these sonar systems is described separately in the sections below. An assessment of potential impacts on marine mammals using best available information is then provided along with proposed safeguards to reduce any potential impacts. OET has a Marine Mammals and Sea Turtle standard operating procedure for navigators/mappers and the vessel crew to follow based on NOAA's National Marine Fisheries Service and Office of National Marine Sanctuaries vessel operating guidelines.

Multibeam systems are focused sonar arrays that use "selective angular directivity" and transmit"very short pulses at limited ping rates" (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the potential sound exposure level as well as decrease the probability of the animals being subjected to temporary threshold shift (TTS) intensity levels. The National Science Foundation's 2011 document "Programmatic Environmental ImpactStatement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey" provides a detailed analysis of potential impacts of seismic, multibeam, and sub-bottom sonars on sea turtles and marine mammals. Seismic surveys have the most potential impact and are not proposed in this permit application. The document evaluates deep water multibeam systems ranging from 12-95 kHz. The EM302 operates at 30 kHz so falls within the frequency, source levels, pulse lengths and beam widths evaluated by this report. The SBP on the Nautilus is of the same type evaluated in the report. With respect to multibeam echosounders (MBES) and subbottom profilers (SBP), the following direct excerpts are conclusions of this document regarding the potential impact on sea turtles, mysticetes, odontocetes, and pinnepeds:

Sea Turtles:

"Operation of the MBES, SBP, or pingers is not expected to affect sea turtles, because the associated frequency ranges are above the known hearing range of sea turtles. The SBP operates at 3.5 kHz with a maximum source output of 222 dB re 1 µPa-m. Thus, the frequency range of the SBP is outside the known detection range of sea turtles based on available data. As a result, sea turtles are not expected to be capable of hearing the higher frequency sounds produced by SBPs. Furthermore, the intermittent and narrow downward-directed nature of the MBES and SBP as emitted from the transiting seismic vessel would result in no more than one or two brief ping exposures."

Mysticetes:

"During the proposed marine seismic surveys, the pings from the MBES, SBP, and pingers would be very short (<1-64 ms). Thus, a given mammal would not receive many of the downward-directed MBES or SBP pings as the vessel passes by. In the case of the MBESs that operate at 30 kHz or higher, their operating frequencies are too high to have any effects on mysticete behavior. Source levels of the SBPs, another type of echosounder, are lower (maximum source level 222 dB re 1 microPa [rms]) than those of the MBES discussed above. Thus, there is even less likelihood of TTS occurring through exposure to SBP sounds, even in an animal that is briefly near the source. The SBP is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals, particularly mysticetes, move away in response to the approaching higher-power sources or the vessel itself before the mammals are close enough for there to be any possibility of effects from the SBP's less-intense sounds. The possibility of PTS through exposure to MBES or SBP sounds is considered negligible and PTS is not expected to occur. Burkhardt et al. (2008) concluded that immediate direct injury was possible only if a cetacean dived under the vessel into the immediate vicinity of the transducer. Furthermore, PTS (or any injury or pathological effect) has never been demonstrated for any marine mammal exposed to echosounders such as the proposed MBESs and SBPs."

Odontocetes:

"In summary, sounds from all the MBESs would be readily audible to most and possibly all odontocetes when animals are within the narrow angular extent of the intermittent sound beam. As with baleen whales, odontocete communications will not be masked appreciably by MBES, SBP, or pinger signals given their low duty cycles, the brief period (i.e., seconds) when an individual mammal would potentially be within the downward-directed MBES or SBP beam from a transiting vessel, and the relatively low source level of a pinger. Operation of MBESs, SBPs, and pingers is not likely to impact odontocetes. The project MBESs, SBPs, and pingers are not expected to induce TTS. The possibility of PTS through exposure to MBES or SBP sounds is considered negligible."

Pinnipeds:

"The SBPs associated with the proposed marine seismic activities operate in the MF range of approximately 3.5 kHz with a maximum source output of 222 dB re 1 µPa-m (rms). The frequency

> *range of the SBPs is within the frequency band audible to pinnipeds. Masking effects due to MBES, SBP, or pinger signals are expected to be minimal or non-existent. Thus, brief exposure of pinnipeds to small numbers of signals from the MBES or SBP would not result in a ―take by harassment as defined by NMFS and the ESA. The project MBESs, SBPs, and pingers are not expected to induce TTS. Although the MBESs, SBPs, and pingers can presumably be heard by pinnipeds, their operation is not likely to affect pinnipeds. The intermittent and narrow downward-directed nature of the MBESs and SPBs would result in no more than one or two brief ping exposures of any individual pinniped given the movement and speed of the vessel and animal; such brief exposure to this sound is not expected to cause injury or PTS based on results of limited studies of some pinniped species."*

Nautilus sonars will be turned on before the ship enters into the Monument. We will minimize turning the system on and off as a precautionary measure to avoid possible startling of the animals. When the multibeam system is turned off in the Monument, the flexible "soft start" mode will be used to restart the multibeam. The soft start mode is a delay function, starting the sonar transmissions at a low output level and then gradually increasing to the level required for optimal bathymetry data collection. The soft start modes can either be set at -10 or -20 decibels with a 0 to 15 minute ramp up time to the desired power. We can select -10 dB, -20 dB or maximum transmit power. Maximum transmit power is recommended by Kongsberg for maximizing the mapping swath coverage. In the deepest operating mode the EM302 is 243 dB re 1 microPa. When operating in shallow modes the decibels are 238 dB re 1 microPa.

Underway CTD

Accurate measurements of sound speed as a function of depth down to approximately 500 meters are needed every 3-6 hours during multibeam sonar mapping operations. These sound speed measurements are essential for ray-tracing calculations used by the EM302 multibeam sonar system in order to collect accurate bathymetry and backscatter data. To obtain these essential data, the Nautilus can either use an XBT or the underway CTD (UCTD) equipped with a sound velocity probe. The Nautilus uses the UCTD as much as possible rather than conducting XBTs, since UCTD does not leave anything in the ocean after gathering the measurements. This is limited to daylight hours and favorable weather conditions.

The UCTD (http://www.oceanscience.com/Products/UnderwayCTD/Underway-CTD.aspx) manufactured by Teledyne Ocean science is a piece of equipment used to gather conductivity/temperature/depth (CTD) measurements or sound velocity measurements while the ship is moving. A brochure from the manufacturer with pictures and specifications is included as appendix B. This instrument is mounted on the stern railing and has a reusable probe that is dropped through the water column then retrieved by rewinding the line onto a motorized spool. The unit would not touch the seafloor. The unit is equipped with a CTD probe. The UCTD can obtain water column profiles down to over 500 meters while the ship is moving at 8 knots. 8-10 knots is the ship's normal ocean mapping survey speed, so the UCTD can sample the water column while continuously mapping. The ship also obtains sound velocity profiles using expendable probes (XBTs). XBTs are expensive consumable supplies and leave behind zinc and

copper waste in the ocean due to the one- time use of each probe. OET has installed the UCTD in order to minimize the use of XBTs while still gathering essential sound velocity profile data needed every 3-6 hours while mapping in order to accurately collect high quality multibeam sonar data.

Expendable Bathythermographs (XBTs)

XBTs are deployed to obtain sound velocity profiles to calibrate the multibeam system and ensure accurate bathymetric mapping when we cannot conduct a UCTD. The XBT type is the Deep Blue probe produced by Lockheed Martin Sippican. A single Deep Blue XBT is 8.5 in. length x 2 in. width and weighs 2.53 lbs. It consists of a plastic spool, hair thin copper wire (< 1mm width), zinc weight, thermistor (comprised of two short wires (< 8.5 in. length)) and is contained in a plastic housing. The Deep Blue XBT contains no chemical solutions. The very fine wire connecting the XBT probe to the ship is extremely easy to break by hand once the probe reaches maximum depth. The minimal tensile strength of the wire should represent a minimal entanglement risk for species of concern. The potential for XBT deployments to impact ESA-listed species was the topic of an informal consultation request from the Monument to NMFS during the permit review for the past expeditions. The Monument's determination was that the Falkor's use of XBTs may affect, but is not likely to adversely affect, Hawaiian monk seals, green sea turtles, hawksbill sea turtles, leatherback sea turtles, olive ridley sea turtles, North Pacific loggerhead sea turtles, MHI Insular false killer whales, humpback whales, sperm whales, fin whales, blue whales, sei whales, and north pacific right whales. We expect the same determination would be made with respect to the deployment of XBTs by the Nautilus. We expect to use a maximum of 75 XBTs during the expeditions. This number will very likely be significantly reduced by prioritizing and using Underway CTD casts instead. XBTs will only be prioritized over Underway CTD casts if the sea-state/conditions do not allow for deployments or if the Underway CTD becomes inoperable for an unforeseeable reason.

National Geographic Drop Cameras

The National Geographic Society Deep Ocean Dropcam, developed by National Geographic Exploration Technology Lab, is an efficient way to capture video of the sea floor (Turchik et al., 2015). It is a high-definition camera encased in a pressure housing rated to go to the deepest part of the ocean, with onboard lights to illuminate the scene. The camera is weighted with ~25lbs of sand and free falls to the sea floor, where it is programmed to record for a number of hours. When recording is complete, the burnwire connecting it to the weight dissolves, and it freely floats to the surface for recovery by the ship. The ballast consists of store-bought, organic and sterile sand in a biodegradable cotton pillowcase and hemp line. We plan to periodically and opportunistically deploy these during deep-water seafloor mapping surveys in water depths 500 meters or deeper. Between July and October, we anticipate approximately 8 drop camera deployments or less.

Uncrewed Surface Vessel (DriX) Mapping

Mapping data from the DriX will be collected with a Kongsberg EM2040 multibeam echosounder. This system is the same system that is used by many NOAA vessels for shallow water survey work. The system operates at frequencies between 200 - 400 kHz. Sources operating at frequencies above 200 kHz produce sound that is outside the functional hearing ranges of marine mammals, and therefore the potential for this equipment to result in any impact on marine mammals is highly unlikely. DriX mapping will take place during daylight hours only, limited to depths between 5 and 500 m and no closer to shore or fringing reef than 500 m. DriX Mapping operations will be supervised by representatives of NOAA's Office of Coast Survey and will follow established procedures. We expect that mapping operations will have no effect on the cultural, natural, and historic resources nor the ecological integrity of the Monument. Multibeam mapping has already taken place in the region with no detected effects on PMNM resources.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects?

We respect the significance and cultural importance of the NWHI to Native Hawaiians. As a sacred place, and especially in the realm of Po, our plan is to tread lightly and leave little impact from our activities. Recognizing that natural resources are cultural resources for Native Hawaiians, the information and data generated by this project will assist PMNM by providing basic information about the rich and unique biological resources and habitats of this region. This knowledge will contribute directly to the documentation of these natural/cultural resources, and it is this understanding that allows for enhanced protection of these resources. Given the minor and short-term durations of potential impact, we expect these mapping operations will have no significant effect on the cultural, natural, and historic resources and ecological integrity of the monument. We believe this proposed activity is consistent with the spirit of Proclamation 8031, and specifically with Finding 1.b. Additionally, this project can help facilitate the Monument's effort to "bring the place to the people, rather than the people to the place" through telepresence and other outreach and education efforts that have the potential to share PMNM resources with local students, educators, and community members in real-time. Ocean Exploration Trust continues to work with PMNM staff to develop opportunities and programs to raise awareness about the cultural, as well as the natural, significance of the Monument.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

The activities proposed here are specifically aimed to help scientists, managers, and others better understand the formation and seafloor of the NWHI. Ship-based and uncrewed systems

mapping of the seafloor is the only way to acquire this high-resolution bathymetry data. A major objective of the project is to benefit the management of the monument by revealing the nature of the seafloor, which can inform research on the associated habitats within its boundaries.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

The information gathered will directly contribute to a better understanding of the formation of deep-water and shallow-water terrain of the NWHI. High resolution maps and baseline oceanographic data including temperature, salinity, dissolved oxygen, and imagery is highly valuable to managers and researchers. As noted in 7.b. (above), there are no significant anticipated impacts to PMNM cultural, natural, or historic resources. No shore access is required unless the project may facilitate the transfer of representatives of the co-Trustees (e.g., FWS staff) to locations of interest in the vicinity of the operating area for this project. In our estimation, the end value of this activity far outweighs any potential impacts, thus meeting the criteria noted under Finding 1.d. in Proclamation 8031.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

E/V Nautilus will remain in the Monument only for the duration required to sustain critical operations for this activity. We will utilize the ship 24/7 for these objectives and will exit the Monument as soon as the proposed projects are completed or when the vessel's scheduled departure happens, whichever occurs sooner.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Ocean Exploration Trust has been conducting scientific exploration of the deep sea since 2009 with its vessel E/V Nautilus in the Pacific, Caribbean, Gulf of Mexico, Mediterranean Sea, Aegean Sea, and Black Sea. The staff and contractors of the organization are experienced maritime professionals, engineers, scientists, and outreach specialists. We have a successful history of safely and professionally conducting seafloor mapping and deepwater exploration with remotely operated vehicles in all US National Marine Sanctuaries along the west coast and in the Thunder Bay National Marine Sanctuary. The vessel and crew have also conducted successful expeditions to the Monument in 2018 and recently in 2021, as well as expeditions within the Pacific Remote Islands Marine National Monument and the Phoenix Islands Protected Area. Ocean Exploration Trust is known as a leading organization in professionally and safely conducting scientific exploration.

PI Mayer is renowned for his contributions to hydrographic surveys around the world as well as aiding in the development and use of highly effective technologies to conduct these types of surveys. Dr. Mayer is a Professor and the Director of the Center for Coastal and Ocean Mapping

at the University of New Hampshire. He is the recipient of the Keen Medal for Marine Geology and an Honorary Doctorate from the University of Stockholm. He was a member of the President's Panel on Ocean Exploration, National Science Foundation's Advisory Committee for the Geosciences, and chaired a National Academy of Science Committee on national needs for coastal mapping and charting as well as the National Academies report on the impact of the Deepwater Horizon Spill on ecosystem services in the Gulf of Mexico. He was the co-chair of the NOAA's Ocean Exploration Advisory Working Group, and the Vice-Chair of the Consortium of Ocean Leadership's Board of Trustees, and is currently the Chair of the National Academies of Science's Oceans Studies Board, a member of the State Dept.'s Extended Continental Shelf Task Force and the Navy's SCICEX Advisory Committee. In 2016, Dr. Mayer was appointed by President Obama to be a member of the Arctic Research Commission, in 2017 he was elected to the Hydrographic Society of America Hall of Fame, in 2018, he was elected as a member of the National Academy of Engineering and in 2019 he was elected as a foreign member in the Royal Swedish Academy of Sciences.

PI Armstrong is the Co-Director of the JHC and a retired officer of NOAA, assigned to the NOAA/University of New Hampshire Joint Hydrographic Center as a civilian NOAA employee. Capt. Armstrong specialized in hydrographic surveying and served on several NOAA hydrographic ships, including the NOAA Ship Whiting where he was Commanding Officer and Chief Hydrographer. He was previously the Chief of NOAA's Hydrographic Surveys Division, directing the agency's hydrographic survey activities. He has a B.S. in Geology from Tulane University and an M.S. in Technical Management from Johns Hopkins University. Capt. Armstrong oversees the hydrographic and ocean mapping education and training program at University of New Hampshire and coordinates the Joint Hydrographic Center's cooperative research with NOAA.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

These mapping activities are funded through the Ocean Exploration Cooperative Institute via NOAA Ocean Exploration (ship-based mapping) and through the NOAA Office of Coast Survey (uncrewed system mapping). The ship and operators are fully insured.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

Multibeam mapping is the best technique for mapping the seafloor. Nautilus is well-suited to map at all depths of the Monument and will focus ship-based surveys at depths greater than 200 meters and. DriX, the uncrewed mapping system we aim to use to map shallower terrain, is a proven technology that is the most efficient and effective at mapping areas that are less accessible for large ships. Surveys conducted with DriX will be focused on water depths between 5-500 meters and will be conducted at least 500 meters away from the closest shoreline or

fringing reef. The approaches and techniques used to map in shallow water will follow the operating procedures of NOAA's Office of Coast Survey and data collected will be expected to eventually be incorporated into nautical charts that will help assure safe navigation in these areas.

i. Has your vessel been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration permitted activities.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

There are no other known factors that would make the issuance of the permit for the activity inappropriate. All vessel personnel will be informed and will abide by the NOAA guidelines and best management practices for relevant activities supported aboard the vessel and that are permitted through the co-Trustees. All personnel will be required to read and sign the Papahānamokuākea Marine National Monument Conservation & Management permit and abide by all permit conditions.

8. Procedures/Methods:

During the proposed expeditions, high-resolution mapping surveys will be conducted with ship-based sonars aboard E/V Nautilus and with an uncrewed surface vessel (DriX). Both techniques will fill in gaps in existing seafloor bathymetry data, with the ship efforts focused on deepwater areas (>200 m) and the DriX efforts focused on more shallow areas (5-500 m).

Ship-based Mapping

Ship-based mapping surveys will be conducted with the Kongsberg EM302 multibeam echosounder installed in the hull of E/V Nautilus. This is the same system that was used during similar expeditions in 2018 and 2021, as well as during those previously conducted by NOAA Ship Okeanos Explorer. The system is capable of mapping the seafloor at depths between 100 and 7,000 meters while the ship cruises at 8-10 knots.

Surveys will be planned in areas where there are significant gaps in bathymetric data as identified by NOAA and via globally available data sets.

Uncrewed Surface Vessel (DriX) Mapping

Uncrewed surface vessel mapping surveys will be conducted utilizing an iXBlue DriX vehicle. DriX is a versatile uncrewed vehicle capable of mapping depths between 5 and 500 meters for

deployments up to 7 days while operating at 7 knots. The vehicle has exceptional line-keeping capabilities in a variety of sea states and in currents. DriX operations will occur during daytime hours and within sight of operators aboard Nautilus. Additionally, a Zodiac will be on standby to recover DriX should the need arise.

We anticipate this mapping work to span 5 separate expedition legs that will operate in and out of Honolulu:

(1) ***July 15 - August 8, 2022: Ship-based mapping surveys + Uncrewed surface vessel mapping surveys***
On the first expedition leg, we plan to dedicate 24 hours/day to conducting mapping surveys within the Monument. During this time, we will deploy the uncrewed surface vessel DriX during daytime hours to map areas between 5-500 meters deep and at least 500 meters away from the nearest shoreline or fringing reef. The targeted survey areas have been identified by NOAA Office of Coast Survey as high-priority areas to map. Overnight, we will utilize the hull-mounted multibeam sonar aboard Nautilus to collect high-resolution bathymetry data in areas that are deeper than 200 meters, within the original boundary as well as within the expanded boundary of the Monument. The National Geographic Drop Cameras are not expected to be utilized often and are largely aboard as a back-up operation should we be delayed in seafloor mapping survey operations.

(2) ***August 14 - October 25, 2022: Ship-based mapping surveys + other permitted activities***
On the subsequent expedition legs (n=4, 2 wks ea.), we plan to conduct ship-based mapping operations 12 hours per day in the overnight hours. Daytime operations will be dedicated to facilitating other permitted activities submitted through separate permit applications to the co-Trustees (e.g., National Geographic Society special use projects). Should some or not all of those separate activities occur, Ocean Exploration Trust would transition a portion or all of the mapping efforts in this timeframe to be 24/7 (with fewer days at sea) and with priority mapping surveys taking place within the expanded area of the Monument.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding.
N/A

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

Common name:
N/A

Scientific name:
N/A

& size of specimens:
N/A

Collection location:
N/A

☐ Whole Organism ☐ Partial Organism

9b. What will be done with the specimens after the project has ended?
N/A

9c. Will the organisms be kept alive after collection? ☐ Yes ☐ No
N/A

• General site/location for collections:
N/A

• Is it an open or closed system? ☐ Open ☐ Closed
N/A

• Is there an outfall? ☐ Yes ☐ No
N/A

• Will these organisms be housed with other organisms? If so, what are the other organisms?
N/A

• Will organisms be released?
N/A

10. If applicable, how will the collected samples or specimens be transported out of the Monument?
N/A

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
N/A

12a. List all specialized gear and materials to be used in this activity:
Kongsberg EM302 multibeam echosounder and sound velocity profiler
Knudsen Chirp 3260 subbottom profiler

DriX, uncrewed system, with EM2040 multibeam echosounder and sound velocity profiler.
Pro 5.5 TGG Zodiac with Yamaha F150 (may be utilized for recovery of DriX)
National Geographic Drop Cameras

12b. List all Hazardous Materials you propose to take to and use within the Monument:
N/A

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:
N/A

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:

Ship-based Surveys
We will finalize multibeam mapping data products by the end of each expedition leg. All data will be available within a month of the expedition by request and provided data to national repositories within 60 days (time until available from repositories varies by institution). Expedition summaries that highlight all results will be published in an annual supplement to the Oceanography Society magazine by March 2024. All data will be made available in accordance with the NOAA Ocean Exploration Cooperative Institute Data Management Plan and can be provided directly to PMNM staff at the culmination of each expedition.

Uncrewed system (DriX) Surveys
For high-resolution DriX surveys, initial data processing and data quality assessments will be made on board the vessel; if possible final processing will be completed on-board, if not it will be completed shortly after the end of the expedition. Data distribution will be done in accordance with the NOAA-UNH Joint Hydrographic Center Data Management Plan that calls for public release of the data and deposition in national repositories as soon as possible . In addition, processed data will be sent to NOAA's Office of Coast Survey for possible incorporation into chart products. Data will be reported in the annual supplement to the Oceanography Society magazine by March 2024 and can be provided directly to PMNM staff at the culmination of each expedition.

15. List all Applicants' publications directly related to the proposed project:

V. E. Schmidt, "Hydrographic Survey with Autonomous Surface Vessels: A Best Practices Guide", International Hydrographic Review, vol. P-1(24). International Hydrographic Organization, Monaco, pp. 189-201, 2020.

Raineault, N.A., and J. Flanders, eds. 2019. New frontiers in ocean exploration: The E/V Nautilus, NOAA Ship Okeanos Explorer, and R/V Falkor 2018 field season. Oceanography 32(1), supplement, 150 pp., https://doi.org/10.5670/oceanog.2019.supplement.01.

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

Signature 3/7/22
Date

SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:

NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
FAX: (808) 455-3093

DID YOU INCLUDE THESE?

☐ Applicant CV/Resume/Biography
☐ Intended field Principal Investigator CV/Resume/Biography
☐ Electronic and Hard Copy of Application with Signature
☐ Statement of information you wish to be kept confidential
☐ Material Safety Data Sheets for Hazardous Materials

LARRY A. MAYER

Professor and Director
Center for Coastal and Ocean Mapping
NOAA/UNH Joint Hydrographic Center
University of New Hampshire
Durham, NH 03824

Phone: (603) 862-2615
Fax: (603) 862-0839
Email: lmayer@unh.edu

Birth Date: 17 May 1952
Birth Place: New York City, N.Y.

Education

1979 Ph.D. Scripps Institution of Oceanography, University of California, San Diego, Marine Geology/Geophysics.

1973 B.S. University of Rhode Island, magna cum laude, Honors program Geology.

Employment:

2004 - Adjunct Scientist – Woods Hole Oceanographic Institution

2000 - Professor and Director of Center for Coastal and Ocean Mapping University of New Hampshire, Durham, New Hampshire

1991-99 Professor and NSERC Chair in Ocean Mapping Department of Geodesy and Geomatics Engineering, University of New Brunswick

1988-89 Visiting Professor, Department de Geologie Dynamique, University of Paris.

1986-91 Associate Professor of Oceanography, Department of Oceanography, Dalhousie University.

1986 Visiting Professor Chair, University of Kiel, W. Germany.

1982-86 Assistant Professor of Oceanography, Department of Oceanography, Dalhousie University.

1980-Present Adjunct Professor of Ocean Engineering, Department of Ocean Engineering, University of Rhode Island.

1980-82 Assistant Marine Scientist, Graduate School of Oceanography, University of Rhode Island.

1979-80 Post-doctoral Research Associate, Graduate School of Oceanography, University of Rhode Island.

1979 Post-doctoral Research Associate, Marine Physical Lab,
Scripps Institution of Oceanography

1974-79 Research Assistant, Marine Physical Lab,
Scripps Institution of Oceanography.

Professional Affiliations:

Chair, Scientific Board, Research Center on Ocean Margins, Bremen Germany

Chair, National Academies of Sciences Ocean Studies Board

Vice Chair Ocean Exploration Trust Board of Directors

Arctic Research Commission, Commissioner

Ocean Research Advisory Panel (ORAP), Member

NOAA Hydrographic Services Review Panel, Member

Interagency Task Force on the Extended Continental Shelf, Member

Ocean Network Canada Board of Directors, Member

Professional Association/Society Memberships:

American Geophysical Union, Oceanography Society, The Hydrographic Society

Honors and Awards

Elected to Norwegian Scientific Academy for Polar Research, Class of 2021
Elected Fellow of American Geophysical Union 2020

Elected to Royal Swedish Academy of Sciences, Class of 2019

Elected to the National Academy of Engineering, Class of 2018
Elected to The Hydrographic Society of America Hall of Fame, Class of 2017

Presidential Appointment to Arctic Research Commission 2016-

Chair, National Academies of Sciences Ocean Studies Board 2015-
Superior Honor Award, Department of State, 2013
Class of 1944 Professorship, University of New Hampshire, 2013–2016
Vice-Chair, Consortium of Ocean Leadership Board of Trustees, 2013–2015

Chair, National Academy of Sciences Committee on Effects of Deepwater Horizon Spill on Ecosystem Services in the Gulf of Mexico, 2011–2014

Trustee, Consortium of Ocean Leadership, 2009–2012

University of Rhode Island – School of Oceanography Distinguished Alumni Award, 2007

University of New Hampshire Excellence in Research Award, 2007

Chair, National Academies Committee on National Needs for Coastal Mapping and Charting, 2003-2004

Member of U.S. Presidential Panel on Ocean Exploration, 2000

Doctor of Philosophy, *honoris causa*, University of Stockholm, 1999

Geological Association of Canada's Michael J. Keen Medal for contributions to marine geoscience, 1998

Petermann Medal for Paleoceanography (Bronze) in Awarded by the Swedish Royal Academy of Sciences - 1997

President, Canadian Geophysical Union, 1997–1999

Member, Minister of Natural Resources Canada National Advisory Board for Earth Science – 1996–1999

Member, Board of Directors Ocean Networks Canada, 2012–

Member, Board of Directors, Canadian Scientific Submersible Facility

Member, Board of Directors, ISOTRACE Laboratories, Toronto 1993–1997

Member, Board of Directors, Institute of Acoustics of Atlantic Canada – 1994 - 1997

Member, Board of Directors, Champlain Institute, 1996–1997

Vice President, Board of Directors, Atlantic Center for Remote Sensing of the Oceans 1993

Lansdowne Visiting Appointment, University of Victoria, 1991–1992

CONOCO Distinguished Lecturer, Woods Hole Oceanographic Institute, May 1987

Kiel University Visiting Professor Chair, 1986

Scripps Institution of Oceanography Dissertation Fellowship

Selected as Astronaut Candidate finalist for the NASA Space Shuttle Program

Phi Kappa Phi Honor Society

N.Y. State Regents Scholarship

Recent Publications (last two years):

Jakobsson, M. and Mayer, L.A., in press, Polar Region Bathymetry: Critical knowledge for the prediction of global sea level rise, Frontiers in Marine Science, doi. 10.3389/fmars.2021.788724

Dijkstra, J., Mello, K., Waitling L., Mayer. L.A. 2021, Fine-scale mapping of deep-sea habitat-forming species densities reveals taxonomic specific environmental drivers, Global Ecology and Biogeography, v. 30, no. 6, pgs. 1286-1298 https://doi.org/10.1111/geb.13285

Kates Varghese H, Lowell K,, Miksis-Olds J, DiMarzio N, Moretti D and Mayer L., 2021, Spatial Analysis of Beaked Whale Foraging During Two 12 kHz Multibeam Echosounder Surveys. Front. Mar. Sci. 8:654184.doi: 10.3389/fmars.2021.654184, https://www.frontiersin.org/articles/10.3389/fmars.2021.654184/full

Mello-Rafter K, Sowers D, Malik M, Watling L, Mayer LA and Dijkstra JA, 2021, Environmental and Geomorphological Effects on the Distribution of Deep-Sea Canyon and Seamount Communities in the Northwest Atlantic. *Front. Mar. Sci.* 8:691668. doi: 10.3389/fmars.2021.691668 https://www.frontiersin.org/articles/10.3389/fmars.2021.691668/full

Mayer, Larry A., and Roach, Ashley, 2021, The quest to completely map the world's oceans in support of understanding marine biodiversity and the regulatory barriers we have created, in*, M. Nordquist and R. Long, eds., Marine Biodiversity of Areas Beyond National Jurisdiction,* Center for Ocean Law and Policy , V. 24, Chapter 8, pp. 149-156, Brill Publishers, Leiden, The Netherlands, ISBN 978-90-04-42241-4 978-90-04-42243-8

O'Regan, Matt ,Cronin, Thomas, Reilly, Brendan, Alstrup, Aage Kristian Olsen, Gemery, Laura, Golub, Anna, Mayer, Larry, Morlighem, Mathieu, Moros, Matthias , Munk, Ole Lajord, Nilsson, Johan, Pearce, Christof, Detlef, Henrieka, Stranne, Christian, Vermassen, Flor, West, Gabriel, and Jakobsson, Martin, The Holocene dynamics of Ryder Glacier and ice tongue in north Greenland, The Cryosphere, Preprint no.: tc-2021-95, https://tc.copernicus.org/preprints/tc-2021-95/

Snoeijs-Leijonmalm, P., Gjosaeter, H., Ingvaldsen, R.B., Knutsen, T., Korneliussen, Ona, E., Skjoldal, H.R., Stranne, C., Mayer, L.A., Jakobsson, M., and Gardfeldt, K., 2021, A deep scattering layer under the North Pole, Progress in Oceanography, vol. 94, 102560,ISSN 0079-6611, https://doi.org/10.1016/j.pocean.2021.102560

Jakobsson, M., Mayer, L.A., Nilsson, J. *et al.*, 2020, Ryder Glacier in northwest Greenland is shielded from warm Atlantic water by a bathymetric sill. *Nature - Commun Earth Environ* **1,** 45. https://doi.org/10.1038/s43247-020-00043-0

Ware, C., Mayer, L., Johhnson, P., Jakobsson, M. and Ferrini, V., 2020, A geographic grid system for visualizing bathymetry, Geosci. Instrum. Method. Data Syst., 9, 375–384, https://doi.org/10.5194/gi-9-375-2020

Kates Varghese, H., Miksis-Olds, J., DiMarzio, N., Lowell, K., Linder, E., Mayer, L., and Moretti, D., 2020, "The effect of two 12 kHz multibeam mapping surveys on the foraging behavior of Cuvier's beaked whales off of southern California", The Journal of the Acoustical Society of America 147, 3849-3858 (https://doi.org/10.1121/10.0001385

Weidner. E., Stranne, C., Sundberg, J., Weber, T., Mayer, L. and Jakobsson, M., 2020, Tracking the spatioteporal variability of the oxic-anoxic interface in the Baltic Sea with broadband acoustics, *ICES Journal of Marine Science*, , fsaa153, https://doi.org/10.1093/icesjms/fsaa153

Mayer, L.A., 2020, Climate change and the legal effects of sea level rise: an introduction to the science, in *Heider, T., ed., 2020, New Knowledge and Changing Circumstances in the Law of the Sea,* Brill, Nijhoff Press, Leiden, Boston, pp. 343-357.

Baumert, K. A. and Mayer, L.A., 2020, Submarine ridges and submarine elevations under the Law of the Sea Convention: a further look, in *Heider, T., ed., 2020, New Knowledge and Changing Circumstances in the Law of the Sea,* Brill, Nijhoff Press, Leiden, Boston, pp. 264-288.

Barker, L.D.L.; Jakuba, M.V.; Bowen, A.D.; German, C.R.; Maksym, T.; Mayer, L.; Boetius, A.; Dutrieux, P.; Whitcomb, L.L. Scientific Challenges and Present Capabilities in Underwater Robotic Vehicle Design and Navigation for Oceanographic Exploration Under-Ice. *Remote Sens.* 2020, *12*, 2588. https://www.mdpi.com/2072-4292/12/16/2588/pdf

Di Stefano, M., & Mayer, L. A. (2020). Chapter 29 Geomorphology and microhabitats of large, isolated, immobile bedforms in the Great South Channel, Northwest Atlantic Ocean. In *Seafloor Geomorphology as Benthic Habitat* (pp. 503-518). doi:10.1016/b978-0-12-814960-7.00029-4

Jakobsson, M., Mayer, L.A., Bringensparr, C. *et al.* The International Bathymetric Chart of the Arctic Ocean Version 4.0. *Sci Data* **7,** 176 (2020). https://www.nature.com/articles/s41597-020-0520-9

Varghese, H.K., Miksis-Olds, J., DiMarzio, N., Lowell, K., Linder, E., Mayer. L.A., and Moretti, D., 2020, The effect of two 12-kHz multibeam mapping surveys on the foraging behavior of Cuvier's beaked whales off Southern California, Jour. Acoustical Society of America, v. 14, no. 6., pp. 3849-3858. https://doi.org/10.1121/10.0001385

Mukasa, S. B., Andronikov, A., Brumley, K., Mayer, L. A., & Armstrong, A., 2020, Basalts from the Chukchi Borderland: $^{40}Ar/^{39}Ar$ Ages and Geochemistry of submarine intraplate lavas dredged from the western Arctic Ocean. *Journal of Geophysical Research: Solid Earth*, 125, e2019JB017604. https://doi.org/10.1029/2019JB017604

Masetti, G., Smith, M. J., Mayer, L. A., & Kelley, J. G. W., 2020, Applications of the Gulf of Maine Operational Forecast System to Enhance Spatio-Temporal Oceanographic Awareness for Ocean Mapping. *Frontiers in Marine Science*, v. *6*,. Sci., 14 January 2020 | https://doi.org/10.3389/fmars.2019.00804

Boggild, K., Mosher, D.C., Travaglini, P., Gebhardt, C., and Mayer, L.A., 2020, Mass wasting on Alpha Ridge in the Arctic Ocean: new insights from multibeam bathymetry and sub-bottom profiler data, Geological Society of London Special Publication 500, https://doi.org/10.1144/SP500-2019-196

Sowers, D., Masetti, G., Mayer, L.A., Johnson, P., Gardner, J.V., and Armstrong, A., 2020, Standardized Geomorphic Classification of Seafloor Within the United States Atlantic Canyons and Continental Margin, Frontiers in Marine Science, v. 7, pp. 9 , https://doi.org/10.3389/fmars.2020.00009

Sowers, D., Dijkstra, J. A., Mello, K., Masetti, G., Malik, M., & Mayer, L. A., 2020. Chapter 56 Application of the coastal and marine ecological classification standard to Gosnold Seamount, North Atlantic Ocean. In *Seafloor Geomorphology as Benthic Habitat* (pp. 903-916). doi:10.1016/b978-0-12-814960-7.00056-7

Hogan, K, Jakobsson, M., Mayer, L. A., Reilly, B., Jennings, A., Mix, A., Nielsen, T., Andresen, K. J., Normark, E., Heirman, K., Kamla, E., Jerram, K., and Stranne, C., 2020, Glacial sedimentation, fluxes and erosion rates associated with ice retreat in Petermann Fjord and Nares Strait, NW Greenland, *The Cryosphere*. Copernicus Publications, v.14, pp. 261-286, https://doi.org/10.5194/tc-14-261-2020

Other Professional Activities:

Participated in more than 90 cruises (over 70 months at sea!) over the last 35 years; have been chief or co-chief scientist of numerous expeditions including two legs of the Ocean Drilling Program, and 13 mapping expeditions in the ice-covered regions of the high Arctic

ANDREW A. ARMSTRONG, III
Captain, NOAA (retired)
Curriculum Vitae

Address:
NOAA/University of New Hampshire Joint Hydrographic Center
Ocean Engineering Building
24 Colovos Road
Durham, New Hampshire 03824
(603) 862-4559, (240) 676-6090

Education:

M.S.	Technical Management, with Honors	1991	Johns Hopkins University
B.S.	Geology	1970	Tulane University

Current Position
National Oceanic and Atmospheric Administration

1999 – present Co-Director, NOAA/University of New Hampshire Joint Hydrographic Center

University of New Hampshire
1999 – present Affiliate Professor of Ocean Engineering

Commissioned Service (positions held):
National Oceanic and Atmospheric Administration

1995 – 1999 Chief, NOAA Hydrographic Surveys Division

1994 – 1995 Modernization Coordinator, NOAA, National Ocean Service

1992 – 1994 Commanding Officer and Chief Hydrographer, NOAA Ship Whiting

1974 – 1992 Hydrographic Surveying Officer

United States Navy

1970 – 1974 Commissioned Officer

Recent International Delegations:
U. S. – Canada Hydrographic Commission, 1995 – 1998, 2004 – present

U.S. – Japan Cooperative Program in Natural Resources (UJNR), Sea-Bottom Surveys Panel, 1995 - Present.

Board Memberships and Professional Societies:
International Federation of Surveyors (FIG)/International Hydrographic Organization (IHO)/International Cartographic Association (ICA) International Advisory Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers (representing The United States and the IHO) 1999 – present, Chairman, 2004 – 2007

The Hydrographic Society of America, Member, 1984 – present; President, 2004 – 2010

Honors:
Department of Commerce Gold Medal, 2020
The Hydrographic Society of America Hydrographer Hall of Fame, 2019
Department of Commerce Bronze Medal 2016

Recent Publications:

J. V. Gardner, Calder, B. R., and **Armstrong, A. A**., "Geomorphometric Descriptions of Archipelagic Aprons off the Southern Flanks of French Frigate Shoals and Necker Island Edifices, Northwest Hawaiian Ridge", Geological Society of America Bulletin (GSAB), vol. 133(9/10). Geological Society of America, pp. 2189-2209, 2021.

A. A. Armstrong, Owen, H., Bothner, W. A., Ward, L. G., and Moyles, D., "Shallow Water Multibeam Data Analysis of Complex Bedrock Geology in Penobscot Bay, Maine", 8th Annual International Conference on High Resolution Surveys in Shallow Water. p. St. John's, NL, Canada, 2018.

A. A. Armstrong and Calder, B. R., "U.S. Extended Continental Shelf Cruise to Map Necker Ridge and Vicinity, Central Pacific Ocean", Center for Coastal and Ocean Mapping / Joint Hydrographic Center, Durham, NH, 2017.

A. A. Armstrong and Mosher, D. C., "Extended Continental Shelf Mapping Cruise in Vicinity of Palmyra Atoll", Center for Coastal and Ocean Mapping / Joint Hydrographic Center, Durham, NH, 2016.

J. V. Gardner, **Armstrong, A. A**., and Calder, B. R., "Hatteras Transverse Canyon, Hatteras Outer Ridge and Environs of the U.S. Atlantic Margin: A View from Multibeam Bathymetry and Backscatter", Marine Geology, vol. 371. Elsevier, pp. 18-32, 2015.

L. A. Mayer, Gardner, J. V., and **Armstrong, A. A**., "An Ultrahigh-Latitude Submarine Channel: Northern Chukchi Rise", in Atlas of Submarine Glacial Landforms: Modern, Quaternary and Ancient., vol. Memoirs, London, UK: The Geological Society of London, 2016, pp. 391-392.

Armstrong, A.A., Mayer, L.A., and Gardner, J.V., Seamounts, Submarine Channels, and New Discoveries, *Journal of Ocean Technology*, Vol. 10, No. 3. Fisheries and Marine Institute of Memorial University of Newfoundland, St. John's, Newfoundland, Canada, pp. 1-14, 2015.

ALLISON FUNDIS

email: allison@oet.org phone: 860-389-3440

EDUCATION

2010	MS, Marine Geology // University of Florida — Gainesville, FL
2003	BA, Human Ecology // College of the Atlantic — Bar Harbor, ME

EXPERIENCE

2018 - present	Chief Operating Officer // Ocean Exploration Trust New London, CT (remotely from CA)
2017 - 2018	VP, Marine Operations & Programs // Ocean Exploration Trust New London, CT (remotely from CA)
2015 – 2017	VP, Education, Outreach & Communications // Ocean Exploration Trust Narragansett, RI
2013 – 2015	Director, Education // Ocean Exploration Trust Narragansett, RI
2010 – 2013	Education & Public Engagement Liaison // University of Washington, School of Oceanography Seattle, WA
2010	Research Assistant // University of Florida, Department of Geology Gainesville, FL
2006 – 2010	Marine Technician // Woods Hole Oceanographic Institution Woods Hole, MA (offshore)
2008 - 2009	Teaching Assistant // University of Florida, Department of Geology Gainesville, FL
2007	Teaching Assistant // University of Florida, Department of Biological Sciences Gainesville, FL
2004 – 2006	High School Science Teacher // University School of Nashville Nashville, TN

RECOGNITION & SYNERGISTIC ACTIVITIES

2021	National Geographic Society — **2021 Emerging Explorer Awardee**
2021	Vallejo, CA Human Rights Commission — **Climate Change & Education Advisor**
2020	University School of Nashville — **Distinguished Alumna**
2020	Explorers Club — **Fellow National Inductee**
2019	Inverse.com — **Future 50 People that will Shape the Next Decade**
2019	AAAS & Lyda Hill Foundation — **AAAS IF/THEN Ambassador**
2019	Academy of Achievement — **2019 Innovation & Technology Delegate**
2019 - present	NOAA Ocean Exploration Cooperative Institute — **Council of Fellows, Chair**

2018	Ocean Exploration Advisory Board — **Subcommittee member of NOAA OER education review**
2016 – present	Ocean Exploration Trust — **Secretary, Board of Directors**
2015 – 2018	National Science Foundation's STEMseas Project — **Advisory committee member**
2012 – 2017	OceanGate Foundation — **Board of Trustees**
2012	Exploratorium — **Advisor: Connecting the Bay Observatory to the Northeast Pacific**
2012	National Science Foundation's Ocean of Data Project — **Advisory committee member**
2011 – 2012	Pacific Science Center — **Science Communication Fellow**
2009	University of Florida, Geology — **Ernst Award for Outstanding Teaching**
1999	Nashville, TN — **City Civitan Awardee**

PEER-REVIEWED PUBLICATIONS

Clague, D., J. Padaun, B. Dreyer, W.W. Chadwick Jr., K. Rubin, M.R. Perfit, **A.T. Fundis**, (2018). Chemical variations in the 1998, 2011, and 2015 laval flows from Axial Seamount, Juan de Fuca Ridge: Cooling during ascent, lateral transport, and flow. *Geochemisty Geophysics Geosystems*, 19: doi 10.1029/2018GC007708.

Brennan, M., Cantelas, F., Elliott, K., Delgado, J., Bell, K., Coleman, D., **Fundis, A**., Irion, J., Tilburg, H., & Ballard, R. (2018). Telepresence-Enabled Maritime Archaeological Exploration in the Deep. *Journal of Maritime Archaeology*, 13(2), 97-121. doi 10.1007/s11457-018-9197-z.

Soule, S.A., D.S. Nakata, D.J. Fornari, **A.T. Fundis,** M.R. Perfit, M.D. Kurz, (2012) CO_2 variability in mid-ocean ridge basalts from syn-emplacement degassing: Constraints on eruption dynamics, *Earth and Planetary Science Letters*, Volumes 327–328, 15 April 2012, Pages 39-49, ISSN 0012-821X, doi 10.1016/j.epsl.2012.01.034.

Fornari, D.J., K.L. Von Damm (deceased), J.G. Bryce, J.P. Cowen, V. Ferrini, **A. T. Fundis,** M.D. Lilley, G.W. Luther III, L.S. Mullineaux, M.R. Perfit, M.F. Meana-Prado, K.H. Rubin, W.E. Seyfried Jr., T.M. Shank, S.A. Soule, M. Tolstoy, and S.M. White. (2012) The East Pacific Rise between 9°N and 10°N: Twenty-five years of integrated, multidisciplinary oceanic spreading center studies. *Oceanography* 25(1):18–43, doi 10.5670/oceanog.2012.02.

Goss, A.R., M.R. Perfit, W.I. Ridley, K.H. Rubin, G.D Kamenov, S.A. Soule, **A. Fundis**, D.J. Fornari. (2010) Geochemistry of lavas from the 2005-2006 eruption at the East Pacific Rise, 9º46'N - 9º56'N: Implications for ridge crest plumbing and decadal changes in magma chamber compositions. *Geochemistry, Geophysics, Geosystems*. 11, Q05T09, doi 10.1029/2009GC002977.

Fundis, A.T., S.A. Soule, D.J. Fornari, M.R. Perfit, (2010), Paving the seafloor: Volcanic emplacement processes during the 2005-2006 eruptions at the fast-spreading East Pacific Rise, 9˚50´N, *Geochemistry, Geophysics, Geosystems*. 11, Q08024, doi 10.1029/2010GC003058.

ARTICLES

Fundis, A.T. (2019, October 20) Why we need far more exploration of the ocean [online article, inverse.com], https://www.inverse.com/science/60276-allison-fundis-protect-our-ocean

Fundis, A. T., M. Cook, S. Wishnak,, K. Moran, T. Burbank, M. Viveiros (2019) A Decade of Engaging Students, Educators, and Global Audiences in Deep-Sea Expeditions. *Oceanography* 32(1), supplement, 150 pp., https://doi.org/10.5670/oceanog.2019.supplement.01.

Fundis, A. T., S. Wishnak, M. Cook, K. Sutton, K. Moran, S. Munro, T. Burbank (2018) Sparking Interest in Ocean Exploration and Providing Experiential STEM Programs for Students and Educators. *Oceanography* 31(1), supplement, 126 pp., https://doi.org/10.5670/oceanog.2018.supplement.01.

Fundis, A. T., M. Cook, S. Garson, K. Sutton, S. Munro, and S. Poulton (2016) A Community Approach to STEM Education, *Oceanography* 29(1): 18-23, https://doi.org/10.5670/oceanog.2016.supplement.01.

Fundis, A. T., S. Garson, S. Munro, S. Poulton, T. Viola, and K.L.C. Bell (2015) Ocean Exploration as a Platform for STEM Education & Outreach, *Oceanography* 28(1):16-24, http://dx.doi.org/10.5670/oceanog.2015.supplement.01.

Fundis, A. T. and K.L.C. Bell, (2014) Inspiring, engaging, and educating the next generation of STEM learners, *Journal of Ocean Technology* 9(3): 73-78.

Fundis, A.T., S. Garson, and K. Cubina, (2014) E/V Nautilus Education Programs. Oceanography 27(1), supplement, 52 pp, http://dx.doi.org/10.5670/oceanog.2014.supplement.01.

Fundis, A. T., K. A. Zarrella, E. Donnelly, R. L. Preston, G. W. Kidder III and C. W. Petersen. (2003). *Fundulus heteroclitus* distribution in Northeast Creek: Sex and size class changes along a salinity gradient. *Bull. Mt. Desert Isl. Biol. Lab.*42:18-20 (MDIBL bulletin page)

FIELD WORK

Led or participated in 50+ international research expeditions since 2006 utilizing deep-sea vehicles including ROVs *Hercules*, *Jason II*, and ROPOS, HOV *Alvin*, AUV *Sentry*, and other technologies. Experienced conducting biological surveys via SCUBA, snorkel, and small boats.

PROFESSIONAL ASSOCIATIONS & CERTIFICATIONS

American Association for the Advancement of Science
American Geophysical Union
Marine Technology Society
The Oceanography Society
PADI SCUBA (advanced open water, wreck, underwater naturalist, marine research, and night diver certifications)
STCW/CPR

GRANT FUNDING

National Marine Science Foundation #19-12-B-243; Advancing ocean exploration education and outreach through public-private collaboration; $348,560 (2020-2021): Fundis

Office of Naval Research # N00014-18-1-2854; Using Ocean Exploration to Support Naval STEM Outreach and Workforce Development; $750,000 (2018-2021); Ballard & Fundis

Office of Naval Research #N00014-15-1-2143; A Community STEM Education Program: Addressing Naval STEM Outreach and Workforce Development; $750,000 (2015-2018); Ballard, Bell, & Fundis

Papahānaumokuākea Marine National Monument

RESEARCH Permit Application

NOTE: ***This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).***

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.

- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.

- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
nwhipermit@noaa.gov
PHONE: (808) 725-5800 FAX: (808) 455-3093

SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.

Papahānaumokuākea Marine National Monument
Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Allison Fundis, Chief Operating Officer
Affiliation: Ocean Exploration Trust
Permit Category: Research
Proposed Activity Dates: TBD. Request permit from July 1, 2022 to October 25, 2022
Proposed Method of Entry (Vessel/Plane): Vessel
Proposed Locations: Deepwater (>100m) expanded area of PMNM; Shallow water (<100m) within original PMNM boundary; TBD offshore: Nihoa Island, Necker Island, French Frigate Shoals, Gardner Pinnacles, Maro Reef, Laysan Island.

Estimated number of individuals (including Applicant) to be covered under this permit: approximately 28

Estimated number of days in the Monument: TBD, up to 74 depending on permitted research activities currently under review by the co-Trustees of PMNM. The maximum number of days (if all related pending permits are approved) is 74 days within PMNM following the schedule below.

(est) DATES	EST DAYS IN PMNM UNDER THIS PERMIT REQUEST	EXPEDITION	PENDING PERMIT APPLICATIONS
7/16-8/8	21	OET Mapping (NOAA OE, NOAA OCS)	Fundis, Mayer, Armstrong
8/8-8/13	0	port: Honolulu	
8/14-8/28	12	OET Mapping (NOAA OE) & Nat Geo snorkeling (Nat Geo)	Fundis, Mayer, Armstrong Hoffman-Kunt & Miller
8/28-8/29	0	port: Honolulu	
8/30-9/13	12	OET Mapping (NOAA OE) & Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Nunez-Lendo & Leonardo
9/13-9/14	0	port: Honolulu	

9/15-9/29	12	OET Mapping (NOAA OE) & Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Agustines
9/29-9/30	0	port: Honolulu	
10/1-10/8	5	Nat Geo SCUBA (Nat Geo)	Hoffman-Kunt, Miller, Agustines
10/8-10/9	0	port: Honolulu	
10/10-10/24	12	OET Mapping (NOAA OE) & Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Dunnavant
total	*74*		

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

Operate exploration vessel (E/V) Nautilus, a 224' research vessel within the boundaries of Papahānamokuākea Marine National Monument. The purpose of this vessel is to provide an at-sea research platform for PIs within PMNM. Research scientists aboard the vessel will work under separate permits from the vessel.

b.) To accomplish this activity we would ….

Transport and support researchers working and traveling within PMNM.

c.) This activity would help the Monument by …

Providing a data collection platform for scientists to conduct research activities in order to inform management activities and preserve and sustain the scientific and cultural significance of PMNM.

Other information or background:

Ocean Exploration Trust is a Connecticut-based 501(c)(3) nonprofit that owns and operates exploration vessel (E/V) Nautilus and has experience conducting expeditions within PMNM (2018, 2021) in collaboration with NOAA Office of National Marine Sanctuaries and NOAA Ocean Exploration. In 2021, Ocean Exploration Trust and representatives of the Papahānaumokuākea Native Hawaiian Cultural Working Group collaborated to begin to address the overdue need for expeditions to be conducted in Hawai'i to reflect collaborative approaches inclusive of Hawaiian worldview. As a result, the 2021 PMNM expedition aboard Nautilus included co-developed outreach and education opportunities including: (1) Hawaiian naming of expeditions, (2) supporting storytelling through development of promotional video in Hawaiian highlighting Hawaiian worldviews ocean ocean exploration, (3) broadening outreach to the local Department of Education, charter, and kula kaiapuni networks, and (4) supporting live ship-to-shore broadcases in Hawaiian and English, which included supporting a paid internship position for a Native Hawaiian student and a paid position for a Cultural Working Group representative to be on board for the expedition as a Hawaiian language correspondent and cultural liaison. Ocean Exploration Trust and PMNM collaborators continue to work together to build on this partnership to make more opportunities available for local students, educators, and

researchers.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Fundis, Allison, T.
Title: Chief Operating Officer

1a. Intended field Principal Investigator (See instructions for more information):
Allison Fundis

2. Mailing address (street/P.O. box, city, state, country, zip):
Ocean Exploration Trust
SEE ORIGINAL APPLICATION FOR CONTACT INFO
SEE ORIGINAL APPLICATION FOR CONTACT INFO

Phone: SEE ORIGINAL APPLICATION FOR CONTACT INFO
Fax: n/a
Email: SEE ORIGINAL APPLICATION FOR CONTACT INFO

3. Affiliation (institution/agency/organization directly related to the proposed project):
Ocean Exploration Trust

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):
E/V Nautilus sails with up to 18 professional crew members on any given expedition. Including crew changes, we anticipate approximately 28 TBC individuals to sail as crew under this permit. Scientists will be named in specific research permits that are being submitted in parallel with this vessel research permit request. E/V Nautilus crew roles per expedition include:

1	*Captain*	*Pavel Chubar or Neal Myles*
1	*Chief Officer*	*TBC*
1	*2nd Mate*	*TBC*
1	*3rd Mate*	*TBC*
1	*ETO*	*TBC*
1	*Chief Engineer*	*TBC*

3	*Engineers*	*TBC*
1	*Chief Cook*	*TBC*
1	*Cook*	*TBC*
1	*Bosun*	*TBC*
2	*Able Seamen*	*TBC*
2	*Motormen*	*TBC*
1-2	*Steward*	*TBC*

Section B: Project Information

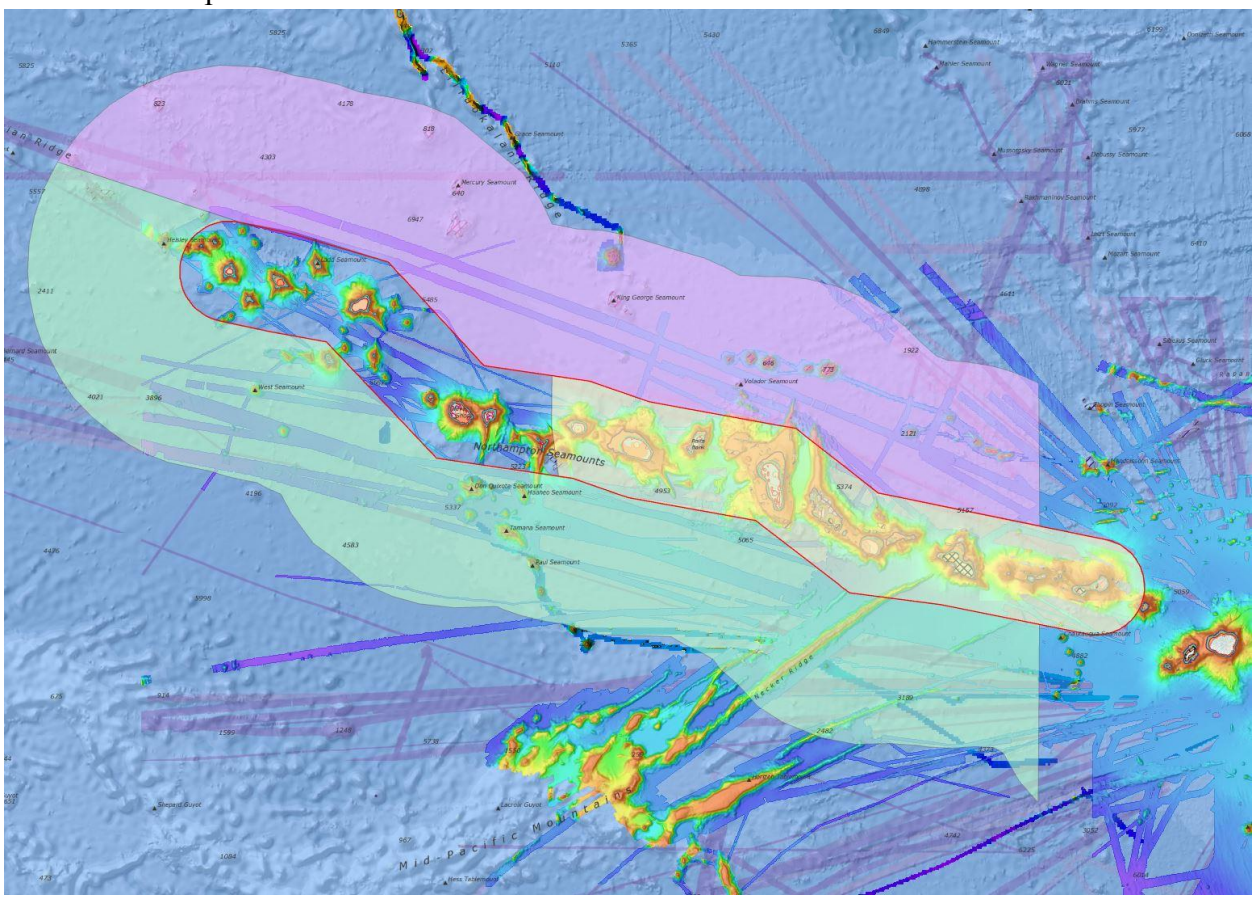
5a. Project location(s):		**Ocean Based**	
X Nihoa Island	☐ Land-based	**X** Shallow water	**X** Deep water
X Necker Island (Mokumanamana)	☐ Land-based	**X** Shallow water	**X** Deep water
X French Frigate Shoals	☐ Land-based	**X** Shallow water	**X** Deep water
X Gardner Pinnacles	☐ Land-based	**X** Shallow water	**X** Deep water
XMaro Reef	☐ Land-based	**X** Shallow water	**X** Deep water
X Laysan Island	☐ Land-based	**X** Shallow water	**X** Deep water
☐ Lisianski Island, Neva Shoal	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Pearl and Hermes Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Midway Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Kure Atoll	☐ Land-based	☐ Shallow water	☐ Deep water
X Monument Expansion Area			
☐ Other			

NOTE: Shallow water is defined by water less than 100 meters in depth.

☐ Remaining ashore on any island or atoll (with the exception of Sand Island,at Midway Atoll and field camp staff on other islands/atolls) between sunset and sunrise.

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:



TBD dependent on permitted activities. We anticipate operating in the southern 50% of the original boundary (yellow) as well as within the expanded boundaries of the Monument (purple = highest priority). Locations will be refined and limited to the scope of other permitted activities.

5b. Check all applicable regulated activities proposed to be conducted in the Monument:
☐ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
☐ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
X Anchoring a vessel
☐ Deserting a vessel aground, at anchor, or adrift
X Discharging or depositing any material or matter into the Monument
☐ Touching coral, living or dead
☐ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
☐ Attracting any living Monument resource

☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
☐ Subsistence fishing (State waters only)
☐ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

Anchoring the E/V Nautilus 5.5-meter RHIB supporting SCUBA operations is not planned but may be required for longer SCUBA dives or in the event of engine failure. OET will endeavor to hand place anchors with divers/snorkelers to minimize any potential impact to underwater fauna and substrate. OET has no plans to anchor E/V Nautilus in PMNM and would only do so in the unlikely event of a ship emergency and loss of propulsion/power requiring the anchor to be dropped for the safety of the vessel and those onboard.

6. Purpose/Need/Scope *State purpose of proposed activities:*

The purpose of the vessel's activities are to provide an at-sea research platform with a 2-3 week endurance to support activities that are permitted through the Monument co-Trustees, including: ship-based multibeam mapping in deepwater; the deployment of an autonomous mapping vehicle for mapping surveys; and small boat, diver, and special use permit activities.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species beyond the protocols provided in PMNM Best Management Practices (https://www.papahanaumokuakea.gov/permit/bestmanagement.html)? Yes ☐ No **X**

If so, please list the species you specifically intend to target.
N/A

For a list of terrestrial species protected under the Endangered Species Act visit:
http://www.fws.gov/endangered/
For a list of marine species protected under the Endangered Species Act visit:
http://www.nmfs.noaa.gov/pr/species/esa/
For information about species protected under the Marine Mammal Protection Act visit:
http://www.nmfs.noaa.gov/pr/laws/mmpa/

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?

Ocean Exploration Trust has a history of scientific exploration that is sensitive to cultural and historic places and resources. We do not touch or disturb any historic sites without proper permission and permitting, and do not intend to include any such activities on these expeditions. Activities aboard E/V Nautilus will be respectful of the natural, historical, and cultural resources of PMNM. All expedition participants and crew will receive a cultural briefing from PMNM, OHA, or designated representative in advance of the expedition to ensure all parties understand the cultural significance of PMNM to Native Hawaiians. Ocean Exploration Trust ensures everyone onboard E/V Nautilus understands that Native Hawaiians consider all natural resources as cultural resources and that both are provided with the utmost respect during our expeditions.

Ocean Exploration Trust will implement a rodent-free plan and be inspected for the presence of rodent species prior to entering PMNM, following the guidelines and inspection standards laid out in PMNM BMP #018. Additionally, underwater hull inspections by divers will be conducted prior to entering PMNM and any potentially harmful biofouling agents will be removed.

E/V Nautilus follows a waste management plan in compliance with all United States Coast Guard, international, and PMNM rules and regulations. The vessel will carry a vessel monitoring system in accordance with PMNM regulations in addition to following all other Monument Best Practices and Policies relevant to the permitted work conducted onboard.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects?

All activities conducted aboard E/V Nautilus will be activities permitted by the co-Trustees of the Monument. All operations will be compatible with the conservation and management goals of PMNM, NOAA Office of National Marine Sanctuaries, USFWS, and the State of Hawai‘i.

Ocean Exploration Trust is respectful of the cultural importance of the Monument to Native Hawaiians. As a sacred place, and especially in the realm of Po, we aim to tread lightly and minimize or omit impacts from activities conducted from aboard E/V Nautilus. Additionally, this project can help facilitate the Monument‘s effort to “bring the place to the people, rather than the people to the place” through telepresence and other outreach and education efforts that have the potential to share PMNM resources with local students, educators, and community members in real-time. Ocean Exploration Trust continues to work with PMNM staff to develop

opportunities and programs to raise awareness about the cultural, as well as the natural, significance of the Monument.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

E/V Nautilus is an at-sea scientific exploration platform that we aim to use to transport scientists and scientific equipment to remote locations throughout the Monument, in addition to providing a way for students, educators, and the public to connect with the research and researchers in real-time. Without this safe mode of transportation, permitted research and outreach activities would not be possible unless another comparable vessel is identified and available in a similar timeframe.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

E/V Nautilus will support permitted scientific research that will help assess and characterize the health and biodiversity of the fauna within the Monument in addition to collecting bathymetric data that will be valuable for informing future research and possibly management priorities. The information that is gathered will be provided to PMNM. In our estimation, the end value of this activity outweighs any potential impacts, thus meeting the criteria noted under Finding 1d in Proclamation 8031.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

E/V Nautilus will only remain in the Monument for the duration of the activities permitted to be conducted aboard. Each expedition leg will average 2-3 weeks in duration, including transit times to/from Honolulu. The ship's schedule will be dependent on the activities permitted by the Monument to take place aboard Nautilus in the timeframe of this request (June - Oct, 2022), with time minimized to sustain critical operations for the permitted projects only.

E/V Nautilus will spend only the time allocated for the scientific mission as approved in the individual research and special use permits granted and approved by the co-Trustees and the State Land Board where relevant.

The schedule for E/V Nautilus under this permit request is dependent on the review of other pending research and special use permit requests submitted by Ocean Exploration Trust and the National Geographic Society. The notional schedule in the scenario all permit requests are approved by the co-Trustees is noted in the table below. For cruise legs that are co-sponsored between NOAA OE and the National Geographic Society, E/V Nautilus will be used overnight to map under NOAA OE funding and support National Geographic-funded activities during

daytime hours. Estimated dates within the boundaries of PMNM are the maximum for each cruise leg and are likely to be less given transit time between sites and the Port of Honolulu.

In the event some project permits included in the schedule below are not approved by the co-Trustees, Ocean Exploration Trust would request to consolidate NOAA OE-funded mapping efforts into an additional dedicated mapping cruise in PMNM.

(est) DATES	(est) # OF DAYS IN PMNM	EXPEDITION ACTIVITY	PIs OF PENDING PERMIT APPLICATIONS
7/16-8/8	21	OET Mapping (NOAA OE, NOAA OCS)	Fundis, Mayer, Armstrong
8/8-8/13	0	port: Honolulu	
8/14-8/28	12	OET Mapping (NOAA OE) Nat Geo snorkeling (Nat Geo)	Fundis, Mayer, Armstrong Hoffman-Kunt & Miller
8/28-8/29	0	port: Honolulu	
8/30-9/13	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Nunez-Lendo & Leonardo
9/13-9/14	0	port: Honolulu	
9/15-9/29	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Agustines
9/29-9/30	0	port: Honolulu	
10/1-10/8	5	Nat Geo snorkeling/SCUBA (Nat Geo)	Hoffman-Kunt, Miller, Agustines
10/8-10/9	0	port: Honolulu	
10/10-10/24	12	OET Mapping (NOAA OE) Nat Geo SCUBA (Nat Geo)	Fundis, Mayer, Armstrong Dunnavant

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Ocean Exploration Trust has been conducting scientific exploration of the deep sea since 2009 with its vessel E/V Nautilus in the Pacific, Caribbean, Gulf of Mexico, Mediterranean Sea, Aegean Sea, and Black Sea. The staff and contractors of the organization are experienced maritime professionals, engineers, scientists, and outreach specialists. We have a successful history of safely and professionally conducting seafloor mapping and deepwater exploration with remotely operated vehicles in all US National Marine Sanctuaries along the west coast and in the Thunder Bay National Marine Sanctuary. The vessel and crew have also conducted successful expeditions to the Monument in 2018 and recently in 2021, as well as expeditions within the Pacific Remote Islands Marine National Monument and the Phoenix Islands Protected

Area. Ocean Exploration Trust is known as a leading organization in professionally and safely conducting scientific exploration.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

During the timeframe of this permit request, Ocean Exploration Trust will be conducting expeditions funded by the NOAA Ocean Exploration Cooperative Institute via NOAA Ocean Exploration (research-mapping), NOAA Office of Coast Survey (research-mapping), and through the National Geographic Society (special use - research). The shiptime will be associated with the days at sea that are permitted through other research and special use activities approved by the co-Trustees. The ship and operators are fully insured.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

Since early 2021, Ocean Exploration Trust has been collaborating closely with PMNM staff and representatives of the Papahānamokuākea Cultural Working Group to address the overdue need for expeditions to be conducted in Hawai‘i to reflect collaborative approaches inclusive of Hawaiian worldview. Ocean Exploration Trust is committed – as are our expedition partners and researchers – to conducting expeditions in an ethical way so that impacts are minimal to the Monument‘s cultural, natural and historic resources, qualities, and ecological integrity. In addition to the ongoing collaborative work between OET, PMNM, and the CWG, all personnel will be briefed on the cultural and historical significance of PMNM and additional resources (e.g., literature, briefing materials) will be made available for personnel aboard the ship.

The only activities that will be conducted from the vessel will be those in support of other permitted projects and activities that are specifically stated in the approved research and special use permits.

i. Has your vessel been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

E/V Nautilus will be obtaining a VMS system in 2022 per the OLE requirements and for the duration of the time the vessel will be in the Monument. The vessel currently utilizes AIS, which it will also retain and have on for the duration permitted activities.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

All vessel personnel will be informed and will abide by the NOAA guidelines and best management practices for relevant activities supported aboard the vessel and that are permitted through the co-Trustees. All personnel will be required to read and sign the Papahānamokuākea Marine National Monument Conservation & Management permit and abide by all permit conditions.

8. Procedures/Methods:

E/V Nautilus will transit to the Monument from Honolulu and operate within the Monument for various permitted research activities, which may include seafloor mapping operations with the vessel and an autonomous mapping vehicle, oceanographic data collection, SCUBA diving and related small boat operations, and supporting the transport of FWS personnel for authorized FWS land-based operations. Crew activities may include small boat operations, SCUBA, or snorkeling, as necessary for emergency operations, vessel maintenance, or support of research activities. All planned small boat and permitted SCUBA research activities will be conducted during daylight hours.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding.

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

Common name:
N/A

Scientific name:
N/A

& size of specimens:
N/A

Collection location:
N/A

☐ Whole Organism ☐ Partial Organism

9b. What will be done with the specimens after the project has ended?
N/A

9c. Will the organisms be kept alive after collection? ☐ Yes ☐ No
N/A

• General site/location for collections:
N/A

• Is it an open or closed system? ☐ Open ☐ Closed
N/A

• Is there an outfall? ☐ Yes ☐ No
N/A

• Will these organisms be housed with other organisms? If so, what are the other organisms?
N/A

• Will organisms be released?
N/A

10. If applicable, how will the collected samples or specimens be transported out of the Monument?
N/A

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
N/A

12a. List all specialized gear and materials to be used in this activity:

- *Pro 5.5 TGG Zodiac with Yamaha F150*
- *Rescue boat*
- *SCUBA gear*
- *Kongsberg EM302 multibeam echosounder and sound velocity profiler (use of this system will be applied for under a separate permit)*
- *Knudsen Chirp 3260 sub-bottom profiler(use of this system will be applied for under a separate permit)*
- *Underway CTD*

12b. List all Hazardous Materials you propose to take to and use within the Monument:
Ship carries diesel fuel for propulsion and gasoline when permitted Zodiac operations are conducted from the vessel. The ship carries typical hazardous materials commonly needed for operating/maintaining vessels and that are for use only aboard the vessel.

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:
N/A

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
N/A

15. List all Applicants' publications directly related to the proposed project:
N/A

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

3.7.22

Signature Date

SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:

NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
FAX: (808) 455-3093

DID YOU INCLUDE THESE?
☐ Applicant CV/Resume/Biography
☐ Intended field Principal Investigator CV/Resume/Biography
☐ Electronic and Hard Copy of Application with Signature
☐ Statement of information you wish to be kept confidential
☐ Material Safety Data Sheets for Hazardous Materials

ALLISON FUNDIS

email: allison@oet.org phone: 860-389-3440

EDUCATION

2010	MS, Marine Geology // University of Florida — Gainesville, FL
2003	BA, Human Ecology // College of the Atlantic — Bar Harbor, ME

EXPERIENCE

2018 - present	Chief Operating Officer // Ocean Exploration Trust New London, CT (remotely from CA)
2017 - 2018	VP, Marine Operations & Programs // Ocean Exploration Trust New London, CT (remotely from CA)
2015 – 2017	VP, Education, Outreach & Communications // Ocean Exploration Trust Narragansett, RI
2013 – 2015	Director, Education // Ocean Exploration Trust Narragansett, RI
2010 – 2013	Education & Public Engagement Liaison // University of Washington, School of Oceanography Seattle, WA
2010	Research Assistant // University of Florida, Department of Geology Gainesville, FL
2006 – 2010	Marine Technician // Woods Hole Oceanographic Institution Woods Hole, MA (offshore)
2008 - 2009	Teaching Assistant // University of Florida, Department of Geology Gainesville, FL
2007	Teaching Assistant // University of Florida, Department of Biological Sciences Gainesville, FL
2004 – 2006	High School Science Teacher // University School of Nashville Nashville, TN

RECOGNITION & SYNERGISTIC ACTIVITIES

2021	National Geographic Society — **2021 Emerging Explorer Awardee**
2021	Vallejo, CA Human Rights Commission — **Climate Change & Education Advisor**
2020	University School of Nashville — **Distinguished Alumna**
2020	Explorers Club — **Fellow National Inductee**
2019	Inverse.com — **Future 50 People that will Shape the Next Decade**
2019	AAAS & Lyda Hill Foundation — **AAAS IF/THEN Ambassador**
2019	Academy of Achievement — **2019 Innovation & Technology Delegate**
2019 - present	NOAA Ocean Exploration Cooperative Institute — **Council of Fellows, Chair**

2018	Ocean Exploration Advisory Board — **Subcommittee member of NOAA OER education review**
2016 – present	Ocean Exploration Trust — **Secretary, Board of Directors**
2015 – 2018	National Science Foundation's STEMseas Project — **Advisory committee member**
2012 – 2017	OceanGate Foundation — **Board of Trustees**
2012	Exploratorium — **Advisor: Connecting the Bay Observatory to the Northeast Pacific**
2012	National Science Foundation's Ocean of Data Project — **Advisory committee member**
2011 – 2012	Pacific Science Center — **Science Communication Fellow**
2009	University of Florida, Geology — **Ernst Award for Outstanding Teaching**
1999	Nashville, TN — **City Civitan Awardee**

PEER-REVIEWED PUBLICATIONS

Clague, D., J. Padaun, B. Dreyer, W.W. Chadwick Jr., K. Rubin, M.R. Perfit, **A.T. Fundis**, (2018). Chemical variations in the 1998, 2011, and 2015 laval flows from Axial Seamount, Juan de Fuca Ridge: Cooling during ascent, lateral transport, and flow. *Geochemisty Geophysics Geosystems*, 19: doi 10.1029/2018GC007708.

Brennan, M., Cantelas, F., Elliott, K., Delgado, J., Bell, K., Coleman, D., **Fundis, A**., Irion, J., Tilburg, H., & Ballard, R. (2018). Telepresence-Enabled Maritime Archaeological Exploration in the Deep. *Journal of Maritime Archaeology*, 13(2), 97-121. doi 10.1007/s11457-018-9197-z.

Soule, S.A., D.S. Nakata, D.J. Fornari, **A.T. Fundis,** M.R. Perfit, M.D. Kurz, (2012) CO_2 variability in mid-ocean ridge basalts from syn-emplacement degassing: Constraints on eruption dynamics, *Earth and Planetary Science Letters*, Volumes 327–328, 15 April 2012, Pages 39-49, ISSN 0012-821X, doi 10.1016/j.epsl.2012.01.034.

Fornari, D.J., K.L. Von Damm (deceased), J.G. Bryce, J.P. Cowen, V. Ferrini, **A. T. Fundis,** M.D. Lilley, G.W. Luther III, L.S. Mullineaux, M.R. Perfit, M.F. Meana-Prado, K.H. Rubin, W.E. Seyfried Jr., T.M. Shank, S.A. Soule, M. Tolstoy, and S.M. White. (2012) The East Pacific Rise between 9°N and 10°N: Twenty-five years of integrated, multidisciplinary oceanic spreading center studies. *Oceanography* 25(1):18–43, doi 10.5670/oceanog.2012.02.

Goss, A.R., M.R. Perfit, W.I. Ridley, K.H. Rubin, G.D Kamenov, S.A. Soule, **A. Fundis**, D.J. Fornari. (2010) Geochemistry of lavas from the 2005-2006 eruption at the East Pacific Rise, 9º46'N - 9º56'N: Implications for ridge crest plumbing and decadal changes in magma chamber compositions. *Geochemistry, Geophysics, Geosystems*. 11, Q05T09, doi 10.1029/2009GC002977.

Fundis, A.T., S.A. Soule, D.J. Fornari, M.R. Perfit, (2010), Paving the seafloor: Volcanic emplacement processes during the 2005-2006 eruptions at the fast-spreading East Pacific Rise, 9˚50´N, *Geochemistry, Geophysics, Geosystems*. 11, Q08024, doi 10.1029/2010GC003058.

ARTICLES

Fundis, A.T. (2019, October 20) Why we need far more exploration of the ocean [online article, inverse.com], https://www.inverse.com/science/60276-allison-fundis-protect-our-ocean

Fundis, A. T., M. Cook, S. Wishnak,, K. Moran, T. Burbank, M. Viveiros (2019) A Decade of Engaging Students, Educators, and Global Audiences in Deep-Sea Expeditions. *Oceanography* 32(1), supplement, 150 pp., https://doi.org/10.5670/oceanog.2019.supplement.01.

Fundis, A. T., S. Wishnak, M. Cook, K. Sutton, K. Moran, S. Munro, T. Burbank (2018) Sparking Interest in Ocean Exploration and Providing Experiential STEM Programs for Students and Educators. *Oceanography* 31(1), supplement, 126 pp., https://doi.org/10.5670/oceanog.2018.supplement.01.

Fundis, A. T., M. Cook, S. Garson, K. Sutton, S. Munro, and S. Poulton (2016) A Community Approach to STEM Education, *Oceanography* 29(1): 18-23, https://doi.org/10.5670/oceanog.2016.supplement.01.

Fundis, A. T., S. Garson, S. Munro, S. Poulton, T. Viola, and K.L.C. Bell (2015) Ocean Exploration as a Platform for STEM Education & Outreach, *Oceanography* 28(1):16-24, http://dx.doi.org/10.5670/oceanog.2015.supplement.01.

Fundis, A. T. and K.L.C. Bell, (2014) Inspiring, engaging, and educating the next generation of STEM learners, *Journal of Ocean Technology* 9(3): 73-78.

Fundis, A.T., S. Garson, and K. Cubina, (2014) E/V Nautilus Education Programs. Oceanography 27(1), supplement, 52 pp, http://dx.doi.org/10.5670/oceanog.2014.supplement.01.

Fundis, A. T., K. A. Zarrella, E. Donnelly, R. L. Preston, G. W. Kidder III and C. W. Petersen. (2003). *Fundulus heteroclitus* distribution in Northeast Creek: Sex and size class changes along a salinity gradient. *Bull. Mt. Desert Isl. Biol. Lab.*42:18-20 (MDIBL bulletin page)

FIELD WORK

Led or participated in 50+ international research expeditions since 2006 utilizing deep-sea vehicles including ROVs *Hercules*, *Jason II*, and ROPOS, HOV *Alvin*, AUV *Sentry*, and other technologies. Experienced conducting biological surveys via SCUBA, snorkel, and small boats.

PROFESSIONAL ASSOCIATIONS & CERTIFICATIONS

American Association for the Advancement of Science
American Geophysical Union
Marine Technology Society
The Oceanography Society
PADI SCUBA (advanced open water, wreck, underwater naturalist, marine research, and night diver certifications)
STCW/CPR

GRANT FUNDING

National Marine Science Foundation #19-12-B-243; Advancing ocean exploration education and outreach through public-private collaboration; $348,560 (2020-2021): Fundis

Office of Naval Research # N00014-18-1-2854; Using Ocean Exploration to Support Naval STEM Outreach and Workforce Development; $750,000 (2018-2021); Ballard & Fundis

Office of Naval Research #N00014-15-1-2143; A Community STEM Education Program: Addressing Naval STEM Outreach and Workforce Development; $750,000 (2015-2018); Ballard, Bell, & Fundis