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

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

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: Dr. Nicole Raineault
Affiliation: Ocean Exploration Trust

Permit Category: Research
Proposed Activity Dates: September 10 to October 15 2018
Proposed Method of Entry (Vessel/Plane): Vessel
Proposed Locations: Naifeh seamount and 9 un-named seamounts located within the expansion area north of Gardner Pinnacles and Necker Island.

Estimated number of individuals (including Applicant) to be covered under this permit:
48 total (31 science and operations, 17 ship's crew)

Estimated number of days in the Monument: 18

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

This oceanographic expedition will involve mapping and subsequent remotely operated vehicle (ROV) dives on enigmatic seamounts located in a poorly explored area of the Papahānaumokuākea Marine National Monument (PMNM). The objectives are to determine how and when these seamounts formed and to document the biological communities that presently live on them. Mapping data and rocks collected during the dives will be used to test the hypothesis that these seamounts were formed by the poorly understood process of arch volcanism. This hypothesis was developed as a result of their enigmatic location and lineation which is parallel to the Hawaiian ridge. The seamounts are located between the Musicians seamounts and the Hawaiian ridge and may be important to the connectivity between these two areas. The ROV dives will survey these seamounts for the present of deep high density coral and sponge communities similar to those found in the Musicians and on rift zone ridges on some of the Hawaiian banks. Finally, the transits between PMNM and Honolulu provide the opportunity to explore commercially important fisheries habitats located on Middle Bank and Kaula Rock.

b.) To accomplish this activity we would ….
Use the Exploration Vessel (E/V) *Nautilus* and team of scientists, engineers, and educators to explore these areas. The first step in most cases is to use the ship's EM302 30 kHz multibeam echosounder and 3.5 kHz sub-bottom profiler to map the seamounts and other unmapped areas of seafloor. Next we would use the two 4000 m-rated ROVs to explore the seamounts. The ROVs are equipped with high definition video cameras, lights, a CTD and O2 sensor, and sampling devices. Representative biological and geological samples be taken with the ROV manipulator or suction (slurp) tool. Water samples (niskins) will be used for chemical and eDNA analyses.

In addition, the ROV cruises will likely provide tremendous education and outreach opportunities for PMNM. Due to high-speed ship-to-shore satellite communications, anyone with an internet connection will be able to watch the ROV video, listen to the scientific dialogue, and ask questions that the shipboard team will answer in real time.

c.) This activity would help the Monument by …
This project has a very important primary science objective, which is to determine if these seamounts could have formed from the poorly understood process of arch volcanism. If our hypothesis is correct, these seamounts will be the second known location where this process has occurred. How it took place here will likely be different than that found in the main Hawaiian Islands, where it did not result in the formation of large volcanoes. The Central and Western Pacific have a huge number of seamounts, whose origin and distribution are extremely complex. Furthering the understanding of a poorly known volcanic process will provide a significant contribution toward solving this enormous puzzle since arch volcanism likely occurred elsewhere from the Hawaiian Islands but the sites simply haven't been recognized to date.

This project also has applied science objectives that are consistent with a number of NOAA Mission priorities. NOAA's long-term Healthy Oceans goal requires studies that will improve our understanding of ocean ecosystems in order to develop management measures to ensure sustainability in the face of both human and climate change impacts. The majority of the dives and mapping conducted during this project will take place within the poorly explored expansion area of the Papahānaumokuākea Marine National Monument (PMNM). The findings from the project will have direct and immediate benefit to monument staff in informing their efforts to protect deepwater habitats in the central Pacific. Furthermore, this study expands on the findings of the 3-year NOAA CAPSTONE project of the existence of large-scale high-density coral and sponge communities throughout the Central and Western Pacific. These communities each have a unique composition of species and support a very large number of associated invertebrates. Even though a modest number of these communities were discovered, how and where they form is still poorly understood.

The discovery and characterization of more of these unique communities will address this priority and is also consistent with another of the NOAA Mission Priorities: the improved understanding of ecosystems to inform resource management decisions. What is known is about these communities is that many are located in the Prime Crust Zone (PCZ) and on Mn-crusted substrate at depths that will be targeted by the deep-sea mining industry in the near future. It is imperative to gain a much better understanding of these communities prior to the onset of

commercial mining activities in order to ensure well informed management decisions can be made. The discovery of more of these communities within PMNM provides valuable information on the resources the monument is protecting, and furthermore provide proxy data on unprotected and vulnerable Mn crust communities throughout the Pacific.

Other information or background:
Ocean Exploration Trust, a non-profit organization, owns and operates the E/V *Nautilus*. We have been conducting scientific exploration of the world's oceans since 2009, while also focusing on using the latest technologies to enhance our exploration and communication efficiencies. A third part of our mission is to conduct extensive outreach and educational opportunities on each cruise through our *Nautilus*Live.org website and student interns who sail as part of the team. This cruise is funded by the NOAA Office of Ocean Exploration and Research.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Raineault, Nicole A.

Title: Vice President, Exploration & Science Operations

1a. Intended field Principal Investigator (See instructions for more information):
Dr. Christopher Kelley

2. Mailing address (street/P.O. box, city, state, country, zip):
Hawaii Undersea Research Laboratory, [redacted]

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

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):

1. Nicole Raineault, Mapping Coordinator, Ocean Exploration Trust, [redacted]
2. Allison Fundis, Expedition Leader, Ocean Exploration Trust, [redacted]
3. Tom Hourigan, biologist, NOAA, [redacted]
4. Dorsey Wanless, geologist, Boise State University, [redacted]
5. TBD, Papahānaumokuākea Representative
6. Leigh Marsh, biologist, University of South Hampton, [redacted]
7. Rebecca Wipfler, biologist, University of [redacted]
8. Lila Ardor Bellucci, biologist (intern), [redacted]

9. Aaron Parness, engineer, [redacted]
10. Spencer Backus, engineer, [redacted]
11. Allan Adams, engineer, MIT, [redacted]
12. TBD, geologist
13. Ben Grassian, navigator and mapper, University of Rhode Island, [redacted]
14. Kris Krasnosky, navigator and mapper, University of Rhode Island, [redacted]
15. Renato Kane, navigator and mapper, Ocean Exploration Trust, [redacted]
16. Ed McNichol, video engineer, Ocean Exploration Trust, [redacted]
17. Erin Ranney, video engineer, Ocean Exploration Trust, [redacted]
18. Sara Matasick, video intern, University of Wisconsin, [redacted]
19. Robert Waters, ROV engineer, Ocean Exploration Trust, [redacted]
20. Trevor Shepherd, ROV engineer, Ocean Dynamics Inc, [redacted]
21. Gregg Diffendale, ROV engineer, Ocean Exploration Trust, [redacted]
22. William Glatt, ROV engineer, Ocean Exploration Trust, [redacted]
23. Michael Marin, ROV engineer, Ocean Exploration Trust, [redacted]
24. TBD, ROV engineer
25. Mark Deroche, deck chief, Ocean Exploration Trust, [redacted]
26. Justin Lowe, data engineer, Ocean Exploration Trust, [redacted]
27. Samantha Wishnak, communications, [redacted]
28. Megan Cook, Science Communications Lead, [redacted]
29. Nevada Winrow, Science Communication Fellow, Black Girls Dive, [redacted]
30. Alix Leszczynski, Science Communication Fellow, The Franklin Institute, [redacted]

Section B: Project Information

5a. Project location(s):

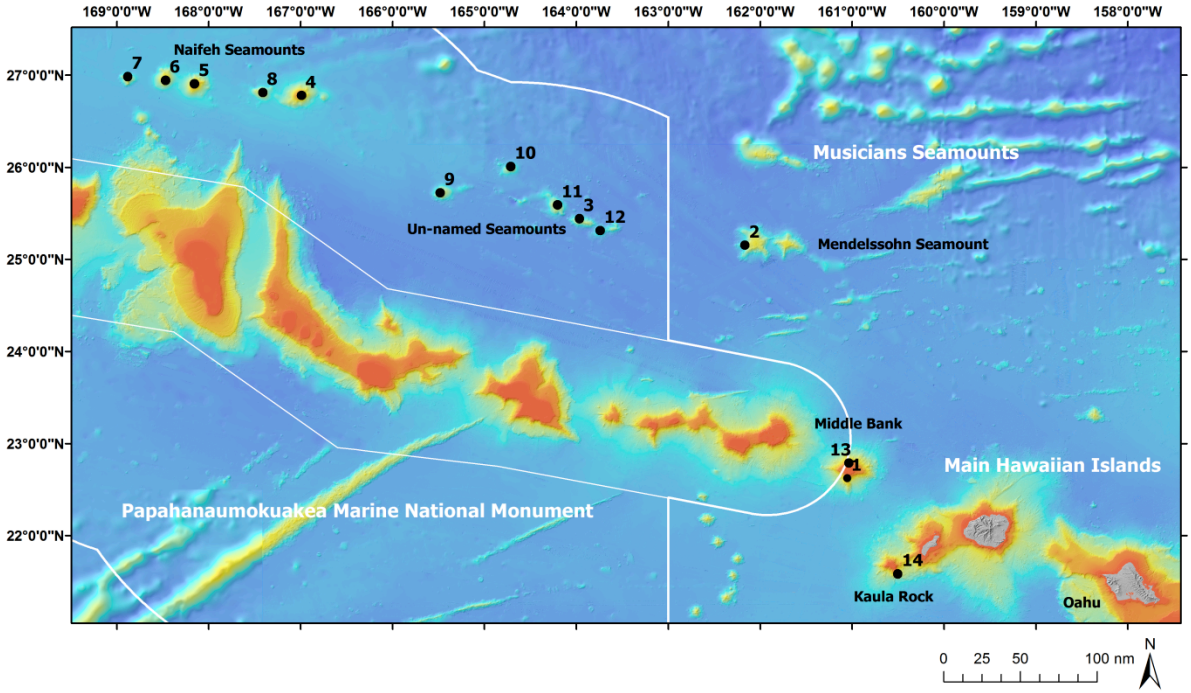
		Ocean Based	
☐ Nihoa Island	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Necker Island (Mokumanamana)	☐ Land-based	☐ Shallow water	☐ Deep water
☐ French Frigate Shoals	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Gardner Pinnacles	☐ Land-based	☐ Shallow water	☐ Deep water
☐ Maro Reef			
☐ Laysan Island	☐ Land-based	☐ Shallow water	☐ 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
☒ 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 plan to map and conduct ROV dives on the Naifeh Seamounts and several un-named seamounts within the northern side of the expansion area between the US EEZ and the old 50 nm monument boundary. We will also conduct 1-2 ROV dives at Middle Bank just outside of the monument boundary. Please see the map below for more information on the numbered mapping and diving locations. Most dives will be transects from deep to shallow up the sides of the seamounts from ~2000-250 meters depth.



Map showing the potential dive sites numbered in order. Mapping will be conducted on and around all sites except for 1, 13, 14, which already have complete coverage.

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

☐ Anchoring a vessel

☐ Deserting a vessel aground, at anchor, or adrift

☒ 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

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

This cruise would first map, then conduct the first biological and geological ROV surveys of enigmatic seamounts in the poorly explored expansion area of the Papahānaumokuākea Marine National Monument. The acquisition of high-resolution seafloor mapping data is an essential precursor to making significant biological, geological, archaeological and oceanographic discoveries in the monument. *Nautilus* cruises will collect seafloor mapping data to supplement previous work. These maps form the basis for selecting ROV dive targets. ROV cruises would take the next major step in baseline habitat characterization by using the ROV system to visually investigate unkown and little known deep water habitats within the monument identified as priority by scientists and managers. Underway CTD casts may be conducted to collect additional information about the physical and chemical properties of the water column, including at sites of interest identified from mapping and ROV investigation.

The information and data generated by this project will directly contribute to a better understanding of the deep water habitats, ecosystems and geologic history of the NWHI by providing PMNM basic information about the about the rich and unique biological resources and habitats of this region. It is this understanding that provides continuous support for the monument and its protection of these resources.

MAPPING
Nautilus has two scientific sonars that are configured to operate simultaneously without interference: a 30 kHz multibeam system and 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 sub-seafloor geology. Both of these systems are routinely used by this exploration vessel and have provided invaluable scientific data for marine researchers and managers, including numerous National Marine Sanctuaries.

<u>Multibeam:</u>
Multibeam echosounder mapping will be conducted in the expansion area of PMNM (i.e., 50-200 nm from emergent land) where gaps are present in the existing coverage, or the existing data is poor quality. Multibeam mapping will also take place during the transits to and from sites where other operations will be conducted, and planned to continue to build upon previous mapping surveys as much as feasible. Multibeam echosounder data will produce high-resolution bathymetry and acoustic backscatter maps. These maps will provide critical baseline information to scientists and resource managers interested in identifying and expanding our understanding of the important biological habitats and ecological connections in the Monument, and the geology of the NWHI. Additionally, the data collected will help scientists better understand the size and character of seafloor habitats in the area, allowing for improved targeting of future exploration and research, including the selection of sites for further investigation with a ROV.

Expendable bathythermographs (XBT):
During multibeam operations, 1-2 XBTs are deployed per day or as needed to obtain accurate sound velocity profiles. The profiles are used to regularly re-calibrate the multibeam systems necessitated by constantly changing water column conditions. Routine re-calibration ensures accurate bathymetric data at every mapping site. Whenever possible, the *Nautilus* uses an Underway CTD to reduce the number of XBTs used. In good weather conditions, this normally results in 1 XBT used per day.

Sub-Bottom Profiler:
The primary purpose of this sonar is to provide echogram images of near-surface geological sediment layers underneath the seafloor to a maximum depth of about 80 meters below the surface. The sub-bottom profiler is normally operated to provide information about the sedimentary features and the bottom topography that is simultaneously being mapped by the multibeam sonar. The data generated by this sonar is fundamental in helping geologists interpret the shallow geology of the seafloor. Collecting this data within the Monument will provide greatly improved insights into the geology of the region, and supplement existing magnetometer and gravity measurements obtained by other vessels.

ROV OPERATIONS:
The purpose of conducting ROV operations is to conduct geological and biological site characterization of enigmatic seamounts in the Monument. High definition video surveying will be augmented by the simultaneous acquisition of environmental data using *in situ* sensors mounted on the ROVs (CTD and DO). ROV dive sites may include seamount and guyot summits and flanks, rift zone ridges, drowned reef terraces, guyots (i.e., flat topped tablemounts), and other types of topography where high quality geologic samples can be collected and where high density deep water coral and sponge communities are likely to be found. The combined dives will enable scientists and managers to have a better understanding of the origins of PMNM's seamounts as well as the diversity and distribution of deep-water communities found on these features, and should contribute to enhanced protection of these resources.

ROV Sampling:
We plan to collect representative rock, short core, and biological specimens via ROV. Only very selective specimen collections with the ROV that have the potential to contribute significant scientific discoveries are requested under this permit. These would be limited to ten rock samples per dive, each of which will have either no or a minimal amount of attached organisms, and no more than ten biological specimens per dive, suspected of being new species or new records for Hawaiian waters.

Ultra-Short Base Line Acoustic Navigation (USBL):
The Tracklink ultra-short base line navigation system is used to track and record the position of the ROVs during the course of a dive. Integration of this relative position information with the surface ship position as determined by GPS allows the calculation of the position of the ROV on the seafloor. In this way, observations made by the ROV can be geo-referenced to standard lattitude, longitude and depth.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species? Yes ☐ No ☒

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?

All of the dive sites are located on deep seamounts in the expansion area of the monument, well away from the core emergent and shallow water features. Only one of the seamounts has been named and only one has a single swath of multibeam coverage. These seamounts have never been dredged, never been mapped, and never been visited and therefore are completely unexplored. Our mission is to discover how they formed and what type of biological communities they suppport. This is a very low impact project that only involves collecting mapping, video, sensor data, and targeted rock or biological specimens via ROV. When specimen collecting is carried out, the ROV manipulator or suction sampler will be used for very selective sampling that minimally effects the the nearby seafloor and fauna. We request permission to collect a maximum of ten rock samples per dive, which will have either no or a minimal amount of attached organisms. We request a maximum of ten voucher biological specimens per dive. Biological specimens suspected of being new species or new records for Hawaiian waters will be the main targets. In some cases we will need to discard steel ballast plates from the ROV to maintain proper buoyancy. The plates are Alvin steel ballast plates that weigh 20lbs in air, 16 lbs in water and have dimensions of 12x9x0.5 inches. We will minimize impacts by only discarding plates in areas where there is no visible macrofauna. On board the vessel, the biological samples will be preserved in ethanol, although bleach and formalin may be used for certain organisms for the best possible preservation. Nautilus has a wet lab with fume hood and established protocols to ensure samples are properly preserved and avoid any impact to the environment.
Mapping information will be collected with a sub-bottom profiler and EM 302 multibeam echosounder (the same system as on R/V *Falkor* and NOAA's ship *Okeanos Explorer*).

Nautilus/Ocean Exploration Trust has a long history of scientific exploration that is sensitive to cultural or historic resources. We do not touch or disturb any historic sites without proper permission and permitting. We will not disturb any historic sites that may be encountered on this cruise. Given the short-term durations of potential impact during ROV dives, we expect ROV operations will have no significant effect on the cultural, natural, and historic resources and ecological integrity of the monument.

XBTs are deployed to obtain sound velocity profiles. The profiles are required to calibrate the multibeam system and ensure accurate bathymetric mapping. 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 *Falkor* 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 maxiumum of 21 XBTs during this cruise. This number will likely be greatly reduced by using Underway CTD casts instead. The Underway CTD is a self-contained, self-logging conductivity, temperature, and depth probe that is retreiveable. It will be used whenever possible to reduce the use of XBTs.

Mapping - We expect that mapping operations will have no effect on the cultural, natural, and historic resources and ecological integrity of the monument. Multibeam mapping has already taken place in the Monument with no detected effects on the Monument resources. We expect all mapping will take place in deep water and at considerable distance from emergent land. *Nautilus* has two scientific sonars that are configured to operate simultaneously without interference: a 30 kHz multibeam system, and 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 sub-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.

Kongsberg EM302 Multibeam Sonar:
The following are specifications for the multibeam system that will be used during this project:

The specifications of the Kongsberg EM302 system are:
Operating frequency .....30 kHz
Depth range ..... 10-7000 m
Swath width .....5.5xDepth, to approx 8 km
Pulse forms.....CW and FM chirp
Swath profiles per ping .....1 or 2
Maximum Source Level (Deep CW Mode)……....……243 dB re 1 µPa @1m (RMS)
Pulse Duration (Deep CW Mode).....5 ms
Pulse Duration (Extra Deep 1, FM Mode).....100 ms
Motion compensation:
- Yaw ..... ± 10 degrees
- Pitch ..... ± 10 degrees
- Roll ..... ± 15 degrees
Sounding pattern .....Equi-distant /equiangular
High resolution mode .....High Density processing
Sidelobe suppression .....> 25 dB
Suppression of sounding artefacts.....8 frequency coded transmit sectors
Beam focusing ..... On transmit (per sector) and on reception (dynamic)
Beamforming method .....Time delay
Gain control .....Automatic
Swath width control ....Manual or automatic, soundings intact when reduced swath width
Seabed imagery/sidescan sonar image .....Standard
Water column display.....Standard
Mammal protection .....Standard
Transmit array (deg)……..150 (across track) x 0.5 (along track)
Receive array (deg)……1 (across track) x 30 (along track)
Number of beams per swath……..……288
Maximum number of sounding per swath……..…….432
Maximum number of swaths per ping……..2
Maximum number of soundings per ping……..……864

Knudsen Chirp 3260 Sub-bottom Profiler (SBP):
The primary purpose of this echosounder is to provide echogram images of shallow sub-surface geological sediment layers underneath the seafloor to a maximum depth of about 80 meters below the surface. The SBP is normally operated to provide information about the sedimentary features and the bottom topography that is simultaneously being mapped by the multibeam echosounder. The data generated by this sonar is fundamental in helping geologists interpret the shallow geology of the seafloor. Collecting this data within the Monument will provide greatly improved insights into the geology of the region, and supplement existing magnetometer and gravity measurements obtained by other vessels. The SBP on the *Nautilus* is a 3.5 kHz 10kW installation. The pings from the SBP are directed downward by a transducer mounted in the hull of the ship, forming a 27º cone. The source power output varies with water depth from 50 watts in shallow water to 800 watts in deep water, with power settings carefully monitored and adjusted appropriately during operations. The nominal power output is 10 kilowatts (kW), but the actual maximum radiated power is 3 kW or 222 dB re1 µPa • m. Note this maximum source

power is less than that of the EM302 multibeam (243 dB re1 μPa • m). The maximum ping duration is up to 64 ms. The SBP is capable of reaching depths of 10,000 m at its highest power and longest pulse length settings.

Mapping
We believe that *Nautilus* multibeam system poses minimal risk to cetaceans in the monument. Given that *Nautilus* uses the same system as the *Okeanos Explorer* and R/V *Falkor*, we have excerpted much of the information from the Monument's ESA section 7 Initial letter to NMFS for the *Falkor* work. There were no reports of impact to marine mammals during the *Falkor* cruises. Please note that *Nautilus* only has an EM302 while *Falkor* has both an EM 302 and an EM 710. The EM302 on *Nautilus* has a 1° transmit array along-ship (the same as on the *Falkor*). 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 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 and will only be turned off during ROV dives. 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.

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 are aware of the significance and cultural importance of the NWHI to Native Hawaiians. As a sacred place, and especially in the realm of Po (beyond Mokumanamana), our plan is to tread lightly and leave no footprint from our activities. Recognizing that natural resources are, in fact, cultural resources for Native Hawaiians, the information and data generated by this project will assist PMNM by providing basic information about the 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. Only selective specimen collections with the ROV that have the potential to contribute significant scientific discoveries (detailed in section 7a) are requested under this permit, and would be collected in a way that minimally effects the nearby seafloor and fauna. Given the minor and short-term durations of potential impact, we expect ROV 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 will 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 will share PMNM resources with a broad audience online in real-time.

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 will help scientists, managers, and others better understand the formation and ecology of seamounts in the NWHI. Direct mapping and ROV dives are the only ways acquire high resolution bathymetry data and obtain close up video data. A major objective of the project is to benefit the management of the monument by revealing the nature of the seafloor and associated habitats within its boundaries. The vast majority of existing high resolution video information is from depths shallower than 2000m. At present there are no other submersibles in the Hawaii region that can operate deeper than 2000m.

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 these seamounts, locations and types of deep water habitats and ecosystems in the NWHI. High resolution maps 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 and if project gear touches or rests on the seafloor, it will

be minimal and for short duration. 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.

We have asked for a cruise of 20 days (which includes transiting from and back to Honolulu, HI). This allows us to conduct ROV dives on up to 16 locations for about 8-10 hours per dive. The remaining time will be used to transit between sites and map currently unmapped seamounts. This is an optimistic schedule and it is possible we will conduct fewer, longer dives on selected seamounts.

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

I have helped to plan and execute numerous deep sea mapping and ROV cruises during my seven years with the Ocean Exploration Trust. We work with an incredibly competent science and operations team for all expeditions. Among those involved in the Monument work is Dr. Christopher Kelley, a researcher from the University of Hawaii, who has been working in the Hawaiian Archipelago for decades and was Chief Scientist on recent *Falkor* mapping expeditions and *Okeanos Explorer* ROV cruises in the Monument. Robert Waters, our ROV Team Lead, has decades of experience safely maintaining and operating both manned and unmanned submersibles around the globe, many of which have been in areas of particular cultural and natural significance.

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.

We are funded by NOAA's Office of Exploration and Research for this cruise. We also receive funding from the National Marine Sanctuary for select cruises. 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 deeper than 50m. The *Nautilus* multibeam system is the most up to date system being produced and sold by Kongsberg. The sub-bottom profiler is simultaneously gathering data to help geologists interpret the shallow geology of the seafloor. ROVs are the state of the best method to collect high resolution video information and targeted samples.

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

No(?) We have a trackable AIS:
https://www.marinetraffic.com/en/ais/details/ships/shipid:467893/mmsi:376404000/imo:6711883/vessel:NAUTILUS

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

There are no other factors that would make the issuance of the permit for the activity inappropriate.

8. Procedures/Methods:

The general plan is to map and then conduct ROV dives. We work 24 hours per day at sea and do not have set ROV or mapping hours. In general we will try to conduct 10-12 hour dives and then about 12 hours of mapping. The sites of interest by dive are:

- Dive 1: Middle Bank- critical for connectivity between the MNM and the main Hawaiian Islands. Important location to study fish habitat. 600m contour and shallower important for bottom fishery management and precious coral management. We will also target the volcanic cones on Middle Bank. This is follow-up in different areas than Okeanos, which found precious coral communities and black coral.
- Dive 2: Mendelssohn Seamount- Two separate seamounts, but considered/named one. We need to map it prior to an ROV dive. Okeanos dove on eastern summit and found large fan coral.
- Dives 3: Un-named cluster of seamounts within PMNM 1- Must be mapped first. Then ROV dives at depths starting around 2000m, which is considered ideal for sponges and corals.
- Dives 4-8: Seamount cluster 2- Map first, then ROV dives on select seamounts.
- Dives 9-12: Return to the southeast, at un-named seamounts
- Dive 13: ROV dive on Middle Bank, at the 2nd volcanic cone
- Dive 14: Kaula Rock- investigate the slope failure around seamount and the emergent cone, which younger than surrounding islands and offset from them. There have been a couple of shallow submersible dives on the top, but nothing deeper.

All samples would be targeted, representative samples taken using the ROV. Short cores are 2.5” inner diameter tubes cut to ~12” lengths and taken with the manipulator arm of the ROV. This typically recovers 8-10” of sediment. Biological samples can be procured using one of several tools on the ROV: 1. Manipulator arm “grab sample”, 2. Manipulator arm with coral cutter attachment for sampling pieces of a cold-water coral, 3. Suction sample, which allows small or fragile organisms or environmental samples to be vacuumed into one of 7 chambers on the ROV, or occasionally 4. a scoop-like tool to retrieve things like shellfish.

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:

Rock, sediment, coral, sponge, worm, crustacean, shrimp, bivalve

Scientific name:

N/A

& size of specimens:

Up to 10 rocks, 5 push cores, and 10 biological samples per site. When possible, only small pieces of coral colonies will be taken.

Collection location:

☒ Whole Organism ☒ Partial Organism

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

We have partnered with scientists who will analyze many samples post-cruise. The basalt rock samples will be sent for Argon-Argon dating to prove age and connection to hot-spot generated seamounts. Select coral samples will be provided to eDNA experts for analysis along side water samples. This allows the researchers to directly compare the DNA in water samples to what is seen and sampled in the environment. Specimens will be stored in public repositories for request. Biological samples are stored in ethanol and sub-sampled for DNA (also stored in ethanol) aboard the *Nautilus*. The biological samples are stored at the Museum of Comparative Zoology at Harvard University. Rock samples are split and air-dried. The sediment cores are stored in a refrigerator and used for shallow (<10 inches) stratigraphic analysis. The geological samples are stored at the Marine Geological Samples Lab at the University of Rhode Island's Graduate School of Oceanography.

9c. Will the organisms be kept alive after collection? ☐ **Yes** ☒ **No**

• General site/location for collections:

Naifeh Seamount and 9 other un-named seamounts in the monument expansion area well north of Gardner Pinnacles and Necker Island

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

• Is there an outfall? ☐ Yes ☐ No

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

• Will organisms be released?

No collected specimen will be released anywhere in the monument or MHI.

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

Specimens will be transported aboard the *Nautilus* to Honolulu where lead scientist, Dr. Kelley will take sub-samples for local researchers back to the lab. Most will be shipped to the repositories once the vessel reaches San Francisco, CA.

The biological samples are archived at Harvard University's Museum of Comparative Zoology, which houses all biological samples from *Nautilus* back to 2013. The curator in charge of the samples is Adam J. Baldinger (abaldinger@oeb.harvard.edu). The address is:
Department of Invertebrate Zoology
Museum of Comparative Zoology
[redacted]
This repository can be publically searched via:
https://mczbase.mcz.harvard.edu/SpecimenSearch.cfm and samples are available to researchers by request.

Environmental DNA (eDNA) samples are sent to the Northwest Fisheries Science Center for analysis by Dr. Meredith Everett ([redacted]). These are filtrates of water samples take via niskin bottles on the ROV to detect coral and fish species. The results are publically available. The address is:
Northwest Fisheries Science Center
[redacted]

Geological samples are sent to the University of Rhode Island Graduate School of Oceanography's Marine Geological Samples lab, which houses all geological samples from *Nautilus* back to 2010. The curator in charge of the samples is Dr. Katherine Kelley [redacted]. The address is:
Graduate School of Oceanography, URI
[redacted]

This repository can be publically searched via:
https://www.ngdc.noaa.gov/mgg/curator/curator.html

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

Nautilus will map areas complementary to mapping accomplished during previous expeditions by *Okeanos Explorer*, *Falkor* or others. We always consult national databases prior to mapping an area to ensure we are not duplicating efforts. *Nautilus* has an open data policy so all data collected during the cruise will be freely available after the cruise. In addition, the planning for this cruise was done through an open planning process. We have over 80 scientists signed up via our "scientists ashore" program. This allows researchers to watch and participate in our cruise from shore. Many participated in a science call to discuss the initial cruise plan and provide input. This allows researchers to become involved in the cruise as well, via a chat service with watchstanders on the vessel. The meeting arranged awareness of the plans, so researchers are also able to collaborate on post-cruise analysis.

12a. List all specialized gear and materials to be used in this activity:
Kongsberg EM302 Multibeam sonar system and sound velocity profiler

Underway CTD

Knudsen Chirp 3260 Sub-bottom profiler.

Hercules and Argus remotely operated vehicles (ROVs), and Tracklink Ultra Short Baseline system for tracking the location of the ROVs underwater

Expendable bathythermographs (XBTs): up to 35 total will be discharged within the Marine Monument. We anticipate fewer will be used, as the Underway CTD will be used instead, weather permitting.

12b. List all Hazardous Materials you propose to take to and use within the Monument:
Most of the biological samples will be stored in EtOH (ethanol) on board the vessel in the ship's wet lab. A few will be preserved in 10% formalin for histological analysis. Small pieces of corals and sponges may also be placed in bleach for onboard microscopic examination of sclerites and spicules.

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:
None

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:
We will finalize multibeam mapping data products by the end of the cruise. All data and samples are available within a month of the cruise by request. All data will be part of a public archive

following the cruise. Video is also available post-cruise by request through the Inner Space Center at the University of Rhode Island. A cruise summary that highlights all results will be published in an annual supplement to the Oceanography Society magazine by March 2019.

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

Brooke, S., C. Kelley, R. Kosaki, M. Parke, F. Parrish, A. Bowman, and J. Potter. 2017. CAPSTONE, Exploring the US Marine Protected Areas in the Central and Western Pacific. *Journal of Oceanography*. 30:1, p. 53-55.

Dohrmann, M., C. Kelley, M. Kelly, A. Pisera, J. Hooper, H. Reiswig. 2017. An integrative systematic framework helps to reconstruct skeletal evolution of glass sponges (Porifera, Hexactinellida). *Frontiers in Zoology*. 14:18. 31p.

Wagner, D. & C. Kelley. 2016. The largest sponge in the world? *Marine Biodiversity*. DOI 10.1007/s12526-016-0508-z.

Kelley, C., S. France, F. Parrish, D. Wagner, M. Gerringer, and M. Garcia. 2016. CAPSTONE's First Year: 2015 Hohonu Moana: Exploring Deep Waters off Hawai'i Expedition. *Oceanography*. vol. 29:1. Supplement. p. 68-73.

Kelley, C.D. T. Kerby, PM Sarradin, J. Sarazin, D. Lindsay. 2016. Chapter 13: Submersibles and ROVs. In: *Biological Sampling in the Deep Sea*. John Wiley & Sons, Ltd. 451 p.

Kelley, C., J. Smith, J. Tree, J. Miller, B. Boston, M. Garcia, G. Ito, J. Taylor, F. Lichowski, D. Wagner, J. Leonard, B. Dechnik, D. Luers. 2015. New Seafloor Mapping Surveys Are Rewriting the Geologic History of the Hawaiian Archipelago. *EOS* 96(11): 17-19.

Parrish, F. A. Baco, C. Kelley, & H. Reiswig. 2015. Pacific Islands region deep sea coral and sponge report. In: *The state of deep coral ecosystems of the United States: 2015.*

Schlacher, T, A. Baco-Taylor, A. Rowden, T. O'Hara, M. Clark, C. Kelley, J. Dower. 2013. Seamount benthos in a Cobalt-rich crust region of the Central Pacific: implications for conservation challenges posed by future seabed mining. *Diversity and Distributions.* 1-12.

Kelley, C.; R. Moffitt; & J.R. Smith. 2006. Description of bottomfish essential fish habitat on four banks in the Northwestern Hawaiian Islands. *Atoll Research Bulletin*. No. 543, 319-332.

Kelley, C. & W. Ikehara. 2006. The impacts of bottomfishing on Raita and West St. Rogatien Banks in the Northwestern Hawaiian Islands. *Atoll Research Bulletin*. No. 543, 305-318.

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.

_____ Nicole A Raimondi _____May 25, 2018_____
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