State of Hawai'i
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawai'i 96813

May 24, 2019

Board of Land and Natural Resources
Honolulu, Hawai'i

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National Monument Research Permit to William Middleton, Liquid Robotics, Inc. for Access to State Waters to Deploy an Unmanned Autonomous Wave Glider for Oceanographic Research

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to William Middleton, Liquid Robotics, Inc., pursuant to § 187A-6, Hawai'i Revised Statutes (HRS), Chapter 13-60.5, Hawai'i Administrative Rules (HAR), and all other applicable laws and regulations.

The research permit, 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
- Necker (Mokumamanamana)

The activities covered under this permit would occur between June 1, 2019 and May 31, 2020.

The Applicant and the proposed reef assessment and monitoring activities are largely a renewal of work previously permitted and conducted in the Monument.

INTENDED ACTIVITIES

The primary purpose of the project is to deploy a wave-powered autonomous marine robot (Wave Glider) to collect weather and ocean current data in support of the organization, the proposed apprentice non-instrumented navigator training sail to the Monument aboard the traditional Native Hawaiian double-hull voyaging canoe Makali'i by Nā Kālai Wa'a (separate permit application PMNM-2019-009). The training sail is tentatively scheduled for June 2019 and the applicant proposes to have the Wave Glider enter the Monument as the Makali'i is in transit toward the Monument and provide weather and wave data from up ahead of the canoe's course, and arrive near Mokumanamana at roughly the same time.

In addition to supporting the training sail with oceanographic and weather observations, the applicant has proposed to deploy the Wave Glider to support other projects as needed in the collection of oceanographic data (i.e., wave height; direction; period and spectrum; water temperature; current depth and vector; dissolved oxygen; salinity, etc.).

The Wave Glider is a robust platform that can remain at sea for up to 12 months monitoring meteorology and ocean current data in a similar fashion to a fixed/moored buoy while also acting as a VEMCO tracker and receiver (acoustic telemetry technology). The Wave Glider consists of a 210 centimeters by 60 centimeters float and a 40 centimeters by 191 centimeters sub (with 107 centimeters wide wings) connected by a two (2) meter umbilical. It weighs 150 kg (330 lbs) and is powered by wave action and solar-charged lithium batteries. No measurable impacts to Monument resources are anticipated, as there would be no human presence in the Monument or collecting or removing Monument resources.

This project would benefit the Monument by providing real time meteorological and oceanographic data for the apprentice training sail to PMNM proposed by Nā Kālai Waʻa as well as other projects as needed. The activity would directly support the Monument Management Plan (MMP) Marine Conservation Science (MCS) Action Plan Strategy MCS-1: Continue and enhance research, characterization and monitoring of marine ecosystems (PMNM MMP Vol. 1, p. 122, 2008).

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

☒ Discharging or depositing any material or matter into the Monument

REVIEW PROCESS

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i 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, the Office of Hawaiian Affairs (OHA), and the PMNM Native Hawaiian Cultural Working Group. In addition, the permit application has been posted on the Monument Web site since April 18, 2019 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.

Comments received from the scientific community are summarized as follows:

QUESTIONS:

1. Is the applicant proposing to deploy only a single wave glider at a time to PMNM?

Yes.

2. What protocols/safeguards are in place to make sure the wave glider does not run aground, washes ashore, and/or collides with a vessel?

Wave Glider is monitored by our 24/7 operations center and operational polygons to alarm for course deviation will be constructed along the entire course. Vessels transmitting AIS will be

autonomously avoided by the Wave Glider, and are viewable in our piloting software. Additionally, our mast is equipped with a high visibility flag and 360 degree white light.

3. How far in advance would the wave glider need to be deployed before Makalii sets sail?

We plan to deploy at Kawaihae and begin transit to the Monument approximately 2 weeks prior to entering the Monument to allow a buffer for strong currents etc.

4. Would the waveglider "wait" near PMNM in order to enter the Monument with Makalii and accompany the canoe as long as possible?

The Wave Glider would preferably enter the Monument as the Makali'i is in transit toward the Monument. We'd like to be able to provide weather and waves data from up ahead on their course, to arrive near the island destinations at roughly the same time. If they spend any amount of time at one location, we would like to proceed forward on the course again due to our slow speeds (~2 knots), as a sort of "leap frog" pattern.

5. What would the waveglider's purpose be once Makalii has sailed on and is no longer sailing side by side with the waveglider?

Depending on the progress of the Makali'i (weather, loiter times) we will hopefully be able to move ahead or catch up on their course at times. Regardless of proximity to the Makali'i, we feel that ocean data collected along the voyage is potentially valuable to many of the Monument's collaborators, and we will make the data available as stated in the permit application to research and STEAM entities. Additionally, weather and ocean current data can be useful to Makali'i even if not in the immediate proximity. If/when the Makali'i has far overtaken the Wave Glider on its course, the Wave Glider can make an early exit of the Monument to observe conditions ahead of Makali'i on her return path.

6. Is the applicant proposing to deploy only a single wave glider at a time to PMNM?
Yes.

7. What protocols/safeguards are in place to make sure the wave glider does not run aground, washes ashore, and/or collides with a vessel?

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The Wave Glider would preferably enter the Monument as the Makali'i is in transit toward the Monument. We'd like to be able to provide weather and waves data from up ahead on their course, to arrive near the island destinations at roughly the same time. If they spend any amount of time at one location, we would like to proceed forward on the course again due to our slow speeds (~2 knots), as a sort of "leap frog" pattern.

10. What would the waveglider's purpose be once Makalii has sailed on and is no longer sailing side by side with the waveglider?

Depending on the progress of the Makali'i (weather, loiter times) we will hopefully be able to move ahead or catch up on their course at times. Regardless of proximity to the Makali'i, we feel that ocean data collected along the voyage is potentially valuable to many of the Monument's collaborators, and we will make the data available as stated in the permit application to research and STEAM entities. Additionally, weather and ocean current data can be useful to Makali'i even if not in the immediate proximity. If/when the Makali'i has far overtaken the Wave Glider on its course, the Wave Glider can make an early exit of the Monument to observe conditions ahead of Makali'i on her return path.

11. How would the Wave Glider's data be shared with personnel on Makalii to help support the crew's observations during their trip in the Monument?

Makalii leadership folks (Chad, Pomai, and one or two others have guest and data access to WGMS, our user interface. In the past, they have been able to communicate from home base to the vessel via cell and sat comms.

COMMENTS / RECOMMENDATIONS:

1. Please provide more details on the purpose of your proposed activity. Specifically, why does the wave glider need to accompany the sailing canoe Makalii?

Liquid Robotics is honored to serve as a community partner with Makali'i. During the Mālama Honua Homecoming journey, the Makali'i was equipped with Wave Glider solar panels which allowed for her crew to integrate traditional ecological knowledge (TEK) as Polynesian navigators with the modern technology of the Wave Glider during their sail to Honolulu. According to Chadd Paishon and Pomai Bertelmann, this created an enhanced STEM learning environment for the crew and haumana. STEM programs "married to the cultural aspects of voyaging" is integral to Makali'i's mission. In this vein, a Wave Glider accompanying Makali'i to Papāhanaumokuākea also has the great potential to create an enhanced STEM learning environment unique to the Monument. In addition, the Wave Glider data collected in the Monument may be used towards creating STEM curriculum unique to the Monument. In discussions with Chadd, he expressed that the Wave Glider's ability to provide 24/7 data e.g. water quality, waves, and weather measurements would also

be useful for navigational purposes and to support the crew's observations of ocean conditions and marine life towards their mission to mālama 'āina.

2. The waveglider should be cleaned and free of all organic films or fouling prior to entering PMNM

The Wave Glider will be cleaned of all organic material prior to launch, and painted with anti biofoul paint per our standard for long term ocean deployments (similar to boat hulls and research buoys). We typically don't see any level of fouling growth until months after launch, we intend to beat the Monument within 2 weeks of launch.

Comments received from the Native Hawaiian community are summarized as follows:

Cultural reviews support the acceptance of this application. No concerns were raised.

Comments received from the public are summarized as follows:

No comments were received from the public on this application.

Additional reviews and permit history:

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g. MMPA, ESA, EA) Yes ☒ No ☐
If so, please list or explain:

- An informal consultation pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq.*) is underway to analyze the effects of proposed activities within the Monument on listed species and designated critical habitat. 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.
- An informal consultation 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 underway to analyze the effects of proposed activities within the Monument on essential fish habitat. 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.
- The Department has made an exemption determination for this permit in accordance with chapter 343 HRS, and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO WILLIAM MIDDLETON , LIQUID ROBOTICS, INC.FOR ACCESS TO STATE WATERS TO DEPLOY AN UNMANNED AUTONOMOUS WAVE GLIDER FOR OCEANOGRAPHIC RESEARCH UNDER PERMIT PMNM-2019-015").

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

PMNM staff is of the opinion that Applicant has properly demonstrated valid justifications for his application and should be allowed to enter the NWHI State waters and to conduct the activities therein as specified in the application with the following special instructions and conditions, which are in addition to the Papahānaumokuākea 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 PMNM staff.

RECOMMENDATION:

That the Board authorize and approve a Research Permit to William Middleton, Liquid Robotics, Inc., with the following special conditions:

a. Upon the finding and adoption of the department's analysis by the Board, that the Board delegate and authorize the Chairperson to sign the declaration of exemption for purposes of recordkeeping requirements of chapter 343, HRS, and chapter 11-200, HAR.

b. That the permittee provide, to the best extant possible, a summary of their Monument access, including but not limited to, any initial findings to the DLNR for use at educational institutions and outreach events.

c. 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.

d. 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.

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

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

g. 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.

h. 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.

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

Respectfully submitted,

MARIA CARNEVALE
Papahānaumokuākea Marine National Monument

APPROVED FOR SUBMITTAL

SUZANNE CASE
Chairperson

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: William Middleton
Affiliation: Liquid Robotics, a Boeing Company, www.liquid-robotics.com

Permit Category: Research
Proposed Activity Dates: 6/1/2019 – 6/1/2024 (1 year)
Proposed Method of Entry (Vessel/Plane):
Wave Glider (surface vehicle, wave propelled and solar powered unmanned autonomous marine robot); Unclassified per United States Coast Guard.
Proposed Locations:
We intend to mimic the Makali'i's course for their planned Summer Solstice voyage in June 2019, as is reasonable, with adjustments for cultural protocol, standoff distance, and timing due to our slower transit speed. Our understanding is currently that this would include Nihoa and Mokumanamana shallow and deep waters, as well as transiting areas of PMNM to access marine areas at these two islands. We intend to enter the Monument around 2 weeks prior to Makali'i's planned entry.

Estimated number of individuals (including Applicant) to be covered under this permit: 5

Estimated number of days in the Monument:
The primary goal of this permit is to allow for the Wave Glider to accompany Makali'i for their time in the Monument, [2-4 weeks?] plus a few weeks on entry and departure to allow for weather lookahead and slower transit times of the Wave Glider. We would like to be able to repeat similar missions for the duration of the permit for future opportunities to work with the Monument and Makali'i.

Description of proposed activities: (complete these sentences):
a.) The proposed activity would...

use our Wave Glider (SV3, see attached Exhibit A) surface vehicle to accompany the sailing canoe Makali'i (separate permit application pending) to provide scientific/marine observational support. The Wave Glider will capture and transmit data in real time via our 24 hour / 7 days a week Wave Glider Operations Center. Data transmission to our Operations Center occurs on a prescribed interval (typically every 5 minutes) for the duration of the mission. The Liquid

Robotics Operations Center is in 24 hour/ 7 days a week "eyes on" contact with the vehicle for risk aversion, status alarms and troubleshooting (as needed).

b.) To accomplish this activity we would ....

transit the Wave Glider into the Monument on similar paths as the Makali'i, with adjustments as appropriate for Wave Glider operation (cultural protocol, standoff distances, schedule adjustments for slower transit speeds, hold station for interesting data or standing by for Makali'i). The Wave Glider will constantly monitor meteorology and oceanographic data in similar fashion to a fixed/moored buoy but will be mobile. The Wave Glider may gather data using the following integrated sensors, pending availability at the time of the voyage: Weather Station, Waves Sensor, CTD (salinity), ADCP (currents), camera, or other standard oceanographic sensors (Exhibit F).

c.) This activity would help the Monument by ...

gathering valuable ocean & weather data with zero environmental impact on the Monument. Data will be made available to teachers across the state, including DOE, private and charter schools to further inform the development of their Mālama Honua STEAM curriculum. The data gathered on this mission will be also made available to the academic community including NOAA/NDBC, NOAA/PMEL, NOAA/PacIOOS, University of Hawaii and others for oceanographic research purposes. The mission will also support and help continue to validate the monitoring of marine sanctuary and marine monuments by a Wave Glider with no human presence required thus minimizing the impact on the subject sanctuary or monument. We are currently working with Mokupāpapa Discovery Center (MDC) to potentially house data collected during this proposed activity to share with academia.

Other information or background:

Exhibits:

A. Wave Glider Specifications Sheet
B. NMSS Multi Permit
C. MBNMS Permit
D. NOAA/NOS/ONMS & Liquid Robotics MOA
E. MSDS
F. Sensors information
G. Resume, William Middleton

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Middleton, William F.

Title: Hawaii Operations Manager, Liquid Robotics, A Boeing Company

1a. Intended field Principal Investigator (See instructions for more information):
William Middleton

2. Mailing address (street/P.O. box, city, state, country, zip):

[redacted]

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

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

Liquid Robotics - A Boeing Company.
Nā Kālai Wa'a (Makali'i Voyaging Canoe) - Community outreach partner.
U.S. Dept of Commerce National Oceanic and Atmospheric Administration National Ocean Service Office of National Marine Sanctuaries and Liquid Robotics NOS Agreement Code: MOA-2017-114/10459.

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):

Nicholas Seabaugh, Senior Contracts Manager
Mark Bindon, VP of Mission Services
Lani Kamauu Yamasaki, Community Outreach/Community Development
Charles (Chuck) Shaver, Senior Support Engineer

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 will be working within the marine Special Preservation Areas at Nihoa and Mokumanamana as well as transiting areas of PMNM to access these SPAs.

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:*

Gather weather observations, meteorology, and ocean current data using the Wave Glider to assist the Makali'i to support and supplement the crew members' Traditional Ecological Knowledge (TEK) by providing quantifiably measured, near real-time weather and ocean data. Data collected will be provided to the Monument which may be potentially used to augment their natural resource management activities. We would also like to make this data available to teachers in order to potentially "enhance" the statewide Mālama Honua STEAM curriculum in our schools, and propose to work with MDC to house this data and contact our Promise to Pae 'Āina partners to understand if this data may be of service to their organizations' missions.

*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.
NA

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?

Papahānaumokuākea is a wahi pana, and Liquid Robotics understands the need for our company to demonstrate cultural sensitivity, protocol and knowledge if we are granted the opportunity to navigate a Wave Glider in this most sacred realm - particularly Mokumanamana. In receiving our previous permit, we extensively consulted with The Monument and The Office of Hawaiian Affairs "Papahānaumokuākea management team" with respect to The Native Hawaiian Plan.

We also sought guidance from cultural practitioners, including those with ancestral kūleana to Papahānaumokuākea to help us design a Wave Glider program that is pono through our on-going community outreach. We hope to continue to work with cultural practitioners within the monument to insure protocols are respected and adhered to. Lani Kamauu Yamasaki, Liquid Robotics Community Development/Outreach specialist has ancestral kūleana to steward religious wahi pana, and was ʻūniki by Hale Makua, her kupuna, who served as the spiritual elder for the Makaliʻi.

The Wave Glider is a surface vehicle that is a wave propelled, solar powered, unmanned autonomous marine robot. Liquid Robotics has a history of operating under permit in the National Marine Sanctuary System including the Hawaiian Islands Humpback Whale National Marine Sanctuary (see attached Exhibit B: Permit #MULTI-2012-004, expired, as HIHWNMS is not currently requiring permitting for our operation). We have an active permit with Monterey Bay National Marine Sanctuary. (see attached Exhibit C: Permit #MBNMS-2018-011), as well as U.S. Dept of Commerce National Oceanic and Atmospheric Administration National Ocean Service Office of National Marine Sanctuaries and Liquid Robotics MOA (see attached Exhibit D: NOS Agreement Code: MOA-2017-114/10459).

All sensors onboard are noninvasive and are all commonly used, industry standard oceanographic sensors as provided in the attached exhibits. The Wave Glider does not carry any hazardous materials with the exception of the contents of the sealed Lithium ion batteries (MSDS attached, Exhibit E) that are used to store the energy harnessed from the onboard solar panels. The Wave Glider discharges no effluents or environmental releases of any kind (closed systems). Our Wave Gliders have traveled more than 1.5 million nautical miles and are a proven platform.

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?

As stated above, Papahānaumokuākea is a wahi pana, and Liquid Robotics understands the need for our company to demonstrate cultural sensitivity, protocol and knowledge if we are granted the opportunity to navigate a Wave Glider in this most sacred realm - particularly Mokumanamana. In receiving our previous permit, we extensively consulted with The Monument and The Office of Hawaiian Affairs "Papahānaumokuākea management team" with respect to The Native Hawaiian Plan. We also sought guidance from cultural practitioners, including those with ancestral kūleana to Papahānaumokuākea to help us design a Wave Glider program that is pono through our on-going community outreach. We hope to continue to work with cultural practitioners within the monument to insure protocols are respected and adhered to. Lani Kamauu Yamasaki, Liquid Robotics Community Development/Outreach specialist has ancestral kūleana to steward religious wahi pana, and was ʻūniki by Hale Makua, her kupuna.

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.

Our mission is to accompany Makali'i on her voyage to the Monument for Summer Solstice 2019.

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 zero impact nature of the Wave Glider presence and data acquisition weighs heavily in the favor of the use of the platform for any number of missions. The activity will cause no adverse impacts on the Monument's resources.

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

The requested 1 year timeline goes beyond this summer's Makali'i voyage, however there is potential for Makali'i to carry out future voyages. There is also opportunity to potentially assist the Monument with future data collection using Wave Glider technology for natural resources management.

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

Liquid Robotics Inc. is a pioneer in design, manufacturing and operation of wave powered unmanned autonomous marine robots. We currently employ a team of engineers, field technicians, scientists, programmers and sales staff totaling around 100 people. We have been operating Wave Gliders and other marine engineering & oceanographic equipment in Hawaiian waters since 2007.

Our marine engineering testing & evaluation facility is located in Kawaihae, within the corridor of The Sanctuary and in a NOAA designated area for Habitat Blueprint and Benthic Mapping. We are also located along the corridor of the Ala Kahakai National Historic Trail National Park. Our community outreach program was developed based on the needs identified by our West Hawaii community including natural resource management teams from Office of National Marine Sanctuaries, Nā Kālai Wa'a, National Park Service, The Nature Conservancy, University of Hawaii at Hilo Marine Sciences, Kailapa Hawaiian Homestead Community, Puakō Community Association to name a few. In total we have 20 community partnerships, and are a member of Promise to Pae 'Āina which actively participated in Hōkulea's Mālama Honua journey.

Many of our missions are environmental in nature. In 2018, the Wave Glider swam 2,808 nautical miles home to Kawaihae after successfully completing a 4-month patrol mission of the Pitcairn Island Marine Sanctuary for the UK Foreign & Commonwealth Office (FCO). Along the way, it collected measurements of meteorological, oceanographic, and marine biodiversity data over expanses rarely traveled. Altogether, the Wave Glider was continuously at sea, untouched, for 213 days while traveling a total of 7,205 nautical miles (13,344 km). This mission demonstrated a fundamental enabling capability for long term and long-range monitoring.

Our local outreach focus is on assisting community to become self-reliant through STEAM, which includes traditional Native Hawaiian practices and other culturally appropriate subsistence living practices integrated with green, non-invasive technology such as the Wave Glider. Wave Glider scientific data has been used by community resource managers to make informed stewardship decisions. From community feedback, it's our understanding that the Wave Glider is considered "pono" technology to aloha 'āina.

Additional projects including outreach within Hawaii which demonstrates that Liquid Robotics is able to "successfully" complete our proposed journey to the Monument include (not limited to):

- Bottom Fish Restricted Areas (BFRA): Contracted by State of Hawaii Division of Aquatic Resources (DAR) and State of Hawaii Division of Conservation and Resources Enforcement (DOCARE)
- 2018 Lava Flow outreach documentation: Partnered with United States Geological Survey (USGS) and University of Hawaii at Hilo (UHH) Marine Science
- Aloha 'Āina - partnered with 14 federal, state, county, NGO and community groups

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.

Any Wave Gliders operating in the Monument would be the property of Liquid Robotics, and are expensive and complex ocean going robots. We would have a vested interest in timely recovery, maintenance, and observation of this asset. While the plan is to transit to/from our home base in Kawaihae, Hawaii, emergency recovery efforts could be engaged if needed per our vast experience in the field. The Wave Glider is equipped with a command/control system and an independent/redundant GPS tracker. If we experience a catastrophic failure of the command/control and power system, the independent tracker will still function. It is housed in an independent pressure vessel. The tracker uses GPS and an Iridium Satellite connection to transmit its location at a preset report rate, which can be adjusted by our pilots remotely. We log into our user interface and can then locate the vehicle using that independent tracker's GPS signal. Once the vehicle is located with the tracker signal, we can retrieve the vehicle using our support vessel or a locally chartered vessel (most likely from Oahu or Kauai). If ONMS has a list of pre-approved & inspected vessels that can enter the Monument we would gladly set-up a proposed recovery charter agreement and/or mission plan for an emergency recovery with a vessel from the list. Although it is extremely unlikely that we would need to enter the Monument via support vessel, we are prepared to do so if recovery is our only option. Regarding financial capabilities, we're a wholly owned subsidiary of The Boeing Company and therefore have financial backing from Boeing.

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.

The Wave Glider is an ocean-going robot that is completely non-invasive and will not impact the Monument's cultural, natural and historic resources, qualities, and ecological integrity.

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 are technically "Unclassified" per the Code of Federal Regulations via the United States Coast Guard thus would be exempt from the above noted requirement. The Wave Glider does have an integral Iridium satellite connection as well as an independent Xeos Resilient Tracker (in the event of total system power loss), two independent systems that track and maintain constant contact with the Wave Glider.

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

The Wave Glider is a proven ocean-going data collection platform as supported in all available literature. The Wave Glider has traveled over 1.5 million miles and through 17 hurricanes. The platform's rugged performance makes it an ideal tool to collect valuable ocean data while leaving no ecological or cultural footprint as a result of its presence in the Monument.

8. Procedures/Methods:

As noted previously, the Wave Glider will transit to marine Special Preservation Areas at Nihoa and Mokumanamana as well as transiting areas of PMNM to access these SPAs while collecting data; then transit out of the Monument following proposed deployment. While the Wave Glider is deployed in the Monument, no maintenance will be required. The Wave Glider is a robust ocean-going platform that can remain at sea for long periods of time (6-12 months) without operator intervention or maintenance. In the unlikely event that maintenance is required during the proposed deployment, the Wave Glider will be piloted out of Monument waters to be repaired or recovered as needed. A detailed operational plan can be made available if such a need arises.

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:
NA

Scientific name:
NA

& size of specimens:
NA

Collection location:
NA

☐ Whole Organism ☐ Partial Organism

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

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

• General site/location for collections:
NA

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

• Is there an outfall? ☐ Yes ☐ No
NA

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

• Will organisms be released?
NA

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

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:
Liquid Robotics is working to collaborate with Nā Kālai Wa'a and MDC to share data with individual teachers and academic organizations. In addition, we propose to collaborate with The Waikiki Aquarium as they will be featuring an exhibit on Makali'i's journey to Papahānaumokuākea.

Duplicative sampling should not be an issue unless the Monument can point us toward other instrumentation covering the same locations and types of measurements the Wave Glider will be performing.

12a. List all specialized gear and materials to be used in this activity:
The Wave Glider would be considered specialized gear and equipment. Please refer to the spec sheets attached for Wave Glider product and integrated sensor spec/data sheets.

12b. List all Hazardous Materials you propose to take to and use within the Monument:
Sealed Lithium Ion batteries (Exhibit E). No discharge of materials of any kind is expected. These batteries are lithium ion (not lithium metal) similar to laptop batteries. They are contained in sealed polymer housings (Liquid Robotics standard) and then again contained within the body of the vehicle (fiberglass hull with solar panels).

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

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

Standard, Wave Glider data will be transmitted near real time back to Liquid Robotics' server. Data will also be transferred via proprietary web-based interface or via File Transfer Protocol (FTP) or direct download, pending the above-mentioned arrangements. Some data may require some limited processing by LRI prior to transmitting to proposed partners.

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

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 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?

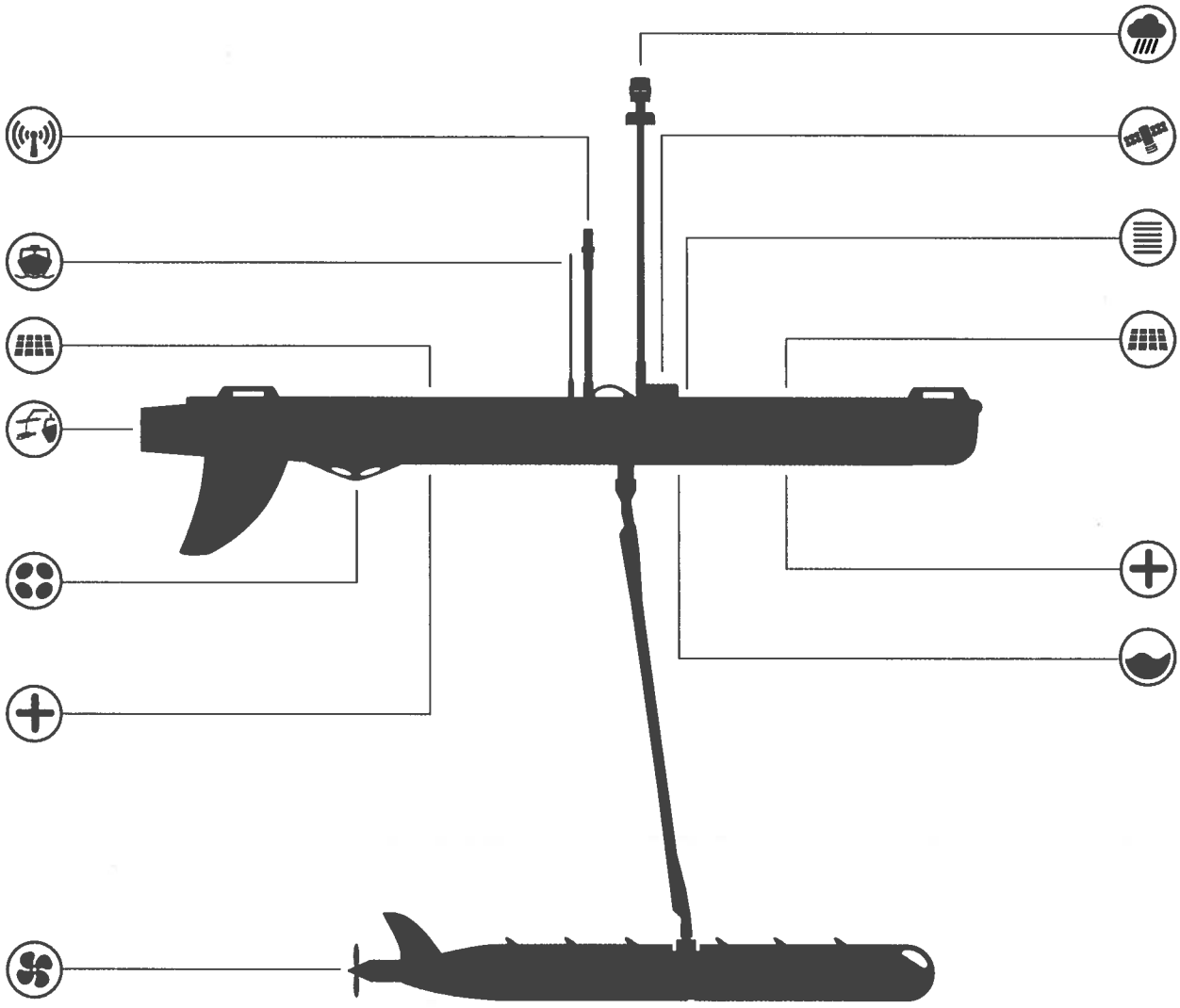
☒ Applicant CV/Resume/Biography
☒ Intended field Principal Investigator CV/Resume/Biography (same as applicant)
☒ Electronic and Hard Copy of Application with Signature
☐ Statement of information you wish to be kept confidential
☒ Material Safety Data Sheets for Hazardous Materials

Exhibit A

Liquid Robotics Products

Wave Glider SV3

BASE PLATFORM SPECIFICATIONS



Cellular comms (option)
AIS
Solar panels
Recovery buoy
ADCP (option)
Payload bay
Electric thruster
Weather station
Iridium comms
Command & Control Unit (CCU)
Wave sensor

LIQUID ROBOTICS
instrument the ocean

408 636 4200 408 747 1923 info@liquidr.com
1329 Moffett Park Drive, Sunnyvale, CA 94089, USA

Liquid Robotics Products
Wave Glider SV3

BASE PLATFORM SPECIFICATIONS

GENERAL

VEHICLE CONFIGURATION
Float and Sub joined by 4m (13ft) Umbilical Tether

FLOAT DIMENSIONS
(L x W x H):
305cm x 81cm x 23cm
120in x 32in x 9in

SUB DIMENSIONS
(L x W x H)
213cm x 142cm x 21cm
84in x 56in x 8.3in

WEIGHT
150kg (330lb)

ENDURANCE
Up to 1 year at sea

WATER SPEED
Max: 3kts
Average: 1.8kts

DEPTH RATING
Continuous wash and spray
Brief submergence to 2m (6.5ft)

OBSERVABILITY
Silent propulsion system
Minimal visual/radar signature
Optional flag and marker light

TRANSPORTATION/SHIPPING
Air freight compatible crates
Crate 1:
300cm x 60cm x 90cm
159kg (350lb)
Crate 2:
230cm x 50cm x 50cm
118kg (260lb)
Crate 3:
150cm x 80cm x 60cm
111kg (245lb)

SAFETY

EMERGENCY LOCATION
Shore-activated light
Redundant RF beacons
2-Year redundant Iridium® tracker

HEALTH SENSORS
Pressure and temperature sensors in dry boxes

BATTERY COMPLIANCE
Automatic charge/discharge cut-off (for temperature and/or voltage)

PAYLOAD

ARCHITECTURE
Standard mechanical, electrical & software architecture for easy integration and configurability

MAX DISCRETE PAYLOADS
7 (MPUs)

MAX PAYLOAD WEIGHT
45kg (100lb)

MAX PAYLOAD VOLUME
93L (3.3cf)

PEAK PAYLOAD POWER
360W

NAVIGATION

HEADING
Solid state magnetometer

GPS
12 channel WAAS capable

NAVIGATION ACCURACY
3m radius CEP50

STATION KEEPING
40m radius CEP90 (SS3)

POWER

PROPULSION
Conversion of wave energy into thrust
Electric propeller for more deterministic control

CONTINUOUS POWER
5W-20W (Avg.)

BATTERY STORAGE
0.9-4.5kWh

SOLAR COLLECTION RATE
150W

INSTRUMENTATION

WATER SPEED SENSOR
Airmar CS4500

AIS RECIEVER
Shine Micro

WEATHER STATION
Airmar PB200WX

COMMUNICATIONS

SATELLITE
Iridium® 9602
RUDICS (option)

CELLULAR
Option

LOCAL
802.11g/n WiFi

OPERATION

MISSION CONTROL
Chart-based GUI
Waypoint & course generation

STATUS MONITORING
Text & visual status indicators accessible via web interface
SMS and email alerts
Programmable inclusion and exclusion zones

AUTONOMOUS NAVIGATION
Programmable waypoint course
Follow course and hold/loop
Station keeping at target

408 636 4200 408 747 1923 info@liquidr.com
1329 Moffett Park Drive, Sunnyvale, CA 94089, USA

Exhibit E

INSPIRED ENERGY
SOLUTIONS FOR PORTABLE POWER

SAFETY DATA SHEET

This Safety Data Sheet Complies with directives from the United States Occupational Safety and Health Administration (OSHA), Canadian Controlled Product Regulations (WHMIS), the European Union Commission Regulation (EC) 1907/2006 & (EC) 2015/830, the Australian National Occupational Health and Safety Commission (NOHSC), the Taiwan Bureau of Standards, the Japan Ministry of Economy, the Inspection and Quarantine of the People's Republic of China (GB/T 16483-2008), the Brazil Standard (ABNT NRB 14725-3) and Malaysian Department of Environment.

SECTION I - PRODUCT AND COMPANY IDENTIFICATION

1.1 Product Identification:
Secondary Smart Lithium-Ion Battery Packs:

Model	Ratings	Model	Ratings	Model	Ratings
L02Dxxxx	7.2V,<24Wh,<10A	ND2037xxxx	7.2V,<49Wh,<10A	Ni2040xxxx	10.8V,<94Wh,<10A
L03Dxxxx	10.8V,<37Wh,<10A	ND2057xxxx	7.2V,<49Wh,<10A	NL2020xxxx	10.8V,<97Wh,<10A
L04Dxxxx	14.4V,<49Wh,<10A	ND2034xxxx	14.4V,<49Wh,<10A	NL2024xxxx	14.4V,<97Wh,<10A
L06Dxxxx	10.8V,<73Wh,<10A	ND3034xxxx	14.4V,<49Wh,<10A	NL2044xxxx	14.4V,<97Wh,<10A
L08Cxxxx	14.4V,<98Wh,<10A	ND2054xxxx	14.4V,<49Wh,<10A	NL2050xxxx	10.8V,<97Wh,<10A
L08Dxxxx	14.4V,<98Wh,<10A	ND3054xxxx	14.4V,<49Wh,<10A	NL2054xxxx	14.4V,<97Wh,<10A
L12Dxxxx	14.4V,<97Wh,<10A	NF2047xxxx	7.2V,<73Wh,<10A	PG3665xxxx	25.2V,<73Wh,<20A
L16Dxxxx	14.4V,<98Wh,<10A	NF2030xxxx	10.8V,<73Wh,<10A	PH2059xxxx	28.8V,<98Wh,<10A
NB2037xxxx	7.2V,<24Wh <10A	NF2040xxxx	10.8V,<73Wh,<10A	PH2054xxxx	14.4V,<98Wh,<20A
NB3037xxxx	7.2V,<24Wh, <10A	NF3040xxxx	10.8V,<73Wh,<10A	PH3054xxxx	14.4V,<58Wh,<20A
NC2040xxxx	10.8V,<37Wh,<10A	NH2054xxxx	14.4V,<98Wh,<10A	PH3059xxxx	28.8V,<43Wh,<20A
NC3040xxxx	10.8V,<37Wh,<10A	NH2057xxxx	7.2V,<98Wh,<12A	RH2024xxxx	14.4V,<98Wh,<10A
NC2560xxxx	10.8V,<22Wh,<2A	NH2034xxxx	14.4V,<98Wh,<10A	RH2044xxxx	14.4V,<98Wh,<10A
ND2053xxxx	3.6V,<49Wh,<10A	Ni2020xxxx	10.8V,<94Wh,<10A		
ND2017xxxx	7.2V,<49Wh,<3A	Ni3020xxxx	10.8V,<94Wh,<10A		

Where "xxxx" indicates all different custom & standard model variants identified by alphanumeric suffixes.

1.2 Company Identification:
Company Name: Inspired Energy, LLC
Address: 25440 NW 8th Place; Newberry, FL 32669
Telephone Number: +1-352-472-4855
Fax Number: +1-352-472-4859
Emergency Contact Number: +1 813-248-0585 or +1 888-533-7762
Report Number: IESDSV7

SECTION II - HAZARD IDENTIFICATION

2.1 Classification of Products:
Secondary battery packs are enclosed in UL-94, V-0 enclosures designed to withstand temperatures and pressures encountered during normal use. The hazardous component in battery packs is the lithium-ion cell. Under normal use the battery cells present no physical danger of ignition or explosion and chemical danger of hazardous materials leakage.
Battery cells are designed to vent gas to prevent explosion, if exposed to a fire, added mechanical shocks, electrically abused or physically damaged. This leaked gas could contain material classified as hazardous.

2.2 Label and Markings:

2.2.1 Example of Battery Pack Markings:

2.2.2 Example of Packaging Labels:

2.3 Effect(s) of Hazard Exposure:
Human Health Effects if Exposed to Cell Venting:
Skin Contact: The steam or liquid of the cell electrolyte can have adverse reactions to the skin. If cell electrolyte contacts skin it can cause severe irritation or chemical burns.
Eye Contact: The steam or liquid of the cell electrolyte can have adverse reactions to the eyes. If cell electrolyte contacts the eyes it can cause severe irritation or chemical burns.
Inhalation: The steam or liquid of the cell electrolyte can have adverse reactions if inhaled. If cell electrolyte is inhaled it may cause severe respiratory irritation.
Ingested: Swallowing or ingesting the contents of an open cell can cause serious chemical burns to the mouth, esophagus and gastrointestinal tract.
Medical Conditions Aggravated by Exposure: Not Available
Interactions with Other Chemicals: Immersion in high conductivity liquids may cause corrosion and breaching of the cell or battery enclosure. If vented cell electrolyte contacts water it will generate detrimental hydrogen fluoride.
Environmental Effects: Not Available

SECTION III - COMPOSITION / INFORMATION OF INGREDIENTS

3.1 Classification of Hazardous Ingredients by Geographic Markets:
USA: This battery pack is an article pursuant to 29 CFR 1910.1200. The information contained in this Safety Data Sheet contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.
Canada: This is not a controlled produced under WHMIS. The products listed in this Safety Data Sheet are defined as "Manufactured Articles" and is not subject to the regulations of the Hazardous Products Act.
EU: This product is an article according to the REACH Regulation (1907/2006).
Australia: The products listed in this SDS are constructed using Lithium-Ion cell or battery and is classified as an article and is not hazardous when used according to the recommendations of the manufacturer. The hazard is associated with the contents of the cell. If the cell or battery is compromised and starts to leak, based upon the battery ingredients the contents are classified as hazardous according to the criteria of the National Occupational Health and Safety Commission stated by SafeWork Australia.

Taiwan: This product is not classified as a dangerous good.
Japan: This product is not classified as a dangerous good.
China: This product is not classified as a dangerous good.
Brazil: This product is an article according to ABNT NRB 14725-2:2009

Cell Component	Chemical Name	Mass Range (Weight %)*
Electrolyte Salt	Lithium Hexafluorophosphate	1~5
Electrolyte Solvents	Ethylene Carbonate, Propylene Carbonate, Diethyl Carbonate, Dimethyl Carbonate, Ethyl Methyl Carbonate	5~20
PVDF	Polyvinylidenfluoride	<1
Base	Copper	1~15
Cathode	Lithium Cobaltite, Manganese, Nickel, Aluminum	20~50
Anode	Graphite, Carbon Black	13~18

(Quantities may vary depending on battery model)*

SECTION IV - FIRST-AID MEASURES

4.1 Description of First Aid Measures:
The hazardous component in secondary battery packs are in the internally sealed cells. **The following measures are only applicable if the cells have been abused/damaged causing exposure of hazardous materials noted under section three.**
Ingestion: Have the victim rinse mouth thoroughly. DO NOT INDUCE VOMITING. Contact your local poison control center. Immediately seek medical attention.
Inhalation: Remove victim from exposure to chemicals and into the fresh air. Immediately seek medical attention.
Skin Contact: Immediately flush with water. Immediately seek medical attention.
Eye Contact: If eye contact with the contents of a vented cell immediately flush eyes with water. Immediately seek medical attention.
Protection for First Aiders: Do not expose yourself to corrosive vapor-contaminated areas without a respirator.
First Aid Facilities: Eye wash bottle, fountain and safety showers (running water).

4.2 Most Important Symptoms & Effects Caused by Exposure:
Ingestion of cell contents may cause gastrointestinal tract irritation or even vomiting. Inhalation of vented cell vapors may lead to severe irritation of the mouth and upper respiratory tract causing a burning/pain sensation or inflammation in the nose and throat. Inhalation could also cause coughing or difficulty breathing. Eye contact may cause severe eye irritation, eye burning/pain and even possible irreversible damage. Skin contact may lead to irritation and possible chemical burns.

4.3 Indication of any immediate medical attention and special treatment needed
ADVICE TO DOCTOR: Treat symptomatically if the person comes into contact with the corrosive electrolyte liquid contents of a damaged battery.

SECTION V - FIRE FIGHTING MEASURES

5.1 Extinguishing Media:
Suitable Extinguishing Media: Water, Fire Extinguishing Powder, Nitrogen Gas, Carbon Dioxide, or Foam.
Unsuitable Extinguishing Media: Oxidizing agents, reducing agents, acids or alkalis.

Explosion Data: Closed containers may explode when exposed to temperatures above 120°C (248°F).
Hazchem Code: 4W (Australia, New Zealand and Malaysia)
Sensitivity to Mechanical Impact: Extreme mechanical abuse could cause venting of the cells.
Sensitivity to Static Discharge: If electrolyte is exposed to electrostatic discharge it could ignite.
TDG/DOT ERG Code:147

5.2 Special Hazards Arising from the Chemical:
If a cell vents and exposes lithium hexafluorophosphate mixed with water vapor, this could create a poisonous gas of hydrogen-fluoride gas. Degradation of the cell by heat may produce hazardous fumes of lithium, cobalt-manganese, hydrofluoric acid, hydrogen and oxides of carbon, aluminum, lithium, copper and cobalt.

5.3 Advice for Fire Fighting:
When battery cells combust, they tend to ignite other cells in the adjacent area. Prevent this by flooding the area with Carbon Dioxide, Foam, Nitrogen Gas or Fire Extinguishing Powder. Although use of water will extinguish flame it may create hydrogen-fluoride gas. Burning component cells or batteries will burn themselves out. Virtually all fires involving Lithium Ion cells and batters can be controlled with water. When water is used however, hydrogen gas may be evolved which can form an explosive mixture with air. LITH-X (powdered graphite) or copper powder fire extinguishers, sand, dry ground dolomite or soda ash may also be used. These materials act as soothing agent.

5.4 Special Protective Equipment for Fire Fighters:
In the case of a fire and release of hydrogen fluoride, it is critical to protect the skin from any contact. Fire fighters should wear a self-contained breathing apparatus. Burning lithium-ion cells and batteries can produce toxic fumes including hydrogen fluoride (HF), oxides or carbon, aluminum, lithium, copper and cobalt. Volatile phosphorous penta fluoride may form at temperatures above 110°C (230°F). Wear adequate personal protective equipment:
Respiratory Protection: Self-contained Breathing Apparatus
Hand Protection: Protective Gloves
Eye Protection: Full Face Breathing Apparatus or Googles
Body Protection: Protective Uniform

SECTION VI - ACCIDENTAL RELEASE MEASURES

If battery packs internal cells become damaged, they could possibly leak minuscule amounts of contaminates. The following procedures list precautions and steps to cleaning these contaminates.

6.1 Personal Precautions:
Quarantine contaminated area at 75 feet (25 meters) radius from the center of contamination. Don protective equipment and clothing listed in Section 8.2.

6.2 Environmental Precautions:
Cover spilled materials with absorbent non-reactive material (ie. vermiculite). Keep contaminated non-reactive material away from soil, sewers or waterways. Inform appropriate authorities if contamination occurs.

6.3 Methods for Clean Up:
Quarantine contaminated area at 75 feet (25 meters) radius from the center of contamination. Don protective equipment and clothing listed in Section 8. Do not touch Spilled material. Use only non-sparking tools and equipment. Do not expose spilled material to moisture. Seal all possible locations where contaminates might migrate into the environment. Clean up solids and place them into a waste container safe for disposing of contaminated trash. Clean up spilled liquids with vermiculite and place them into the same container. Appropriately transport contaminated material to a waste facility capable of handling contaminated materials.

6.4 Precautions to Prevent Secondary Hazard:

Avoid the release of collected materials. Do not bring the collected materials near open flame. Seal contaminates into a waste container safe for disposing of contaminated trash. Transport contaminates to an appropriate waste facility.

SECTION VII - HANDLING AND STORAGE

7.1 Precautions for Safe Handling:
Avoid shorting the battery. Do not immerse in water. Do not disassemble or deform the battery. Do not expose to, or dispose of the battery in fire. Avoid excessive physical shock or vibration. Keep out of the reach of children. Battery must be charged in an approved charger. Never use a modified or damaged charger. Use for specified product applications only. Store in a cool, dry and well-ventilated area. Never use a battery that has suffered abuse. Refer to data sheet for safe operating instructions.

7.2 Conditions for Safe Storage:
Store battery packs in a cool (25°C+/-5°C), Dry (<85% Humidity) well ventilated area. Keep battery packs in packaging material to prevent exposure to elements and conductive material.

Do not store battery packs near heat, high humidity, open flame, sunlight, water, seawater, strong acids, strong oxidizers, strong reducing agents, strong alkalis or metal wire.

7.3 Specific End Uses:
Rechargeable Smart Battery Packs are used across a wide market scope as a DC power supply for portable electronic devices.

SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION

Under routine operation none of these safety procedures or equipment are required. Take the following safety measures only if the internal cells are comprised and leak or vent.

8.1 Exposure Control Measures:
Exposure Limit Values- ACGIH does not mention electrolyte as a controlled method. Not applicable.
Biological Monitoring-Not Applicable.
Control Banding- Not Applicable.
Recommended Monitoring Procedures- Follow standard monitoring procedures.
Derived no-effect level- Not Applicable.
Derived minimal effect level- Not Applicable.
Predicted no-effect concentrations- Not Applicable.

8.2 Personal Protective Equipment:
Engineering Controls- Special ventilation is only required if cell venting occurs.
Eye and Face Protection- Wear chemical resistant safety googles or face shield.
Hand Protection- Wear chemical resistant gloves.
Skin Protection- Wear long sleeved clothing. Solid clothing should be washed with detergent.
Respiratory Protection- Wear an approved half face inorganic vapor, gas, acid and particulate respirator.
Thermal Protection- Not Applicable.
Hygiene Measures- Do not eat, drink or smoke in work areas.

Environmental Exposure Controls- Do not release into the environment.

SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

Physical State- Sealed Solid
Appearance- Small Battery Pack
pH- Not Applicable
Relative Density- Not Applicable
Boiling Point- Not Applicable
Melting Point- Not Applicable
Viscosity- Not Applicable
Oxidizing Properties- Not Applicable
Flash Point- Not Applicable
Water Partition- Not Applicable
Vapor Pressure (mm Hg @20°C)- Not Applicable
Vapor Density- Not Applicable
Solubility in Water- Insoluble
Water Distribution Coefficient- Not Applicable
Odor Type- Odorless
Odor Threshold- Not Applicable
Evaporation Rate- Not Applicable
Auto Ignition Temperature- Not Applicable
Flammability Limits- Not Applicable
Decomposition Temperature- 90°C

SECTION X - STABILITY AND REACTIVITY

10.1 Stability and Reactivity:
Stability- The battery packs manufactured by Inspired Energy are completely stable under normal use and in normal storage conditions.
Reactivity- The internal cells within the battery packs may become unstable due to abusive conditions.
Conditions to Avoid- Avoid shorting the battery. Do not immerse in water. Do not disassemble or deform the battery. Do not expose to, or dispose of the battery in fire. Avoid excessive physical shock or vibration. Keep out of the reach of children. Battery must be charged in approved charger. Never use a modified or damaged charger. For specified product use only. Store in a cool, dry and well-ventilated area. Never use a battery that has suffered abuse. Refer to data sheet for safe operating instructions.
Incompatible Materials- Do not immerse in water or any other high corrosive conductive liquid.
Hazardous, Decomposition Products- Internal cells may decompose to hydrogen fluoride, phosphorous oxides, sulfur oxides, sulfuric acid, lithium hydroxide, carbon monoxide and carbon dioxide.

SECTION XI - TOXICOLOGICAL INFORMATION

11.1 Information on Toxicological Effects:
The battery packs manufactured by Inspired Energy present no toxicological effects under normal use. The hazardous components of the battery packs are within the internal cell. Within recommended conditions the electrode materials and liquid electrolytes do not react when the cell remains sealed. Exposure to these hazardous components is only possible if the battery leaks or vents. The following toxicology data is in respect to a person coming into contact with exposed electrolyte of the cell.

11.2 Acute Toxicity:
Swallowed- The electrolyte contained within the cells of the battery pack is a corrosive material. Ingestion of this electrolyte would be harmful. Swallowing may result in nausea, vomiting, diarrhea, abdominal pain and chemical burns in the gastrointestinal tract. During normal usage ingestion of a sealed battery pack is physically impossible.

11.3 Skin Corrosion or Irritation:
The electrolyte contained within the cells of the battery pack is a corrosive liquid. If this corrosive liquid make contact to your skin they could cause irritation or even severe chemical burns. A sealed battery presents no danger to a person's hand or skin.

11.4 Serious Eye Damage or Irritation:
The electrolyte contained within the cells of the battery pack is a corrosive liquid. If this electrolytes makes contact with the eye it could cause irritation or even irreversible damage to the eye. A sealed battery presents no danger to eyes.

11.5 Respiratory or Skin Sensitization:
OECD Test 406 as performed by the cell manufacture, presented no evidence that the electrolyte contained within the cell of battery pack cause no respiratory or skin sensitizers.

11.6 Germ Cell Mutagenicity:
OECD Test 471, 475, 476, 478 and 479 Test 406 as performed by the cell manufacture, presented no evidence that the electrolyte contained within the cell of a battery pack cause no mutagenic effect.

11.7 Carcinogenicity:
The electrolyte contained within the cell of a battery pack is not considered by the cell manufacture to be a carcinogen.

11.8 Reproductive Toxicity:
OECD Test 414 and 421 Test 406 as performed by the cell manufacture, presented no evidence that the Electrolyte contained within the cell of a battery pack cause an hazard to the human reproductive system.

11.9 Specific Target Organ Toxicity (STOT) - Single Exposure:
Inhalation of vapors from a leaking cell within a battery pack will cause irritation or even severe pain to the mouth and respiratory tract. Sealed battery packs present no organ toxicity.

11.10 Specific Target Organ Toxicity (STOT) - Repeated Exposure:
OECD Tests 410 and 412 presented that prolonged exposure to a battery pack cells causes no organ damage.

11.11 Aspiration Hazards:
The electrolyte contained within the cell of the battery pack presents no aspiration concern. Although if the electrolyte is swallowed vomiting could occur and cause aspiration into the lungs.

SECTION XII - ECOLOGICAL INFROMATION

12.1 Ecotoxicity: A sealed battery pack does not pose any ecotoxicity hazard. The internal cells under normal use and conditions pose no ecotoxicity hazard. In the rare case the cells seal is broken or damaged the cell could leak electrolyte. If this electrolyte reacts with water it could potentially cause damage to flora and fauna. Follow the steps under Section 13 to insure cells are disposed of properly.

12.2 Persistence and Degradability: No data available.

12.3 Bio Accumulative Potential: Not applicable.

12.4 Mobility in Soil: No data available.

12.5 Results of PBT and vPvB Assessment: Not applicable.

SECTION XIII - DISPOSAL CONSIDERATIONS

13.1 Waste Treatment Methods: Recycling of Inspired Energy's Smart Battery Packs is strongly encouraged. Every battery has instructions for contacting the Rechargeable Battery Recycling Corp (RBRC) to ensure the appropriate recycling method within the USA. Every battery has the appropriate symbols to direct appropriate disposal in Europe. The battery packs internal cell's contents should not be released into the environment, do not dump into any sewers, on the ground or into any body of water. Do not dispose of battery packs in fire. Used battery packs should be stored in their original packaging. Ensure packs are stored in a manner to prevent short circuit of the cells. Battery pack should be fully discharged before recycling. Do break battery pack open before disposal.

13.2 Classification of Waste to comply with Waste Regulations:
USA: Expended batteries are not considered hazardous waste. Cells and batteries involved in a fire may be considered to be hazardous waste. Dispose of in accordance with local, state and federal laws and regulations. Consult universal/hazardous waste regulations for further information regarding disposal of spent batteries. If the internal cells are leaking/broken open, consult hazardous waste regulations under US Environmental Protection Agency's Resource Conservation and Recovery Act (RCRA). Also, consult state and local regulations for further disposal requirements.

RECYCLE RBRC Li-Ion 1.800.822.8837	Inspired Energy is a committed partner in Call2recycle's Rechargeable Battery Recycling Corporation (RBRC) program. Promoting the recycling of Li-Ion battery packs by providing a toll-free telephone number to call and receive information to the nearest local recycling facility.

Canada: Expended battery packs are not considered hazardous waste. Cells and batteries involved in a fire may be considered to be hazardous waste. Dispose of in accordance with local, provincial and federal laws and regulations. Consult the Canadian Environmental Protection Act for additional details.
EU: Expended battery pack waste must be disposed of in accordance with relevant EC Directives and national, regional and local environmental control regulations. For disposal within the EC, the appropriate code according to the European Waste Catalogue (EWC) should be used. EU Waste Code: 16 06 05 – other batteries and accumulators.
Australia: Expended battery packs must be taken for recycling or disposal at an appropriate collection depot by suitably licensed contractors in accordance with government regulations.
Taiwan: Expended battery packs are not considered hazardous waste. Cells and batteries should be recycled at an appropriate collection site in accordance with government regulations.
Japan: Recycling of expended lithium-ion battery packs is regulated by the Wastes Disposal and Public Cleaning Law and the Law for Promotion of Effective Utilization.
Brazil: Expended battery packs should be recycled in accordance to the Natation Solid Waste Policy (PNRS) or CONAMA in compliance with the directives and regulations of the National System of Environmental (SISNAMA).
Malaysia: Lithium-ion cells and batteries are considered scheduled wastes and must be sent to a proper collection treatment, recycling and Disposal center; **Scheduled Waste Code SW103**

13.3 Classification of Waste to comply with Transport Regulations: Expended Lithium-Ion Battery packs are not considered hazardous waste. Lithium-ion battery packs that have been involved in a fire maybe considered hazardous waste and should be marked and classified as such.

13.4 Classification of Waste Packaging Material: Under normal use packaging is not consider hazardous and should be disposed of in accordance with local recycling regulations. Packaging that has been exposed to a damaged leaking cells should be considered hazardous waste and disposed of in accordance to local rules and regulations.

SECTION XIV - TRANSPORT INFORMATION

14.1 UN Number: 3480 or 3481
UN Testing: UN *Manual of Tests and Criteria*, Part III subsection 38.3 **ST/SG/AC.10/C/3/2010** *5th Edition*: All battery assemblies noted in Section 1.1 have been tested to meet the referenced standard.

14.2 UN Proper Shipping Name: 3480-Lithium Ion Batteries. 3481-Lithium Ion Batteries Contained in Equipment or Lithium Ion Batteries Packed with Equipment

14.3 Transport Hazard Classes:
Class: 9
Subsidiary Risk: None
Labels: Lithium Handling Label, Class 9 Lithium Label, Cargo Aircraft Only Label
Hazard No. (ADR): 9
Tunnel Restriction Code: E

14.4 Packing Group: II
14.5 Environmental Hazards: None

14.6 Special Precautions for User: Read Safety Data Sheet and Specification Data sheet before use. Australia, New Zealand and Singapore follow Hazchem Code: 4W. TDG/DOT ERG Code: 147. ICAO/IATA ERG Code: 9F.

14.7 Transport in bulk IBC Code: No applicable code.

14.8 Modal Information:

Land (ADR):	3480 – 188, 230, 310, 348, 376, 377 and 636 (Special packaging instruction P903 applies). 3481 – 188, 230, 348, 360, 376, 377 and 636 (Special packaging instruction P903 applies).
Land (RID):	3480 – 188, 230, 310, 348, 360, 376, 377 and 636 (Special packaging instruction P903 applies). 3481 – 188, 230, 348, 360, 376, 377 and 636 (Special packaging instruction P903 applies).
Land (ADN)	3480 – 188, 230, 310, 348, 376, 377 and 636 (Special packaging instruction P903 applies). 3481 – 188, 230, 348, 360, 376, 377 AND 636 (Special packaging instruction P903 applies).
Sea (IMDG):	188, 230, 310, 348 and 957 (Special packaging instruction P903 applies). EmS: F-A, S-I; Stowage Category A; IMDG Code: 9033
Air (IATA)	A88, A99, A154, A164, A183, and A206 (Packing Instruction 965, 966, 967). ERG Code: - Lithium ion cell or batteries - Lithium ion batteries in compliance with Packing Instruction 965. Lithium ion cell or batteries packed with equipment - Lithium ion batteries in compliance with Packing Instruction 966. Lithium ion cell or batteries contained in equipment - Lithium ion batteries in compliance with Packing Instruction 967.

All listed provisions may not apply. Inspired Energy products listed under this SDS will conform to various sections of PI 965 or PI 966 or PI 967 based on the contents and packaging of the shipment. Please see the shipping documents for complete details for individual shipments. This document is not intended to replace or authorize shipments of lithium-ion cells; it is intended as a guide for use by trained individuals.

SECTION XV - REGULATORY INFORMATION

15.1 Safety, Health and Environmental Regulations/ Legislation:

United States Federal and State Regulations: TSCA Status: All ingredients in these products are listed on the TSCA inventory. **OSHA:** These products do not meet criteria as per Part 1910.1200, manufactured article. **SARA EPA Title III:** None. **Sec. 302/304:** None. **Sec. 311/312:** None. **Sec. 313:** Supplier Notification: The Product contains a toxic chemical or chemicals subject to the reporting requirements of section 313 of (Title) III of superfund amendments and reauthorization act of 1986 and 40 CFR Part 372. Supplier notification requirement does not apply to batteries that are considered consumer products.

Chemical	CAS	% by weight
Aluminum	7429-90-5	17-27
Copper	7440-50-8	9-18
Graphite	7782-42-5	13-18
Lithium Cobaltite	12190-79-3	20-50
Lithium-Hexafluorophosphate	21324-40-3	1=5

CERCLA RQ: None. **US EPA Waste Code:** D003(reactivity)-Damaged and leaking cell or battery only. **State of California:** Rechargeable Battery Recycling Act- Division 30, Part 3, Chapter 8.4 of the public resource code. Consumers must recycle all single use batteries or take them to a household hazardous waste disposal facility, a universal waste hander or an authorized recycling facility. This product can expose you to Nickel, a chemical known in the state of California to cause cancer and birth defects or other reproductive harm for more information go to www.p65warnings.ca.gov/product. **State of Minnesota:** Rechargeable Battery and products law – Rechargeable batteries and products with non-removeable batteries cannot be disposed as mixed municipal waste. **State of New York:** Rechargeable Battery law – It is illegal to dispose of rechargeable batteries in the state of New York as solid waste. **Canadian Federal Regulations:** These products have been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations. **WHMIS Classification:** Not Controlled, manufactured article. **New Substance Notification Regulations:** Lithium hexafluorophosphate is listed on the Non-Domestic Substance List (NDSL). All other ingredients in the product are listed, as required, on Canada's Domestic Substances List (DSL). **National Pollutant Release Inventory (NPRI) Substances:** These products do not contain any NPRI chemicals.
EU Regulations: Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex I: Not listed. Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex II: Not listed. Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I as amended: Not listed. Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1 as amended: Not listed. Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2 as amended: Not listed. Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3 as amended: Not listed. Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V as amended: Not listed. Regulation (EC) No. 166/2006, REACH Article 59(10) Candidate List as currently published by ECHA: Not listed. **EU Authorizations:** Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended: Not listed. **EU Restrictions on use:** Regulation (EC) No. 1907/2006, REACH Annex XVII Substances subject to restriction on marketing and use as amended: Aluminum (CAS 7429-90-5) Directive 2004/37/EC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding: Not listed. **Other EU Regulations** Directive 96/82/EC (Seveso II) on the control of major accident hazards involving dangerous substances: Not listed. Directive 94/33/EC on the protection of young people at work: Not listed. FSSF00058AG Inspired Energy's Page 13 of 15 August 2015 This Safety Data Sheet complies with the requirements of Regulation (EC) No. 1907/2006 and amended on 28 May 2015 by (EU) 2015/830. **Australia and New Zealand SUSMP:** Not applicable **AICS:** All ingredients are on the AICS list. **HSNO Approval number:** Not applicable **HSNO Group Title:** Not applicable **NOHSC:10008 Risk Phrases:** R34 - Causes Burns. **NOHSC:1008 Safety Phrases:** S1 – Keep locked up. S2 – Keep out of reach of children. S23 – Do not breathe vapor. S24/25 – Avoid contact with skin and eyes. S26 – In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S27/28 – After contact with skin, take off immediately all contaminated clothing and wash

immediately with plenty of water. S36/37/39 – Wear suitable protective clothing, gloves and eye/face protection. S56 – Dispose of this material and its container at hazardous waste or special waste collection point. S62 – If swallowed, DO NOT induce vomiting: seek medical advice immediately and show this container or label. S64 – If swallowed, rinse mouth with water (Only if the person is conscious). **EC Classification for the Substance/Preparation:** These products are not classified as hazardous according to Regulation (EC) No. 1272/2008. Keep out of the reach of children. **Japanese Regulations** Japanese Industrial Standards (JIS) JIS Z 7253:2012 Waste disposal and public cleaning law Law for Promotion of Effective Utilization of Resources **Taiwanese Regulations** Regulation of Labelling and Hazard Communication of Dangerous and Harmful Materials: Labeling requirements and other relevant provision of chemicals, this product is not classified as dangerous goods. Toxic Chemicals Substance Control Law: Not Listed. CNS 1030016 Safety of primary and secondary lithium cells and batteries during transport. **Chinese Regulations** General Rule for Classification and Hazard Communication of Chemicals (GB 13690-2009): Specifies the classification, labeling and hazard communication of chemicals in compliance with the GHS standard for chemical production sites and labeling of consumer goods. General Rule for Preparation of Precautionary Labels for Chemicals (GB 15258-2009): Specifies the relevant application methods of precautionary labels for chemicals. Safety Data Sheet for Chemical Products Content and Order of Sections (GB/T 16483-2008). **Brazil Regulations:** National Solid Waste Policy (PNRS of CONAMA in compliance with the directives and regulations of National System for the Environment (SISNAMA). **Malaysian Regulations:** Guidelines for the classification of used electrical and electronic equipment in Malaysia, 2nd Edition, 2010 Environmental quality regulations, 2005. Scheduled Waste code: SW103: Waste of batteries containing cadmium and nickel or mercury or lithium.

15.2 Chemical Safety Assessment: Not applicable.

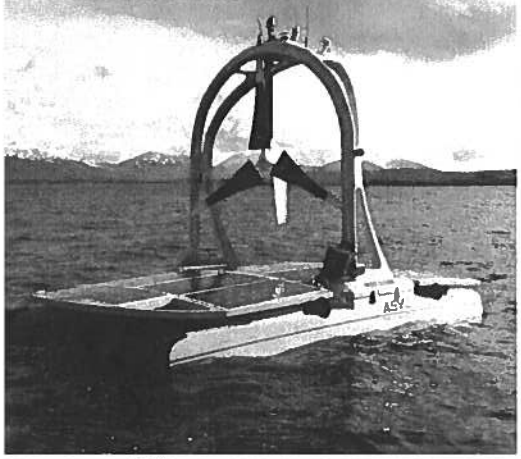
SECTION XVI - OTHER INFORMATION

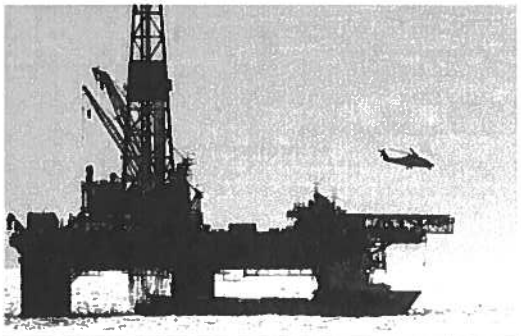
Preparation Date: February 8, 2019
Prepared by: Inspired Energy's Compliance Department
Revision:
V1 - Initial Release
V2 - Update to Section 1.1
V3 - Update to Section 14.1
V4 - Updated Section 2.2.2 and 14.8
V5 - Updated Sections 2.2.2, 3.1, 5.1, 13.2, 14.3, 14.6, 14.8 and 15.1
V6 - Updated Section 1.1, 1.1.2 and 2.2.2
V-7 - Added Report Number to Section 1.2, Updated 1.1
V-8 - Updated Section 1.1
V-9 - 2018 Release
V-10- 2019 Update

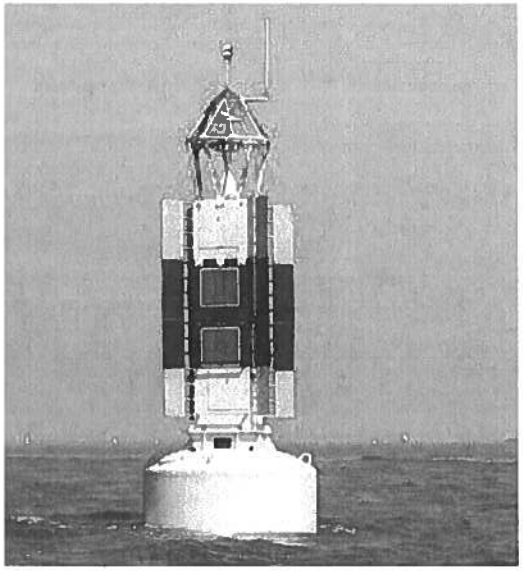
Disclaimer: The information contained within is provided for your information only. The information and recommendations set forth herein are made in good faith and are believed to be accurate as of the date of preparation. However, INSPIRED ENERGY, LLC. MAKES NO WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THIS INFORMATION AND DISCLAIMS ALL LIABILITY FROM RELIANCE ON IT.

Exhibit F

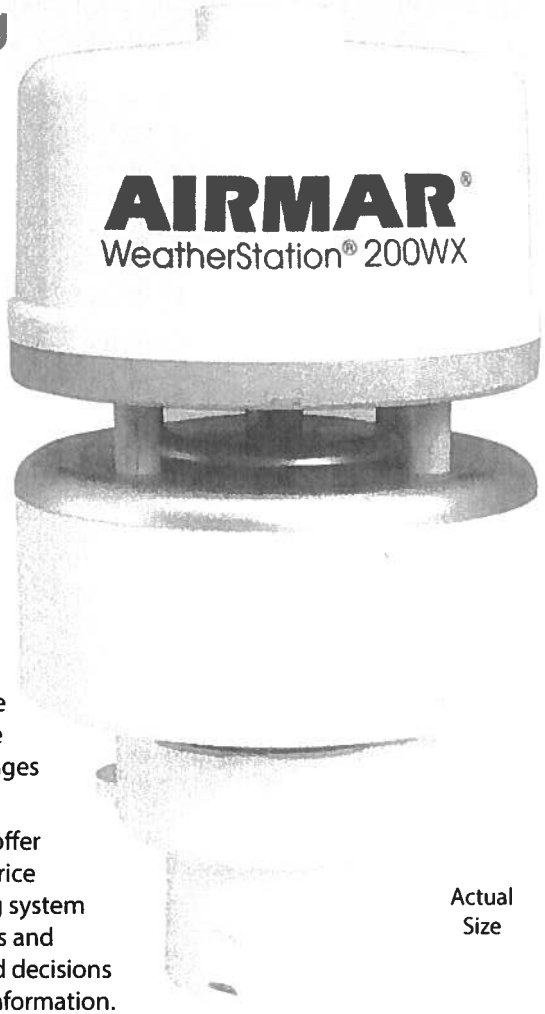
WX Series







WX Ultrasonic WeatherStation® Instruments for Offshore Weather Monitoring



Actual Size

Available Model: 200WX-IPX7

Weather impacts every aspect of operations on offshore platforms, ships, and in ports. Rapid changes in weather and sea conditions make monitoring of both meteorological and oceanographic parameters a critical part of ensuring safety, while also maintaining operational efficiency.

Reliable environmental monitoring is critical for various offshore needs. The numerous sensors contained in the compact size of the 200WX is an attractive feature for installations where space is limited, such as on buoys, USVs, and ASVs.

Having worked with many autonomous vehicle and buoy manufacturers, we have further developed the 200WX to be more robust—meeting the operational challenges of the harsh ocean environment.

The WeatherStation WX Series products offer a truly best-in-class solution at a better price point than any other weather monitoring system on the market today, enabling individuals and professionals the ability to make informed decisions based on real-time site-specific weather information.

FEATURES

The 200WX-IPX7 WeatherStation instrument accurately measures current weather conditions, including:

- Theoretical wind speed and direction
- Air temperature and calculated wind chill
- Barometric pressure
- GPS position, speed over ground, course over ground
- Three-axis solid state compass with dynamic stabilization
- Three-axis rate gyro for rate of turn
- Best-in-class <1° pitch and roll accuracy
- IPX7 waterproof rating
- Current draw: <105mA (1.2W) at 12 VDC
- Available outputs: NMEA 0183 (RS422 or RS232) and NMEA2000® (CAN bus)

AIRMAR® TECHNOLOGY CORPORATION

Achieving Best-in-Class Product Specifications

SPECIFICATIONS

Wind Speed Range:
— 0 knots to 78 knots (0 MPH to 90 MPH, 0 m/s to 40 m/s)
Wind Speed Resolution:
— 0.1 knot (0.1 MPH, 0.1 m/s)
Wind Speed Accuracy @ 0°C to 55°C (32°F to 131°F), no precipitation*:
— Low Wind Speeds:
0-10 knots; 1 knot RMS +10% of reading
(0 MPH to 11.5 MPH; 1.1MPH + 10% of reading)
(0 m/s to 5 m/s; 0.5 m/s + 10% of reading)
— High Wind Speeds:
10-78 knots; 2 knots RMS or 5%, whichever is greater
(11.5 MPH to 90 MPH; 2.3 MPH or 5%, whichever is greater)
(5 m/s to 40 m/s; 1 m/s or 5%, whichever is greater)
Wind Speed Accuracy in wet conditions:**
— 5 knots RMS (5.7 MPH RMS, 2.5 m/s RMS)
Wind Direction Range: 0° to 360°
Wind Direction Resolution: 0.1°
Wind Direction Accuracy @ 0°C to 55°C (32°F to 131°F), no precipitation*:
— Low Wind Speeds (5° RMS typical):
4 -10 knots (4.6 MPH to 11.5 MPH, 2 m/s to 5 m/s)
— High Wind Speeds (2° RMS typical):
> 10 knots (>11 .5 MPH, >5 m/s)
Wind Direction Accuracy in wet conditions (8° RMS Typical):**
>8 knots (>9.2 MPH, >4 m/s)
Compass Accuracy:
— 1° static heading accuracy; 2° dynamic heading accuracy
Pitch and Roll Range / Accuracy: ±50° / <1°
Air Temperature Range*:** -40°C to 55°C (-40°F to 131°F)
Air Temperature Resolution: 0.1°C (0.1°F)
Air Temperature Accuracy:
±1.1°C (±2°F)* @ >4 knots wind (>4.6 MPH wind) (>2 m/s wind)
Barometric Pressure Range:
300 mbar to 1100 mbar (24 inHg to 33 inHg, 800 hPa to 1100 hPa)
Barometric Pressure Resolution: 0.1 mbar (0.029 inHg, 0.1 hPa)
Barometric Pressure Accuracy:
±1 mbar (±0.029 inHg, ±1 hPa) when altitude correction is available
GPS Position Accuracy:
3 m (10') with WAAS/EGNOS (95% of the time)
Operating Temperature Range: -25°C to 55°C (-13°F to 131°F)
Supply Voltage: 9 VDC to 40 VDC
Supply Current (@ 12 VDC):
— (<105 mA) <1.25W —200WX
Weight: 300 grams (0.8 lb)
Communication Interface: NMEA 0183 (RS422 or RS232) and NMEA2000® (CAN bus)****
Mounting Thread Size on Base: Standard 1"-14 UNS (3/4" NPT optional)
Certifications and Standards: CE, IPX7, RoHS, IEC61000-4-2, IEC60945

RMS—Root Mean Square
*When the wind speed is less than 2 m/s (4.6 MPH) and/or air temperature is below 0°C (32°F), wind, temperature, and relative humidity readings will be less accurate.
**Wet conditions include moisture, rain, frost, dew, snow, ice and/or sea spray in the wind channel.
***Temperature and Relative Humidity report invalid during heater operation.
****Airmar has made the address claiming modifications to enable compatibility with the ISO 11783 communication protocol for the agriculture industry - that is based on the SAE J1939 protocol.

PART NUMBERS

200WX: 44-848-1-01, NMEA 0183 (RS422) and NMEA2000® (CAN bus)

200WX: 44-849-1-01, NMEA 0183 (RS232) and NMEA2000® (CAN bus)

* Cables sold separately

Now available on iTunes — OnSiteWX
The innovative App for real-time weather data!

DATA OUTPUT PROTOCOL

NMEA 0183 Sentence Structure

$GPDTM	GPS Datum Reference
$GPGGA	GPS Fix Data
$GPGLL	Geographic Position—Latitude and Longitude
$GPGSA	GNSS DOP and Active Satellite
$GPGSV	Satellites in View
$GPRMC	Recommended Minimum GNSS
$GPVTG	COG and SOG
$GPZDA	Time and Date
$HCHDG	Heading, Deviation, and Variation
$HCHDT	True Heading
$HCTHS	True Heading and Status
$TIROT	Rate of Turn
$WIMDA	Meteorological Composite
$WIMWD	Wind Direction and Speed
$WIMWV	Wind Speed and Angle
$WIMWR	Relative Wind Direction and Speed
$WIMWT	Theoretical Wind Direction and Speed
$YXXDR	Transducer Measurements*

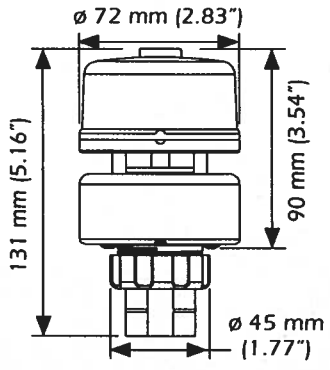
NMEA2000® Output Message Structure

59392	ISO Acknowledgement
060928	ISO Address Claim
126208	Acknowledge Group Function
126464	PGN List
126992	System Time
126996	Product Information
126998	Configuration Information
127250	Vessel Heading
127251	Rate of Turn
127257	Attitude
127258	Magnetic Variation
129025	Position and Rapid Update
129026	COG and SOG, Rapid Update
129029	GNSS Position Data
129033	Time and Date
129044	Datum
129538	GNSS Control Status
129539	GNSS DOPs
129540	GNSS Sats in View
130306	Wind Data
130310	Environmental Parameters
130311	Environmental Parameters
130312	Temperature
130313	Humidity
130314	Actual Pressure
130323	Meteorological Station Data

* See Tech Data for details

DIMENSIONS

200WX IPX7



www.airmar.com

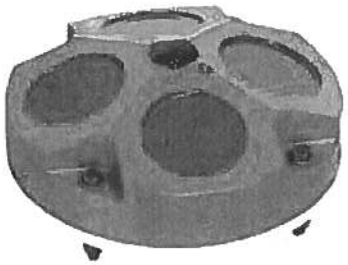
WX_Series_OFFSHORE_rF 09/15/17

AIRMAR® TECHNOLOGY CORPORATION

Teledyne RD Instruments

Workhorse Sentinel

Self-Contained 1200, 600, 300kHz ADCP

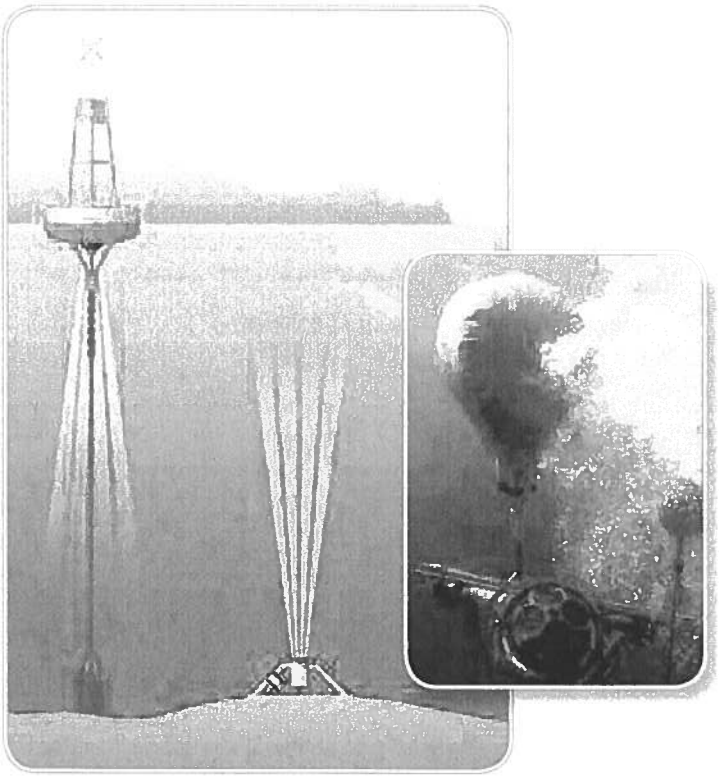


The Industry Standard for High Accuracy Data Collection

The self-contained SENTINEL is Teledyne RD Instruments' most popular and versatile Acoustic Doppler Current Profiler (ADCP) configuration, boasting thousands of units in operation in over 50 countries around the world.

By providing profiling ranges from 1 to 154m, the high-frequency Sentinel ADCP is ideally suited for a wide variety of applications. Thanks to Teledyne RDI's Broadband signal processing, the Sentinel also offers unbeatable precision, with unmatched low power consumption, allowing you to collect more data over an extended period.

The lightweight and adaptable Sentinel is easily deployed on buoys, boats, or mounted on the seafloor. Real-time data can be transmitted to shore via a cable link or acoustic modem, or data can be stored internally for short or long-term deployments. The Sentinel is easily upgraded to include pressure, bottom tracking, and/or directional wave measurement—for the ultimate data collection solution.



PRODUCT FEATURES

- **Versatility:** Direct reading or self contained, moored or moving, the Sentinel provides precision current profiling data when and where you need it most.
- **A solid upgrade path:** The Sentinel has been designed to grow with your needs. Easy upgrades include pressure, bottom tracking, and directional wave measurement.
- **Precision data:** Teledyne RDI's BroadBand signal processing delivers very low-noise data, resulting in unparalleled data resolution and minimal power consumption.
- **A four-beam solution:** Teledyne RDI's 4-beam design improves data reliability by providing a redundant data source in the case of a blocked or damaged beam; improves data quality by delivering an independent measure known as error velocity; and improves data accuracy by reducing variance in your data.

Workhorse Sentinel

Self-Contained 1200, 600, 300 kHz ADCP

TECHNICAL SPECIFICATIONS

Water Profiling	Depth Cell Size[1]	Typical Range[2] 12m **1200kHz**		Typical Range[2] 50m **600kHz**		Typical Range[2] 110m **300kHz**	
	Vertical Resolution	Range[3]	Std. Dev.[4]	Range[3]	Std. Dev.[4]	Range[3]	Std. Dev.[4]
	0.25m	11m	14.0cm/s				
	0.5m	12m	7.0cm/s	38m	14.0cm/s	see note 1	
	1m	13m	3.6cm/s	42m	7.0cm/s	83m	14.0cm/s
	2m	15m[2]	1.8cm/s	46m	3.6cm/s	93m	7.0cm/s
	4m	see note [1]		51m[2]	1.8cm/s	103m	3.6cm/s
	8m					116m[2]	1.8cm/s
Long Range Mode	2m	19m	3.4m/s				
	4m			66m	3.6cm/s		
	8m					154m	3.7cm/s
Profile Parameters	Velocity accuracy	0.3% of the water velocity relative to ADCP ±0.3cm/s		0.3% of the water velocity relative to ADCP ±0.3cm/s		0.5% of the water velocity relative to ADCP ±0.5cm/s	
	Velocity resolution	0.1cm/s		0.1cm/s		0.1cm/s	
	Velocity range:	±5m/s (default) ±20m/s (max)		±5m/s (default) ±20m/s (max)		±5m/s (default) ±20m/s (max)	
	Number of depth cells	1–255		1–255		1–255	
	Ping rate	Up to 10Hz		Up to 10Hz		Up to 10Hz	
Echo Intensity Profile	Vertical resolution	Depth cell size, user configurable					
	Dynamic range	80dB					
	Precision	±1.5dB					
Transducer and Hardware	Beam angle	20°					
	Configuration	4-beam, convex					
	Internal memory	Two PCMCIA card slots; one memory card included					
	Communications	RS-232 or RS-422; ASCII or binary output at 1200-115,200 baud					
Power	DC input	20–50VDC.					
	Number of batteries	1 internal battery pack					
	Internal battery voltage	42VDC (new) 28VDC (depleted)					
	Battery capacity @ 0°C	450 watt hrs					
Standard Sensors	Temperature (mounted on transducer)	Range -5° to 45°C, Precision ±0.4°C, Resolution 0.01°					
	Tilt	Range ±15°, Accuracy ±0.5°, Precision ±0.5°, Resolution 0.01°					
	Compass (fluxgate type, includes built-in field calibration feature)	Accuracy ±2°[5], Precision ±0.5°[5], Resolution 0.01°, Maximum tilt ±15°					
Environmental	Standard depth rating	200m; optional to 500m, 1000m, 6000m					
	Operating temperature	-5° to 45°C					
	Storage temperature (without batteries)	-30° to 60°C					
	Weight in air	13.0kg					
	Weight in water	4.5kg					
Software	TRDI's Windows™-based software included: **WinSC**–Data Acquisition System; **WinADCP**–Data Display and Export						
Available Options	• Memory: 2 PCMCIA slots, total 4GB • Pressure sensor • External battery case • High-resolution water-profiling modes • Bottom tracking or surface referencing track • AC/DC power converter, 48VDC output • Pressure cases for depths up to 6000m • Directional Wave Array • Acoustic Modem • Inductive Modem • **Velocity** for advanced post processing						
Dimensions	228.0mm wide x 405.5mm long *(line drawings available upon request)*						

1 User's choice of depth cell size is not limited to the typical values specified.
2 Longer ranges available.
3 Profiling range based on temperature values at 5°C and 20°C, salinity = 35ppt.
4 BroadBand mode single-ping standard deviation (Std. Dev.).
5 <±1.0° is commonly achieved after calibration.

TELEDYNE RD INSTRUMENTS
Everywhereyoulook™
www.rdinstruments.com

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Les Nertieres 5 Avenue Hector Pintus 06610 La Gaude France
Tel. +33-49-211-0930 • Fax +33-49-211-0931 • Email: rdie@teledyne.com

MOSE-G1000

Datawell - Oceanographic Instruments

Specifications

Motion sensor	Sensor	single GPS (not differential)
	Periods	1 - 100 s (high frequency) 10 - 1000 s (low frequency)
	Precision	1 - 2 cm (high frequency) 5 - 10 cm (low frequency, 1000 s cut-off) 3 - 5 cm (600 s cut-off) 2 - 3 cm (300 s cut-off) all 1σ, lower limit horizontal precision, upper limit vertical precision
	Calibration	not required ever
	Exclusion	Selective Availability (SA, may be switched on by US Department of Defence for strategic reasons) will have the following effect: low frequency motion not resistant to SA high frequency motion period range reduces to 1 - 30 s
Motion data	Data	date, time, local north, local west, local vertical, GPS gap indicator (high and low frequency)
	Resolution	1 mm
	Rate	2 Hz (high frequency) 0.2 Hz (low frequency)
	Latency	approx. 4 min (high frequency) approx. 40 min (low frequency)
	Reference	WGS84
Position	Sensor	GPS
	Precision	5 - 10 m, 1σ
	Rate	every 10 sec.
	Exclusion	SA will reduce position precision to 100 m
	Data	date, time, longitude, latitude, height, HDOP, VDOP
Interface	Port	RS232, NMEA compliant
	Format	NMEA proprietary messages
General	Outer dimensions	height 0.16 m (incl. GPS ant.) base plate 0.20 m × 0.20 m
	Weight	approx. 5 Kg
	Housing material	stainless steel AISI316
	Power	10 – 30 V, 1.5 W

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SEA-BIRD SCIENTIFIC

sea-birdscientific.com
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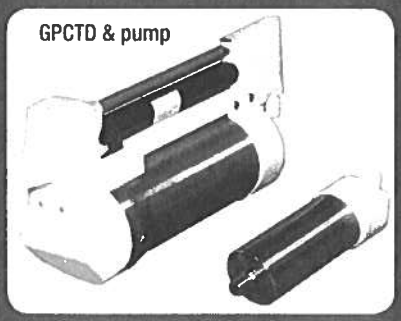
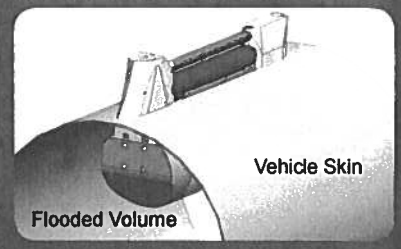
Glider Payload CTD (optional DO)

GPCTD





The GPCTD is a modular, low-power profiling instrument for autonomous gliders with the high accuracy necessary for research, inter-comparison with moored observatory sensors, updating circulation models, and leveraging data collection opportunities from operational vehicle missions. The externally powered, continuously pumped CTD consumes only 175 mW recording at 1 Hz (190 mW for real-time data). One Alkaline D cell could operate the CTD continuously for 114 hours (9.5 days at 50% duty cycle, profiling continuously at 1 Hz on every glider upcast); one Lithium DD cell could provide 48 days continuous profiling on every upcast. Data are output in engineering units.

The GPCTD can optionally be equipped with an SBE 43F Dissolved Oxygen sensor, but does not support other auxiliary sensors.

Features

- Conductivity, Temperature, Pressure, and (optional) Dissolved Oxygen (modular SBE 43F DO sensor).
- Pressure-proof module allows for exchange of CTD (and DO sensor) without opening glider pressure hull.
  - Assembly visible on glider exterior consists of intake sail (with integral T-C duct and anti-foulant device), internal field conductivity cell, and exhaust sail with pump connections. Intake sail allows measurements to be made outside vehicle's boundary flow (where old water is thermally contaminated by vehicle). Pump pulls water into intake sail, past temperature sensor, through anti-foulant device and conductivity cell, and out exhaust sail (preventing exhaust re-circulation and Bernoulli pressure differences from changing flow rate). Outside of conductivity cell is free-flushed. minimizing salinity errors. Connecting neck, electronics, pump, and DO sensor are in a flooded space inside hull, placed so that tubing lengths are minimized (between conductivity cell and pump intake, and from pump outlet to sail exhaust fitting), sharp bends are avoided, and pump and tubing are oriented to avoid trapping air that will interfere with pump priming.
- RS-232 interface, memory, real-time output, no batteries (for use on vehicles that can supply power).
- Four sampling modes: Continuous (1 Hz), Fast Interval (5-14 sec intervals), Slow Interval (15-3600 sec intervals; CTD only), and Polled.
  - Continuous sampling time series suitable for corrections (e.g. response filtering, alignment, thermal mass correction) for dynamic errors in data.
  - File headers (maximum 1000) contain beginning and ending sample numbers, sampling mode and interval, and starting date/time.
- Unique flow path, pumping regimen, and expendable anti-foulant device, for maximum bio-fouling protection.
- Pump-controlled, T-C ducted flow to minimize salinity spiking.
- Depths to 350 or 1500 m.
- Field-proven design based on Argo float CTD, with more than 10,000 Argo float CTDs deployed.
- Seasoft© V2 Windows software package (setup, data upload, data processing).
- Five-year limited warranty.

Components

- Unique internal-field conductivity cell permits use of expendable anti-foulant device, for long-term bio-fouling protection.
- Aged and pressure-protected thermistor has a long history of exceptional accuracy and stability.
- Pressure sensor with temperature compensation is available in four strain-gauge ranges (to 2000 m).
- (optional) Oxygen sensor is field-proven, individually calibrated SBE 43F Dissolved Oxygen sensor.
- For Continuous and Fast Interval sampling, pump runs continuously, providing bio-fouling protection and correlation of CTD (and optional DO) measurements.

Options

- Strain-gauge pressure sensor in one of 4 ranges (to 2000 m).
- SBE 43F interface in GPCTD, and modular SBE 43F Dissolved Oxygen Sensor in 600 or 7000 m housing.
- Plastic (350 m) or titanium (1500 m) housing.

Measurement Range

Conductivity	0 to 9 S/m (calibrated 0 to 6 S/m)
Temperature	-5 to +42 °C (calibrated +1 to +32 °C)
Pressure	0 to 100 / 350 / 1000 / 2000 m (calibrated to full scale)

Initial Accuracy

Conductivity	In calibration range: ± 0.0003 S/m; Outside calibration range: ±0.0010 S/m [1]
Temperature	In calibration range: ± 0.002 °C; Outside calibration range: ±0.004 °C [1]
Pressure	In calibration range: ± 0.1% of full scale range

[1] *Due to fit extrapolation errors.*

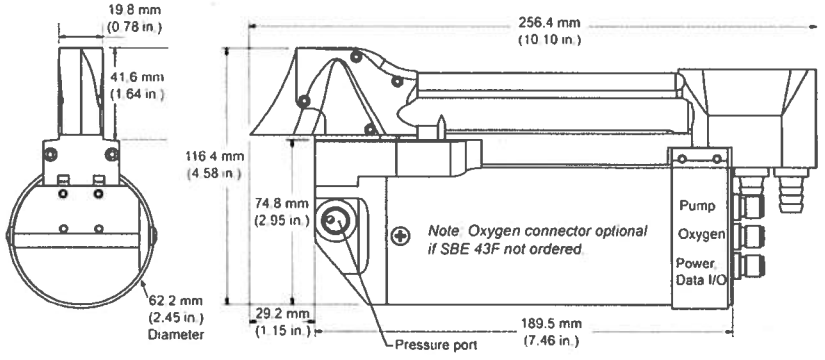
Typical Stability

Conductivity	0.0003 S/m per month
Temperature	0.0002 °C per month
Pressure	± 0.05% of full scale range per year

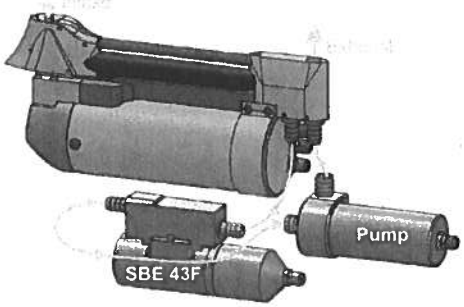
Resolution

Conductivity	0.00001 S/m
Temperature	0.001 °C
Pressure	0.002% of full scale range

	1 Hz (1 sample/sec) maximum
	8 to 20 VDC nominal. CTD only: 175 mW recording at 1 Hz; 190 mW transmitting real-time data. CTD & DO: 265 mW recording at 1 Hz; 280 mW transmitting real-time data.
	8 Mbytes; 699,000 samples CTD (194 hours at 1 Hz) or 559,000 samples of CTD & DO (155 hours at 1 Hz)
	Real-time and uploaded data in decimal or Hex: S/m, °C, decibars, DO frequency.
	CTD & pump: Plastic, 350 m, in air 1.0 kg, in water 0.2 kg; Titanium, 1500 m, in air 1.2 kg, in water 0.4 kg. SBE 43F DO sensor: Plastic, 600 m, in air 0.3 kg, in water 0.1 kg; Titanium, 7000 m, in air 0.4 kg, in water 0.2 kg.



Forward End View — Side View



With SBE 43F Oxygen Sensor (plumbing approximate)

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www.seabird.com

Papahānaumokuākea Marine National Monument
Compliance Information Sheet

1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant):

William Middleton	Hawaii Operations Manager	Liquid Robotics
	808-354-9170	billy.middleton@liquid-robotics.com
Nicholas Seabaugh	Senior Contracts Manager	Liquid Robotics
	408-636-5058	nicholas.seabaugh@liquid-robotics.com
Mark Bindon	VP of Mission Services	Liquid Robotics
	408-636-4277	mark.bindon@liquid-robotics.com
Lani Kamauu Yamasaki, Community Outreach/Community Development, Liquid Robotics		
	808-987-8868	lycd@mac.com
Charles (Chuck) Shaver, Senior Support Engineer		Liquid Robotics
	808-354-9170	chuck.shaver@liquid-robotics.com

2. Specific Site Location(s): (Attach copies of specific collection locations):
Vicinities of Nihoa Island and Mokumanamana Island, plus transit to/from.

3. Other permits (list and attach documentation of all other related Federal or State permits):
NA

3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances surrounding the violation or permit suspension, amendment, modification or revocation.
NA

4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information):
Internally funded by Liquid Robotics. No official budget exists.

5. Time frame:
Activity start: June
Activity completion: July/August

Dates actively inside the Monument:
From: Mid June
To: Mid July (Anticipating being in the Monument during Makali'i's time in the Monument (2-4 weeks? TBD) plus some extra time (1-2 weeks) on entry and exit depending on transit routes and speeds.

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application:
Our transit and entrance dates are dependent on the Makali'i's schedule, which is still TBD.

Personnel schedule in the Monument: None, Wave Glider (ocean robot) only.

6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:
No personnel to enter. If it were to become necessary, we are financially backed by Boeing.

7. Check the appropriate box to indicate how personnel will enter the Monument:
NA
☐ Vessel
☐ Aircraft

Provide Vessel and Aircraft information: NA

8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):

☐ Rodent free, Date:
☐ Tender vessel, Date:
☐ Ballast water, Date:
☐ Gear/equipment, Date:
☐ Hull inspection, Date:

The Wave Glider will be cleaned of all rodents, water, biofouling, etc. during the week prior to launch for transit from Kawaihae.

9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):
NA
Vessel name:
Vessel owner:
Captain's name:
IMO#:
Vessel ID#:
Flag:
Vessel type:

Call sign:
Embarkation port:
Last port vessel will have been at prior to this embarkation:
Length:
Gross tonnage:
Total ballast water capacity volume (m3):
Total number of ballast water tanks on ship:
Total fuel capacity:
Total number of fuel tanks on ship:
Marine Sanitation Device:
Type:

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems:
NA

Other fuel/hazardous materials to be carried on board and amounts:
Lithium Ion rechargeable batteries, see attached MSDS. Wave Gliders have qty 10 of, 98 WHr, NH2054HD34 standard, and additional packs of 10 can be added as auxiliary power. This deployment will likely have either 30 or 40 total batteries (3 to 4 total "packs") depending on final configuration, which is normal for Wave Glider operations. Each battery weighs 0.97 lb, making for a total of 30 or 40 lb.

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type:
NA

VMS Email:
Inmarsat ID#:

* Individuals MUST ENSURE that a type-approved VMS unit is installed and that its automatic position reports are being properly received by the NOAA OLE system prior to the issuance of a permit. To make sure your VMS is properly configured for the NOAA OLE system, please contact NOAA OLE at (808) 203-2503 or (808) 203-2500.

* PERMITS WILL NOT BE ISSUED TO INDIVIDUALS ENTERING THE MONUMENT VIA VESSEL UNTIL NOAA OLE HAS CONTACTED THE MONUMENT PERMIT COORDINATOR WITH A 'POSITIVE CHECK' READING.

10. Tender information:

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors: NA

Additional Information for Land Based Operations

11. Proposed movement of personnel, gear, materials, and, if applicable, samples: NA

12. Room and board requirements on island: NA

13. Work space needs: NA

DID YOU INCLUDE THESE?

- ☐ Map(s) or GPS point(s) of Project Location(s), if applicable
- ☐ Funding Proposal(s)
- ☐ Funding and Award Documentation, if already received
- ☐ Documentation of Insurance, if already received
- ☐ Documentation of Inspections
- ☐ Documentation of all required Federal and State Permits or applications for permits

DAVID Y. IGE
GOVERNOR OF HAWAI'I

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

ROBERT MASUDA
FIRST DEPUTY

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 HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAI'I 96813

May 24, 2019

TO: Division of Aquatic Resources File

THROUGH: Suzanne D. Case, Chairperson

FROM: Maria Carnevale
Papahānaumokuākea Marine National Monument

SUBJECT:
DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO WILLIAM MIDDLETON, LIQUID ROBOTICS, INC. FOR ACCESS TO STATE WATERS TO DEPLOY AN UNMANNED AUTONOMOUS WAVE GLIDER FOR OCEANOGRAPHIC RESEARCH UNDER PERMIT PMNM-2019-015.

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, HAR:

Project Title:
Papahānaumokuākea Marine National Monument Research Permit to William Middleton, Liquid Robotics, Inc. for Access to State Waters to Deploy an Unmanned Autonomous Wave Glider for Oceanographic Research.

Permit Number: PMNM-2019-015

Project Description:

The activities covered under this permit would occur between June 1, 2019 and May 31, 2020.

INTENDED ACTIVITIES
The primary purpose of the project is to deploy a wave-powered autonomous marine robot (Wave Glider) to collect weather and ocean current data in support of the organization, the proposed apprentice non-instrumented navigator training sail to the Monument aboard the traditional Native Hawaiian double-hull voyaging canoe Makali'i by Nā Kālai Wa'a

(separate permit application PMNM-2019-009). The training sail is tentatively scheduled for June 2019 and the applicant proposes to have the Wave Glider enter the Monument as the Makali'i is in transit toward the Monument and provide weather and wave data from up ahead of the canoe's course, and arrive near Mokumanamana at roughly the same time.

In addition to supporting the training sail with oceanographic and weather observations, the applicant has proposed to deploy the Wave Glider to support other projects as needed in the collection of oceanographic data (i.e., wave height; direction; period and spectrum; water temperature; current depth and vector; dissolved oxygen; salinity, etc.).

The Wave Glider is a robust platform that can remain at sea for up to 12 months monitoring meteorology and ocean current data in a similar fashion to a fixed/moored buoy while also acting as a VEMCO tracker and receiver (acoustic telemetry technology). The Wave Glider consists of a 210 centimeters by 60 centimeters float and a 40 centimeters by 191 centimeters sub (with 107 centimeters wide wings) connected by a two (2) meter umbilical. It weighs 150 kg (330 lbs) and is powered by wave action and solar-charged lithium batteries. No measurable impacts to Monument resources are anticipated, as there would be no human presence in the Monument or collecting or removing Monument resources.

This project would benefit the Monument by providing real time meteorological and oceanographic data for the apprentice training sail to PMNM proposed by Nā Kālai Wa'a as well as other projects as needed. The activity would directly support the Monument Management Plan (MMP) Marine Conservation Science (MCS) Action Plan Strategy MCS-1: Continue and enhance research, characterization and monitoring of marine ecosystems (PMNM MMP Vol. 1, p. 122, 2008).

Consulted Parties:
The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i 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, the Office of Hawaiian Affairs (OHA), and the PMNM Native Hawaiian Cultural Working Group. In addition, the permit application has been posted on the Monument Web site since April 18th, 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 HAR § 11-200-8, including the criteria used to determine significance under HAR § 11-200-12, 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, including surveys and collections, have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a

group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. Since this permit involves an activity that is precedent to a later planned activity (i.e. the recovery of Subsurface Temperature Recorders (STRs), Calcification Accretion Units (CAUs), and Bioerosion Monitoring Units (BMUs)), the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and § 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. HAR §11-200-8.A.5. exempts the class of actions which 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 class has been interpreted to include research, falling under Exemption Class #5, Exempt Item #15 which is interpreted to include mapping activities under Exemption Class #5, Exempt Item #2 "Non-destructive data collection and inventory, including field, aerial and satellite surveying and mapping." (DEPARTMENT OF LAND & NATURAL RESOURCES, EXEMPTION LIST, published June 5, 2015).

As discussed below, no significant disturbance to any environmental resource is anticipated in the sampling of Monument resources. Thus, so long as the below considerations are met, an exemption class 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." HAR § 11-200-8.B. 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. HAR § 11-200-12. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

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 would 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, nor did it raise any cultural concerns, that would occur as a result of these activities.

All other permits active during that time period and at those locations would be dealing with different organisms or habitat types and would not overlap. Of these proposed permits, none are intended to duplicate the collections and scope of the Applicant's research. The culmination of

these permits, and their disparate activities, occurring throughout the Monument, is not anticipated to have significant cumulative impacts.

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 be Minimal and Insignificant. 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 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.