Papahānaumokuākea Marine National Monument

CONSERVATION AND MANAGEMENT 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: David Wilcox
Affiliation: National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC)/Wallops Flight Facility (WFF) Range and Mission Management Office (RMMO), Low Density Supersonic Decelerators (LDSD) Project, Project Manager (GS15)

Permit Category: Conservation and Management
Proposed Activity Dates: every June 1 through August 31, 2015 - 2019

Proposed Method of Entry (Vessel/Plane): up to 3 commercial vessels & 2 Navy aircraft

Proposed Locations: within a 320 kilometer (approximately 200 mile) arc centered on Makaha Ridge, Kauai

Estimated number of individuals (including Applicant) to be covered under this permit: 35
Estimated number of days in the Monument: 8

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…
allow for PMNM access to recover decelerator technologies flight hardware in the event the decelerator enters and lands in PMNM waters. This activity supports full scale testing of decelerator technologies at representative conditions to those found on the planet Mars. The decelerator technologies developed as part of the Low Density Supersonic Decelerator (LDSD) project could enable the following on future missions to Mars:

- Placement of more mass on the Martian surface in a single landing
- Make more of the Martian surface accessible for exploration
- Increase landing accuracy on the Martian surface

The focus of the LDSD project's campaign is to validate a 100 feet (ft.) diameter Supersonic Ring Sail (SSRS) parachute behind a 19 ft. 8 inches (in.) attached torus Supersonic Inflatable Aerodynamic Decelerator (SIAD).

b.) To accomplish this activity we would ….

The LDSD Project seeks, as a contingency condition, to potentially drop and recover floating expended flight hardware from up to two scheduled SFDTs in 2015 (with the possibility for up to 2 additional flights per summer [June through August] through 2019) in the Open Ocean area within the boundary of PMNM, but outside of the 3 NM Special Management Area surrounding Nihoa Island. This operations area would not include the 170 acres of Nihoa Island and the Special Management Area within the 3 NM surrounding Nihoa Island. In order to circumvent this area, one of two scenarios would occur: (1) the LDSD Program would initiate the Supersonic Flight Dynamic Test (SFDT) in such a manner that expended flight hardware would be recovered or sink before drifting into the Special Management Area or (2) the flight system would overfly Nihoa and the Special Management Area and the Test Vehicle would be dropped outside the Special Management Area surrounding Nihoa Island. Therefore, expended flight hardware would not be deposited on Nihoa Island or within the Special Management Area surrounding the Island. Enclosure 1A highlights the area within PMNM in which the LDSD Project is requesting permission to potentially drop and recover floating expended flight hardware within the boundary of PMNM during the months of June, July, and August 2015 through 2019. This overlay of the hardware splashdown area was derived from negotiations between LDSD Project, U.S. Navy (USN) Range Management, and the Federal Aviation Administration (FAA) within the 170 NM arc defining the TV to PMRF telecommunications limit plus and additional 6 NM buffer to account for a conservative estimate of the distance the floating hardware could drift with surface currents for the 12 hours it would take for recovery vessels to reach them.

In accordance in with the National Environmental Policy Act (NEPA), in May 2013 NASA prepared an Environmental Assessment (EA) for the proposed LDSD Technology Demonstration Mission (TDM) (http://www.govsupport.us/nasaldsdea/default.aspx). Based on the EA, NASA issued a Finding of No Significant Impact (FONSI) on 29 May 2013. Section 2.6.2 of the May 2013 LDSD EA, details the site selection process for the LDSD Project. NASA began evaluating sites for the LDSD Program in 2011; originally analyzing twelve global candidate test sites. The USN Pacific Missile Range Facility (PMRF) in Kauai, Hawaii was considered the most viable launch range and, therefore, was selected as the host test range for the execution of the SFDT portion of the LDSD Project. Additionally, please refer to the enclosed PMNM Advisory Council White Paper for more details (Enclosure 1).

Each nominal SFDT flight would consist of releasing from PMRF a 34 million cubic foot (mcf) scientific balloon that carries the TV to the minimum desired float altitude of 120,000 ft (Figure 1 of Enclosure 1). At float altitude, the balloon fully inflates to approximately 400 ft tall and 450 ft in diameter. The TV is then released, initiating the mission sequence. Once the TV is dropped, a signal is sent that separates the flight train from the balloon and in the process, ripping the balloon to allow descent. After the TV drops, small solid-fueled rocket motors ignite and stabilize the TV prior to the main motor ignition. The main motor is an Orbital Alliant Techsystems, Incorporated manufactured Star 48B, a long nozzle solid-fueled rocket engine. The Star 48B ignites propelling the TV upwards to an altitude of approximately 180,000 ft at a speed of approximately Mach 4. The TV then deploys a torus (doughnut-shaped) tube called the Supersonic Inflatable Aerodynamic Decelerator (SIAD) to slow its velocity to approximately Mach 2. The TV then deploys the 100-ft diameter supersonic parachute, which carries the TV safely to a controlled oceanic impact in a pre-coordinated operational area off the west coast of the Island of Kauai, Hawaii.

Almost all expended flight hardware is then recovered from the ocean, with the exception of the balloon flight train (Enclosure 2, "Balloon Flight Train Assembly, Summary"). This flight train connects the TV to the balloon. The flight train, that separates from the balloon and the TV, weighs approximately 830 pounds; is approximately 990 feet long; and consists of a burst parachute (a safety instrument), sensors, connections, and Kevlar® cabling. This system would sink rapidly in the ocean and would be almost impossible to locate.

The balloon system carries approximately 250 pounds of 0.3 to 0.5 mm steel shot ballast (roughly the diameter of beach sand) that would be slowly and completely released during the ascent phase. Ballast released during ascent would travel in the upper atmospheric winds and be dispersed over hundreds of miles. It is, therefore, highly unlikely that ballast material would enter PMNM. If, in the unlikely event that all ballast is not released during ascent, the leak proof container would be recovered with the balloon system.

Whether the SFDT is nominal or off nominal, the intention is to drop the TV and scientific balloon within an approximately 170 NM arc centered on the PMRF instrumentation site located on Makaha Ridge, Kauai. This arc distance is defined by the TV to PMRF telecommunications limitation. A 6 NM buffer would be added to telecommunications limit (resulting in a 176 NM arc) to account for a conservative estimate of the distance the floating hardware could drift with surface currents for the 12 hours it would take for recovery vessels to reach them.

c.) This activity would help the Monument by …

In the event the LDSD enters and lands in the Monument, recovery activities would ensure protection of Monument resources. In addition, NASA is willing to discuss potential avenues to partner with the Monument in support of outreach and/or education activities that would mutually benefit both the Monument's and NASA's mission goals.

Other information or background:

The focus of the successful 2014 LDSD Project campaign was to validate the SFDT test architecture itself. The SFDT executed on 28 June 2014 from the USN's PMRF was accomplished within existing constraints outlined in the LDSD project's EA and USN's Range Safety Operational Plan (RSOP). However, there were several lessons learned during this first campaign.

Although the initial two week launch window opened on 2 June 2014, the LDSD project experienced daily upper wind conditions that preempted all launch attempts during window. The LDSD project and USN Range Management scheduled a second launch window at the end of June 2014 requiring redeployment of project personnel and support assets. The first day of the second launch window opened on 28 June 2014 and provided a valid opportunity for launch. The predicted scientific balloon trajectory was along a path north of Niihau Island (Figure 3 of Enclosure 1). The trajectories north of Niihau provide much less time at float and thereby less time for reaction to unknowns. The LDSD project accepted the risks associated with this northern trajectory and moved forward with a launch attempt. The LDSD project and USN Range Safety identified a nominal TV drop location from the scientific balloon for the execution of the SFDT. After numerous decision meetings, all Go / No Go criteria were green and the scientific balloon was released from the launch site at PMRF.

The combined flight system (TV and scientific balloon) is continually tracked by PMRF ground instrumentation providing positional data to the USN Range Safety Organization. The present position of the flight system along with individual impact dispersions (which is a variable circle with a maximum radius of 14 NM) for the scientific balloon, detached flight train on recovery parachute, and TV are overlaid onto a display system. The impact dispersions are compared to restrictions imposed on the LDSD project due to Niihau and Kauai Islands (public safety criteria), FAA boundaries (public safety criteria), and PMNM (environmental safety criteria).

The 2014 SFDT was nominal except for slightly higher upper air winds speeds than predicted and the scientific balloon's ascent being slightly slower than predicted. The combination of the northern trajectory, higher than predicted winds, and slower than predicted ascent shortened the available decision window for initiation of the SFDT. Had there been any significant delay in the mission countdown (e.g. non-participating vessels in the range, hardware issue, etc.), then the USN Range Safety Organization would have issued a mission termination order, resulting in an immediate drop of the TV into the ocean in order to prevent the trajectory from crossing into PMNM.

The LDSD project demonstrated the ability to accurately predict the scientific balloon's climb out trajectory and to recover all floating expended flight hardware (see Figures 4 and 5 of Enclosure 1). The hard lessons learned from the 2014 campaign was that there is the possibility of going weeks without acceptable conditions for launch. The northern trajectories represents significant risk of early termination unless mitigated. One potential path of mitigating the risk is seeking a PMNM entry permit for the SFTD campaigns.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Wilcox, David A.

Title: NASA GSFC/WFF LDSD Project Manager

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

Mr. Eric Littleton
LDSD Project Recovery Director
[redacted]

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

[redacted]

Phone: [redacted]

Fax:

Email: [redacted]

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

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

NASA GSFC/WFF, Range and Mission Mangement Office

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):

Each of the three vessels listed below either already has a PMNM-approved VMS system installed and operational or has a system on order that will be installed and operational prior to entering the Monument:

Vessel Kahana
4 – 6 Ship Crew from Hawaii Resources Group
3 – 4 Explosive Ordnance Disposal (EOD) Technicians from Naval Station Pearl Harbor
2 – 3 Flight Hardware Subject Matter Experts from NASA Jet Propulsion Laboratory
Total not to exceed 11 passengers
VMS System:
Sailor Inmarsat 150 communication unit
Sailor 3026D VMS Gold tracking unit
(already installed and operational)

Vessel Honua
4 – 6 Ship Crew from Hawaii Resources Group
VMS System:
Sailor Inmarsat 150 communication unit
Sailor VMS 3027D Gold tracking unit
(on order)

Vessel Manao II
3 Ship Crew from Hawaii Resources Group
VMS System:
Sailor Inmarsat 150 communication unit
Sailor VMS 3027D Gold tracking unit
(on order)

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			

☐ Remaining ashore on any island or atoll (with the exception of Midway & Kure Atolls 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:
Project could occur within a 320 km arc centered at Makaha Ridge, Kauai, excluding all State waters.

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:***
In the event the TV and/or scientific balloon lands or drifts into the PMNM boundary as a result of the SFDT, NASA is requesting access to PMNM to recover floating expended flight hardware (see Enclosure 2 for description of flight hardware not to be recovered and Enclosure 3 for descriptions of flight hardware to be recovered). The LDSD Project seeks to potentially drop and recover floating expended flight hardware from up to two scheduled SFDTs in 2015 (with the potential for up to 2 additional flights per sum [June to August] through 2019) in the Open Ocean area within the boundary of PMNM, but outside of the 3 NM Special Management Area surrounding Nihoa Island. Enclosure 1A highlights the area within PMNM in which the LDSD project is requesting permission to operate. This overlay of the hardware splashdown area was derived from negotiations between LDSD Project, U.S. Navy (USN) Range Management, and the Federal Aviation Administration (FAA) within the 170 NM arc defining the TV to PMRF telecommunications limit plus and additional 6 NM buffer to account for a conservative estimate of the distance the floating hardware could drift with surface currents for the 12 hours it would take for recovery vessels to reach them.

The purpose of the LDSD Project is to support full-scale testing of decelerator technologies at representative conditions to those found on the planet Mars. The decelerator technologies developed as part of the LDSD project could enable the following on future missions to Mars:

- Placement of more mass on the Martian surface in a single landing
- Make more of the Martian surface accessible for exploration
- Increase landing accuracy on the Martian surface

The focus of the LDSD project's campaign is to validate a 100 ft. diameter supersonic parachute behind a 19 ft. 8 in. attached torus-shaped SIAD. The validation of the supersonic parachute requires execution of a SFDT from the USN PMRF in a pre-coordinated operational area off the west coast of the Island of Kauai, Hawaii.

Each nominal SFDT would consist of releasing from PMRF a 34 mcf scientific balloon that carries a TV to the minimum desired float altitude of 120,000 ft. (Figure 1 of Enclosure 1). At float altitude, the balloon fully inflates to approximately 400 ft. tall and 450 ft. in diameter. The TV is then released, initiating the mission sequence. Separate sets of solid-fueled rocket motors first stabilize the TV, and then propel the TV upwards to an altitude of approximately 180,000 ft. at a speed of approximately Mach 4. The TV then deploys a doughnut-shaped tube called the SIAD to slow its velocity to approximately Mach 2. The TV then deploys the 100 ft. diameter supersonic parachute, which carries the TV safely to a controlled oceanic impact, while the balloon and balloon flight train separate and splashdown.

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

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?

The proposed activities would be carried out with strict safeguards for the natural, cultural and historic resources of the Monument as required by Presidential Proclamation 8031, other applicable laws, and agency policies and standard operating procedures. Early and ongoing coordination of proposed activities would occur between NASA, the USN, Monument managers and all other relevant partners. NASA will ensure full participation in all pre-access permit and cultural briefings required each year prior to access to the Monument as well as strict adherence to all relevant Monument Best Management Practices (BMPs).

The notional predicted trajectories of the balloon from PMRF include possible over-flight of Nihoa Island, the Special Management Area around Nihoa Island, and the eastern-most part of PMNM. Although, fine control of the balloon's altitude is possible by releasing ballast material or venting helium, trajectory control (i.e., steering) cannot be achieved; the balloon system would follow the prevailing wind patterns encountered during its flight. These wind patterns were part of the computational algorithms used during the Monte Carlo simulations utilized to project flight trajectories.

The Monte Carlo method is a problem solving technique which approximates the probability of certain outcomes by running multiple trial runs, called simulations, using random variables. Monte Carlo simulations were employed to take an identified set of variables (e.g., wind patterns) representing real world conditions that could affect the LDSD flight and used computational algorithms to find potential outcomes (i.e., flight trajectories) of “what-if” scenarios. These scenarios were not screened against the safety and mission success criteria, so several of these trajectories would not be executed under the project’s established Go/No Go criteria (e.g., safety restrictions, proper weather conditions, operational status of all LDSD subsystems, telemetry checks, and readiness of recovery systems).

Under the assumption that all possible trajectories were allowed to fly, NASA estimates the balloon system has approximately a 0.4% chance of reaching float altitude within PMNM and a 20% chance of overflying PMNM after reaching float altitude (e.g., 110,000 ft). These probabilities are reduced when NASA and the U.S. Navy apply the project’s established Go/No Go criteria. These Go/No Go test rules eliminate trajectories that are predicted to fly out directly over large populated areas or follow a trajectory outside boundaries set by NASA, the U.S. Navy, and the FAA.

NASA has a vested interested in recovering the floating expended flight hardware including the scientific balloon, the TV, the flight imagery recorder, and the SIAD. Enclosure 3, "Flight Hardware to be Recovered" gives a detailed description of each of these systems. High speed and high resolution memory data storage devices for each flight are onboard the TV and must be recovered. Part of the flight reconstruction process is physical examination of the actual decelerators, so those too must be recovered. Therefore, accurate tracking information is captured and analyzed in real-time starting at launch of the scientific balloon, during execution of the SFDT, through splash down.

The recovery concept of operations has been demonstrated. During the 2014 campaign, the NASA and USN team demonstrated the ability to precisely predict and track the scientific balloon, TV, and other associated flight hardware through splash down. Lessons learned from the 2014 campaign will be leveraged in the remaining demonstration tests to improve the project’s prediction, tracking, and recovery performance. The process improvements being implemented for the 2015 through 2019 campaigns represent the adequate safeguards being submitted for consideration.

Almost all expended flight hardware is recovered from the ocean, with the exception of the balloon flight train (Enclosure 2, "Balloon Flight Train Assembly, Summary"). This flight train connects the TV to the balloon. Once the TV is dropped, a signal is sent that separates the flight train from the balloon and in the process, ripping the balloon to allow descent. The flight train weighs approximately 830 pounds; is approximately 990 feet long; and consists of a burst parachute (a safety instrument), sensors, connections, and Kevlar® cabling. This system would sink rapidly in the ocean and would be almost impossible to locate.

In August 2014, NASA, in consultation with the National Science Foundation and the National Marine Fisheries Service, finalized an Initial Environmental Evaluation/Environmental Assessment of Southern Hemisphere Ultra Long Duration Ballooning Operations Expansion (accessible online at http://sites.wff.nasa.gov/code250/docs/ULDB/ULDB%20Southern%20Hemi%20IEE-EA%20FINAL.pdf) which found no significant impact to environmental resources from scientific balloons designed to sink after performing in the southern hemisphere (between the 29°S and 65°S latitude bands).

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 assessed in the 2013 LDSD EA, NASA does not anticipate direct, indirect, secondary, or cumulative effects (either beneficial or detrimental) to Monument cultural, natural, and historic resources, qualities, or ecological integrity. Section 4.3.2.5 of the EA stated that "…activities would not result in any direct impacts on the coral or degradation of water/sediment quality in the vicinity of the corals. PMRF strictly controls launches and does not permit an exercise to proceed until the range is determined clear after consideration of inputs from ships' sensors, visual surveillance of the range from aircraft and range safety boats, radar data, acoustic information from a comprehensive system of sensors, and surveillance from shore. Implementation of these controls minimizes the potential for cumulative impacts to marine species. No substantial adverse cumulative impacts are anticipated from the planned LDSD launches. Implementation of the Proposed Action in conjunction with other past, present, and reasonably foreseeable future actions will not result in cumulative effects on cultural resources within the Open Ocean Area. Any submerged features that might be within this area are at considerable depth, and the potential for disturbance is extremely remote."

In addition, NASA is willing to discuss potential avenues to partner with the Monument in support of outreach and/or education activities that would mutually benefit both the Monument's and NASA's mission goals. NASA staff have reached out to NOAA ONMS staff in efforts to begin discussions regarding potential support for education and/or outreach activities and hope to continue discussions with the broader Monument managing agencies.

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.

There is no practicable alternative to allowing for this proposed action to occur within the Monument. Once at float altitude, there are common wind conditions that could push the scientific balloon into PMNM before attaining the altitude needed to execute an SFDT. Allowing Monument access to the LDSD project team would ensure timely and safe recovery of any floating flight hardware that entered the Monument as well as would allow NASA to conduct a full-test of the decelerator technologies under development.

As previously mentioned, there are common wind conditions that could push the scientific balloon into PMNM before attaining the altitude needed to execute an SFDT. Allowing balloon flights over the Monument would give the LDSD Project additional flight opportunities based on predicted balloon trajectories and avoid terminating a healthy flight vehicle in the event that contingencies preclude a timely TV drop (e.g., non-participating vessels in the range, stratospheric wind speeds are under predicted). Additionally, the TV is notionally launched in a northeasterly to easterly direction from the scientific balloon which may put mission-critical cameras at risk of pointing into the sun. The TV's on-board high-speed and high-resolution cameras are used to measure parachute shape versus flight time. The proposed splashdown area within the Monument would allow the TV to be launched in a more eastward or potentially southeastwardly direction such that the cameras' field of view would not be exposed to sun glare. Without the option of splashdown and recovery in the Monument, the probability that the SFDT would fail to meet mission objectives, due to an absence of proper imaging, is higher.

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

NASA does not anticipate adverse impacts on Monument cultural, natural, or historic resources, qualities, or ecological integrity. On the contrary, NASA's ability to quickly and safely recover floating flight hardware after splashdown would ensure minimal if any impact to Monument resources and could be considered an appropriate management action to safeguard Monument resources in the event of a landing within PMNM boundaries. In addition, participants will ensure that all Monument BMPs are followed to ensure safety and protection of Monument natural and cultural resources. NASA will also work with the USN to establish appropriate mission rules of engagement to further ensure safety and protection of Monument natural and cultural resources.

In addition, as expressed by the Space Studies Board's Committee on the Planetary Science Decadal Survey in "Vision and Voyages for Planetary Science in the Decade 2013-2022", a technology development program is considered one of the highest priority activities for the upcoming decade in support of the Mars Exploration Program. The report emphasized the need for a focused technology program that includes the development of new and improved capabilities for entry, descent, and landing in a variety of surfaces and atmospheres including Venus and Mars. The Space Studies Board further elaborates that the continued success of NASA planetary exploration is dependent on a "robust, stable technology development program" emphasizing key investment technologies that do not currently exist. (Space Studies Board, 2011; http://www.nap.edu/openbook.php?record_id=13329).

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

NASA would only enter the Monument to recover floating expended flight hardware as demonstrated in the 2014 SFDT mission (see Figures 4 and 5 of Enclosure 1). NASA would deploy three recovery vessels to anchor at Test Support Positions (TSPs) selected to minimize the recovery operations timeline. Immediately upon splashdown of the floating expended flight hardware, the vessels would be directed to the different floating hardware locations to begin recovery. Swimmers, with snorkeling gear, may enter the water to assist in recovery of the floating hardware. As the LDSD project is limited by the 170 NM arc from Makaha Ridge, Kauai, swimmers would not enter the water within a Special Preservation Area or the Midway Atoll Special Management Area. During the 2014 mission, it took the respective vessels approximately 5 hours to reach and recover the parachute, 6.5 hours to reach and recover the balloon carcass, and 4 hours to reach and recover the TV.

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

NASA, in partnership with the USN, demonstrated the ability to conduct and complete the SFDT during the successful LDSD 2014 campaign at PMRF.

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.

NASA, as with all Federal agencies, is subject to appropriations from Congress and both the mission and the recovery operations for the 2015 have been fully funded. Appropriations would occur annually prior to the 2016 through 2019 LDSD campaigns. Additionally, given NASA's strong commitment to stewardship, the Agency would advocate for any necessary mitigation funding from impacts resulting from the LDSD Program.

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.

NASA will make every effort to limit the time spent within the Monument. Analogous to the 2014 demonstration mission, NASA would deploy three recovery vessels to anchor at TSPs, selected to minimize the recovery operations timeline. Immediately upon splashdown of the scientific balloon and TV, the vessels would be directed to the different floating hardware locations to begin recovery. During the 2014 mission, it took the respective vessels approximately 5 hours to reach and recover the parachute, 6.5 hours to reach and recover the balloon and flight train, and 4 hours to reach and recover the TV.

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

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

No other forseeable factors exist that would make the issuance of a permit for this activity inappopriate.

8. Procedures/Methods:
Sections 2.2, 2.3, and 2.4 of the May 2013 NASA LDSD Technology Demonstration Mission EA, (http://www.govsupport.us/nasaldsdea/default.aspx) detail the procedures and methods used for the LDSD missions. Prior to launch, the LDSD Project and USN Range Management conduct a series of launch decision meetings to determine whether a launch attempt can be made within a pre-determined set of public safety (e.g., non-participant vessel risks), environmental safety (e.g., potential to encroach on the PMNM), and mission success criteria (e.g., weather/winds conditions, critical hardware success). Each of these criteria imposes separate restrictions on the impact dispersion of both the scientific balloon and the TV. When the separate dispersion patterns are combined, the resulting pattern serves as the primary aid for these decision meetings.

If all range safety criteria are met, the SFDT is allowed to proceed and the 3 vessels are sent to their respective TSPs. Each SFDT consists of a 34 mcf scientific balloon that carries the SFDT TV to the minimum desired float altitude of 120,000 ft then releases the TV to initiate the mission sequence. Once the TV is dropped, a signal is sent that separates the flight train from the balloon and in the process, ripping the balloon to allow descent. After the TV drops, small solid-fueled rocket motors ignite and stabilize the TV prior to the main motor ignition. The main motor is an Orbital Alliant Techsystems, Incorporated manufactured Star 48B, a long nozzle solid-fueled rocket engine. The Star 48B ignites propelling the TV upwards to an altitude of approximately 180,000 ft at a speed of approximately Mach 4. The TV then deploys a doughnut-shaped tube called the SIAD to slow its velocity to approximately Mach 2. The TV then deploys a 100-ft diameter supersonic parachute, which carries the TV safely to a controlled oceanic impact. After splashdown, the three vessels transit to the locations of the floating expended flight hardware (balloon and TV) for recovery. The flight train, that separates from the balloon and the TV, would sink rapidly in the ocean and would be almost impossible to locate.

All launch activities would occur during daylight and all trajectories would direct splashdown into deep water, beyond 3 nautical miles of any island (vessels may be transiting to TSPs overnight). No Monument staff or volunteers would be required by NASA or its affiliate contractors, in conducting the mission.

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:

Scientific name:

& size of specimens:

Collection location:

☐ Whole Organism ☐ Partial Organism

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

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

• General site/location for collections:

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

• Is there an outfall? ☐ Yes ☐ No

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

• Will organisms be released?

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

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

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

Sections 2.2.2 and 2.2.3 of the 2013 LDSD EA and Enclosure 5 "Equipment and Materials Description" detail the balloon launch platform and the SFDT Test Vehicle. The following is a breakdown of main components on each system:

5,100-pound, 34 mcf scientific balloon flight train assembly composed of thin sheets (0.8 mil) of polyethylene film (much like a typical trash bag) sealed together with enclosed polyester fibers.

830-pound balloon flight train including:

- Kevlar cable ladder made of ½" Zylon/PBO Synthetic
- FAA Air Traffic Control Radar Beacon System
- Micro Instrumentation Package (including global positioning system, uplink and downlink telemetry (TM), line of sight ultra-high frequency (UHF) transceiver and an Iridium unit for over the horizon commanding and TM)
- 90-pound, 72-foot balloon burst parachute and cabling
- Ballast (very fine fine steel shot [0.3 to 0.5 mm] - released during balloon ascent)
- Small, self-contained pyrotechnic device for balloon termination - ignited in flight, spent prior to landing

6,600-pound Test Vehicle (15 feet in diameter by 7 feet in height)

- TV core structure is constructed of composite sandwich panel, with carbon facesheets and closed-cell (foam) to provide bouyancy
- Orbital Alliant Techsystems, Incorporated manufactured Star 48B, a long nozzle solid-fueled rocket engine - ignited in flight, spent prior to landing
- Heat shield segments
- C-band beacon for radar tracking
- Two TM downlink systems operating in the S-band frequency range of 2,200-2,300 megahertz (MHz).
    - Frequency Modulation (FM) transmitter and two circularly polarized slot antennas
    - National Television System Committee (NTSC) standard video FM transmitter and two circularly polarized slot antennas
- Small solid-fueled rocket motors that ignite and stabilize the TV prior to the main motor ignition - ignited in flight, spent prior to landing
- 20-foot diameter silicone-coated Kevlar® or silicone-coated Technora® Supersonic Inflatable Aerodynamic Decelerator (SIAD) uses automotive gas generators (air bag propellant) and a custom designed gas diffuser for inflation
- 100-foot diameter Supersonic Ringsail (SSRS) parachute with a mortar fired pilot ballute (to provide extraction force for the main parachute deployment) and rigging (deployment bags, braided riser bridle, and bridle rigidizers)
- Flight image recorder and Go-Pro® cameras
- Electronics control platform with two subsystems battery packs:
    - Electrical power susbsystem contains 5 battery packs in parallel consisting of 11 lithium manganese dioxide (M62) cells in series per pack
    - Drop subsystem contains a 24 cell nickel cadmium (NiCad) "D" pack

13. List all Hazardous Materials you propose to take to and use within the Monument:
Refer to Enclosure 5. "Equipment and Materials Descriptions" for full descriptions of each hazardous system and corresponding safety data sheets.
All hazardous materials are fully integrated into either the balloon system or the TV. Immediately post-landing, vessels will transit from test support locations beyond the launch hazard arc to intercept and salvage the floating systems - balloon and TV. Whether or not either of these systems enter PMNM, they will be recovered as quickly as possible. Under nominal conditions, all pyrotechnic systems are fired during flight and land spent (as part of the balloon system or TV) in the ocean.

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

15. Provide a time line for sample analysis, data analysis, write-up and publication of information:
Feb – Web Video – China Lake Rocket Sled testing
Feb/March – media day at JPL (include press release and video file)
April 1 – image release
April – feature story
May – web video
May – press release
May - Image release
June 1 – televised news briefing, video file, press release, web video, press kit
June 2 – commentary, press release
June 3 – media telecon, web video, video file and press release
June 4 – web video
June 17 – web video
D=0: Day of Test (to be determined in June, July, or August)
D+2 days: Flash Report on estimated trajectory conditions
D+30 days: Status Update on Trajectory Reconstruction
D+60 days: Test Summary Report Issued
D+90 - D+365 days: Publication and Presentation of Conference Papers

16. List all Applicant's publications directly related to the proposed project:
May 2013. National Aeronautics and Space Administration Low Density Supersonic Decelerator Technology Demonstration Mission Pacific Missile Range Facility, Environmental Assessment (http://www.govsupport.us/nasaldsdea/default.aspx)

June 2013. Low Density Supersonic Decelerators Fact Sheet (JPL 400-1530) (http://www.nasa.gov/pdf/737628main_Final_LDSD_Fact_Sheet_3-26-13.pdf)

May 2014. Low-Density Supersonic Decelerator (LDSD) Press Kit (http://www.jpl.nasa.gov/news/press_kits/ldsd.pdf)

June 2014. NASA's Low-Density Supersonic Decelerator Set to Lift Off. NASA Jet Propulsion Laboratory News (http://www.jpl.nasa.gov/news/news.php?release=2014-207)
June 2014. NASA's Low-Density Supersonic Decelerator Lifts Off. NASA Jet Propulsion Laboratory News (http://www.jpl.nasa.gov/news/news.php?release=2014-208)

June 2014. First LDSD Test Flight a Success. NASA Jet Propulsion Laboratory News (http://www.jpl.nasa.gov/news/news.php?release=2014-210)

August 2014. High-Def Video of NASA's 'Flying Saucer' Test. NASA Jet Propulsion Laboratory Videos (http://www.jpl.nasa.gov/video/details.php?id=1321)

August 2014. Fishing LDSD out of the Water. NASA Jet Propulsion Laboratory Images (http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA18465)

November 2014. NASA Saucer Named 'Best of What's New'. NASA Jet Propulsion Laboratory News (http://www.jpl.nasa.gov/news/news.php?feature=4385)

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
☒ Electronic and Hard Copy of Application with Signature

☐ Statement of information you wish to be kept confidential
☒ Material Safety Data Sheets for Hazardous Materials