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 represent significant risk of early termination unless mitigated. One potential path of mitigating the risk is seeking a PMNM entry permit for the SFTD campaigns.