

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:

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
nwhipermit@noaa.gov
PHONE: (808) 397-2660 FAX: (808) 397-2662

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: Umran S. Inan (contact for details is Kevin L. Graf)

Affiliation: Stanford University

Permit Category: Research

Proposed Activity Dates: January 2010 -- January 2012

Proposed Method of Entry (Vessel/Plane): Plane

Proposed Locations: Midway Atoll National Wildlife Refuge

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

1

Estimated number of days in the Monument: 10

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...
reinstall our receiver which was previously located at Midway Atoll before construction at the site forced the temporary removal of our equipment. The reinstallation would allow us to complete our data sets for on-going studies of transmitter induced precipitation of electron radiation, and fill a critical hole in a global detection network of very low frequency (VLF) radio waves for the purposes of studying lightning activity, additional thunderstorm phenomena, the ionosphere, the Earth's near-space environment, and the propagation of VLF waves therein. Without our receiver at this location in the Monument, the data for our on-going studies lacks consistency, and a hole remains in the data for any new studies involving the Pacific Region.

b.) To accomplish this activity we would
send one person to Midway Atoll to reinstall our receiver. The receiver consists merely of a completely passive antenna with preamplifier and a computer with receiver inside to log the data. The antenna is only for receiving waves that are already present, which means it should have no environmental impact.

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

providing significant data on thunderstorm activity in the Pacific region, and continuing the study of VLF wave propagation and its potential uses. The studies pertaining to VLF waves are critical to communications -- Naval communications rely directly on VLF waves, and communications satellites may have their lifetimes significantly extended through the proper use of VLF waves.

Other information or background: We have previously installed one of our receivers at Midway Atoll prior to the institution of the permit requirements. That receiver was shut down and placed in storage because the building in which it was located was being renovated. Our planned trip to reinstall the receiver had to be cancelled at the last minute when the new permit requirements were brought to our attention. This year, we hope to receive the required permit and return to bring our receiver back online.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Inan, Umran S. -- CV is attached (contact for details, and the intended traveler to the Monument, is Graf, Kevin L.)

Title: Professor of Electrical Engineering and Director of STAR Laboratory at Stanford University (K. L. Graf is a PhD student at Stanford University)

1a. Intended field Principal Investigator (See instructions for more information):
Graf, Kevin L.

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

[REDACTED]

Phone: [REDACTED]

Fax: [REDACTED]

Email: [REDACTED]

For students, major professor's name, telephone and email address: Umran Inan [REDACTED]
[REDACTED]

3. Affiliation (institution/agency/organization directly related to the proposed project):
The Space, Telecommunications, and Radioscience (STAR) Laboratory in the Department of Electrical Engineering at Stanford University

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):
N/A

Section B: Project Information

5a. Project location(s):

<input type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<u>Ocean Based</u>	
<input type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> French Frigate Shoals	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Maro Reef			
<input type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Pearl and Hermes Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Midway Atoll	<input checked="" type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Other			

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

Location Description:

From our previous installation on Midway Atoll, we remain in contact with Refuge Manager Matt Brown and will coordinate with him to find the optimal location for our equipment. We require the computer for our receiver to be in a building that has power, and our antenna must be within 2500 feet of that computer. Beyond that, we prefer a quiet location but are flexible and will coordinate with Matt if our permit is accepted.

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:*

To reinstall our Stanford VLF Receiver at Midway Atoll which will permit us to continue on-going studies and to fill a critical hole in a global detection network of very low frequency (VLF) radio waves for the purposes of studying lightning activity, additional thunderstorm phenomena, the ionosphere, the Earth's near-space environment, and the propagation of VLF waves therein. Without a receiver in a quiet location in the Pacific, a hole remains in the data. Without the receiver reinstalled near its original location, our data lacks consistency.

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?

Professor Umran Inan and his students have a history of installing their VLF receivers at remote locations with little to no impact on the location. The receiver is completely passive (it should never transmit or produce any form of interference) and mostly autonomous (it will continue running on its own with minimal human intervention).

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? The activity should have no diminishing effects -- direct, indirect, or cumulative -- on the cultural, natural, and historic resources, qualities, and ecological integrity of the Monument. The receiver has been installed at other remote locations for several years without diminishing effects, and we will coordinate with Midway Atoll Refuge Manager Matt Brown to ensure that no diminishing effects are caused in the Monument. The findings from the data provided by the receiver may enhance life in the Monument through improved understanding of nearby thunderstorm activity and improved Naval and satellite communications.

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 conducting our activities within the Monument. The reasoning is three-fold. 1) Installation within the Monument has been critical to our NPM keying experiments. NPM is a Naval VLF transmitter in Lualualei, HI. Its effect on geomagnetically trapped radiation, a critical factor in satellite missions, can be studied indirectly by monitoring the signals propagating from the Naval VLF transmitter NLK in Jim Creek, WA to the region within the Monument. The only available pathways available for this study require a receiver in the Monument. 2) For data consistency over the course of our on-going studies, we require that our receiver be reinstalled near its original location. NPM keying experiments were conducted

during the initial years of installation, but the data set for a full analysis from the location is incomplete and requires that the receiver be brought back online. 3) For a thorough analysis of lightning activity and additional VLF propagation studies, we require a receiver stationed in a quiet location the Pacific region. In the past, we have had receivers stationed both in the Monument and in other locations in the Hawaiian Islands. The sites outside the Monument provided inferior data due to the noise present at those locations. The site located within the Monument on Midway Atoll provided excellent data for our research. Given that location within the Monument is critical to our specific NPM keying experiments and optimal for a wealth of additional studies, the prospect of searching for another site in the Pacific that is sufficient for our research is not practicable.

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

There should be no adverse impacts of our activity, so the end value will easily outweigh these impacts. The end value will be in the form of potentially significant advances in the study of thunderstorm phenomena, VLF propagation, ionospheric research, the near-space environment, and communications.

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

Thunderstorm, ionospheric, and space-environment phenomena all experience some degree of seasonal variation. Coordination with Naval resources for the additional VLF studies is expected to continue over the next several years. Therefore, the site's presence for at least two years is critical to the reception of data through multiple years of seasonal variations and the scheduled Naval transmissions.

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

Our research group headed by Professor Umran Inan has installed or overseen the installation of approximately 100 of our Stanford VLF Receivers at various locations around the world. Many of those locations are remote and we make it a primary goal to avoid any potential impact on the environment, wildlife, or people at the location. We also make it a goal to be as little of a burden as possible for the local peoples overseeing our sites. Our site should be completely passive and mostly autonomous -- having little to no impact and requiring very little upkeep. Our group has significant experience with successfully meeting these goals.

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.

The work will be supported under the Office of Naval Research (ONR) grant N00014-06-1-1036 to Stanford University. Amongst additional costs, these grants include funds for two post-MS graduate students, an engineer, a data analyst, equipment for the construction and installation of our Stanford VLF Receiver, travel to and from the site for installation, and compensation for any support provided by personnel at the site.

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.

Installation of the receiver can be completed in one or two days with minimal required resources. All necessary equipment can be carried with me, or shipped ahead. This installation procedure will minimize any burden on local personnel, and the act of installation itself should have no impact on the Monument cultural, natural and historic resources, qualities, and ecological integrity. As the receiver continues to run autonomously throughout the following months, we will maintain email contact with personnel at the Midway Atoll Wildlife Refuge where the equipment will be housed. This will both help us to maintain consistent operation of our equipment, and allow the personnel to warn us of any potential impact our equipment may have on the Monument. If any potential impact becomes apparent, changes can be made, or the site can be immediately shut down, to avoid any problems before they occur.

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

We will not be using a vessel.

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

There are no other factors that would make the issuance of a permit for the activity inappropriate. The purpose and impact of the activity has been explained. There should be no adverse impact on the Monument, we are already in contact with local personnel due to our previous installation at the site, and we are very experienced at installing our receivers in remote locations without causing any diminishing effects.

8. Procedures/Methods:

Installation involves the set-up of a VLF radio receiver, including an antenna (4 to 5 meters in height), preamplifier, line receiver, and a PC computer (with a data recording card) provided by Stanford University for deployment at a suitable location on Midway Atoll. The suitable location will be selected through coordination with Midway Atoll Refuge Manager Matt Brown. All necessary equipment can be provided by Stanford University and can be transported or shipped to the site. Installation can be completed in one to two days and consists primarily of securing the antenna structure, running a cable, and setting up the computer.

The receiver monitors radio waves at frequencies in the range 100Hz-45kHz. Data volume is small enough to be archived on DVDs or hard drives. Daily summary data can be transferred to Stanford University via ftp if an internet connection is available, and/or the data can be archived on DVDs or hard drives to be sent to Stanford University.

Once the initial receiver is in place, Stanford will continue to provide help as needed in support of the ongoing operation of the system and assurance that no adverse impact

on the Monument is ever experienced. Stanford will help solve any hardware or software problems, and, should anything break, Stanford will replace it or give instructions for its repair.

Should the stay of the equipment expire, the duration of the permit expire, or any adverse effects become apparent, the equipment will be shut down and removed from the Monument. Should a return to the Monument be appropriate in the circumstances for removal, a representative from Stanford will return to the Monument to deconstruct the receiver and remove all equipment from the Monument. Should removal be required more quickly than a return trip would allow, Stanford shall instruct local personnel on the deconstruction and removal of the equipment. Deconstruction and removal of our equipment is not complicated and can easily be completed by someone who is not experienced with our equipment. All local personnel would be reimbursed by Stanford University for their time, resources, and expenses should their assistance be required.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application.

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

Common name:

N/A

Scientific name:

N/A

& size of specimens:

N/A

Collection location:

N/A

Whole Organism Partial Organism

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

N/A

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

N/A

- General site/location for collections:

N/A

- Is it an open or closed system? Open Closed

N/A

- Is there an outfall? Yes No

N/A

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

N/A

- Will organisms be released?

N/A

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

N/A

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

N/A

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

No particular specialized gear or materials will be used. See #13 for a description of the equipment to be installed.

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

N/A

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

The receiver consists of two air-core wire-loop antennas, a preamplifier box, a line receiver box, GPS antenna, a computer, and appropriate cabling. The wire-loop antennas will be 4 to 5 meters in height and will be secured outside to a pole or other such structure. They are thin and provide minimum obstruction. That minor obstruction is the only impact the antennae will have on its surroundings. The preamplifier box is secured near the antenna and is approximately 12 inches by 12 inches in size. Only a single cable will run from the preamplifier inside to the computer. That single cable is a Beldin 1217B audio cable of 0.5 inches in diameter and will carry all necessary power and data to and from the preamplifier and wire-loop antennas. The GPS antenna is approximately 1.5 feet in length. Inside, there will be a line receiver box and computer setup. This inside setup will consume the same space and resources as a typical computer setup. Its purpose is to receive and record the data from the antenna. If its presence is obtrusive, then the monitor, keyboard, and mouse can be disconnected and the computer can be stored wherever is appropriate while it continues to function autonomously.

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

Data reception and logging begins immediately following site installation. As the site is already known to be one of the better and more unique sites for reception of VLF data, we will likely begin use of the data immediately. Data from our Stanford VLF Receivers is used in multiple papers every year, so data from this site will likely appear in publication within the year. Many different studies should be possible with this data set, so the data will be archived and likely be used for many papers in future years, as well.

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

Below you will find a brief listing of publications which have either made use of our previously installed site at Midway Atoll or which are most pertinent to the research for which we anticipate the proposed site to be most applicable. For a more complete listing of publications pertaining to the VLF research conducted by Professor Umran Inan and our research group, see his attached CV or visit <http://www-star.stanford.edu/~vlf/pubsyear.html>.

- 1) Cohen, M. B., U. S. Inan, E. W. Paschal (2009), Sensitive broadband ELF/VLF radio reception with the AWESOME instrument, *IEEE Trans. Geosc. Remote Sensing*, 47, ??, doi:10.1109/TGRS.2009.2028334.
- 2) Wood, T. G., and U. S. Inan (2004), Localization of individual lightning discharges via directional and temporal triangulation of sferic measurements at two distant sites, *J. Geophys. Res.*, 109, D21109 , doi:10.1029/2004JD005204.
- 3) Inan, U. S., et al. (2007), Subionospheric VLF observations of transmitter-induced precipitation of inner radiation belt electrons, *Geophys. Res. Lett.*, 34, L02106, doi: 10.1029/2006GL028494.
- 4) Marshall, R. A., U. S. Inan, and W. A. Lyons (2007), Very low frequency sferic bursts, sprites, and their association with lightning activity, *J. Geophys. Res.*, 112, D22105, doi:10.1029/2007JD008857.
- 5) Cotts, B. R. T., and U. S. Inan (2007), VLF observation of long ionospheric recovery events, *Geophys. Res. Lett.*, 34, L14809, doi:10.1029/2007GL030094.
- 6) Peter, W. B., M. W. Chevalier, and U. S. Inan (2006), Perturbations of midlatitude subionospheric VLF signals associated with lower ionospheric disturbances during major geomagnetic storms, *J. Geophys. Res.*, 111, A03301, doi:10.1029/2005JA011346.
- 7) Peter, W. B., M. Chevalier, and U. S. Inan, Subionospheric VLF measurements of the effects of geomagnetic storms on the mid-latitude D-region, 11th International Ionosphere Effects Symposium, A070, May 3-5, 2005, pp. 1-8, 2005.

8) Mika, A., C. Haldoupis, R. A. Marshall, T. Neubert, U. S. Inan (2005), Subionospheric VLF signatures and their association with sprites observed during EuroSprite-2003, *J. Atmos. Solar-Terrest. Phys.*, 67, 16.

9) Haldoupis, C., T. Neubert, U. S. Inan, A. Mika, T. H. Allin, and R. A. Marshall (2004), Subionospheric early VLF signal perturbations observed in one-to-one association with sprites, *J. Geophys. Res.*, 109 , A10303 , doi:10.1029/2004JA010651.

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:

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
FAX: (808) 397-2662

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