State of Hawaii

DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of State Parks
Honolulu, Hawaii

May 23, 2008

Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

SUBJECT: Request for Approval of a Special Use Permit to Conduct a Remote Sensing research Experiment at Makapuu Point, Ka Iwi Scenic Shoreline, Oahu

The U.S. Naval Research Laboratory has submitted a request to conduct the subject experiment at Makapuu Point, attached. The experiment will be conducted from August 18-29, 2008, with equipment set-up beginning August 11, and break-down and clean up to be completed September 5.

The project is a study of radar signals generated by ocean surface waves. The Makapuu Point location provides a unique combination of factors the scientists need for their study; steady winds, extremely long "fetch", and deep water close to shore.

Equipment to be used in this experiment includes two personnel trailers, to be parked within the Federal easement for Makapuu Lighthouse, and the radar pedestal, related electric enclosures and cameras to be placed about 70' away, near the edge of the cliff. The equipment will be powered by temporary connection to an existing HECO power line that powers the lighthouse.

In addition, in order to calibrate the radar, the scientists would like to place temporary reflectors on the roof of an old military bunker on a ridge south of the lighthouse. These reflectors would be installed for about 15 minutes, and the actual test time would be less then one minute. This calibration would occur several times during the course of the experiment.

The radar is a microwave source. As outlined in section 3 of the attached request, the radar generates microwaves at the same level of a household microwave oven. The

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power density of microwave ovens is kept to a safe level by the mesh screen in the oven door. Safety for the radar is achieved by keeping people at a distance from the radar. The applicant will cordon off a safety zone of 18.5 feet around the radar to insure no one is exposed to unsafe levels of microwaves. Accordingly, a guard will be posted to insure no one enters the cordoned-off areas. If someone ignores warnings, and enters the cordoned-off area while the radar is on, the radar will be shut down.

The permittee has consulted with the U.S. Fish and Wildlife service to seek guidance on measures to mitigate any impact on migratory birds. The project will be staffed 24 hours a day, and at times will be operated at night. Therefore, there will be exterior lighting. Steps will be taken to shield the exterior lights from direct ocean view, and non-reflective surface will be installed on the trailer near exterior lights. The radar will pose no risk to ocean life, as the radar signal does not penetrate the ocean's surface.

RECOMMENDATION:

That the Board approves the request with the following conditions:

1. The U.S. Naval Research Laboratory coordinates with the U.S. Coast Guard with respect to their road easement and operation of the navigation light at Makapuu Point.

2. Calibration of the radar shall be done at night after the park is closed and after an inspection of the area to determine the area is clear of people.

3. Comply with any conditions set forth by the Department.

4. Abide by all Federal, State, and City and County of Honolulu laws, administrative rules, and ordinances.

Respectfully submitted,

DANIEL S. QUINN
State Parks Administrator

APPROVED FOR SUBMITTAL:

LAURA H. THIELEN, Chairperson

Request for a Special Use Permit
To Conduct a Remote Sensing Research Experiment
at
Makapuu Point Wayside Park
Oahu, HI

Submitted by
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Point of Contact:
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Submitted to
Mr. Daniel Quinn
Hawaii State Parks Administrator
Honolulu, HI

1.0 Overview of Proposed Experiment

1.1 Purpose

This proposed experiment at Makapuu Point Wayside Park will support basic research at the Naval Research Laboratory (NRL) in radar-based remote sensing of the ocean. Analysis of the data collected during this exercise will further our understanding of the relationship between ocean surface waves and the radar signals they generate, a relationship that may form the foundation of many future civilian as well as military remote sensing applications.

1.2 Physical Layout

During the four-week experiment (see section 4.0 for the proposed schedule), NRL will deploy an imaging radar, cameras, and two temporary personnel trailers near the federal "turn-around" easement adjacent to the US Coast Guard gate leading to the Makapuu Point lighthouse. The trailers will be placed on the turn-around easement itself, while the radar pedestal, an electronics enclosure, and cameras will be positioned near the cliff edge, about 70 feet seaward of the easement. See Figures 1-3 for a photo and diagram of the site and for a photo of the radar pedestal. The radar and cameras will be connected to the trailers via several power and communication cables, run temporarily along the ground. Power to run the equipment will be supplied by a temporary connection to an existing HECO powerline that supports operation of the lighthouse.

On several occasions during the experiment, we would like to temporarily place benign radar reflectors on the concrete "pill-box" located on a high point just east of the main access road, approximately 530 meters south of the turn-around easement. (See Figure 1.) These reflectors, mounted on tripods placed on the roof of the pill-box, will be used to periodically check the radar calibration. During these calibration measurements, the radar will be turned to the south in order to put the reflectors in the field of view. (The radar will otherwise be directed eastward in order to observe the ocean surface.) The actual data collection time for each calibration measurement will be less than one minute. Allowing for set-up, the reflectors will reside on the pill-box for a total of approximately 15 minutes.

2.0 Use of Public Space

2.1 Why Makapuu Point?

Makapuu Point has a unique combination of steady winds, extremely long "fetch" (i.e., the distance over which the wind blows and the waves propagate), and deep water close to the shore. Other sites exist in the U.S. where one or two of these characteristics can be found, but Makapuu Point is the only location we have found where all three exist. (We gave the Pacific Missile Range Facility on Kauai serious consideration, but insufficient water depth and the prevailing offshore wind direction unfortunately preclude use of this location.) These characteristics will significantly simplify the analysis of the data we hope to collect and improve our ability to interpret and understand the results. Variable winds, short fetch, and shallow water are all factors that effect surface waves in ways that are, at present, difficult to account for. While these complicating factors are certainly ones we want to study eventually, we need to understand the simpler case first.

2.2 Benefits to the Public

As this is a basic research experiment that will address broad, fundamental issues related to the interaction of radar signals and ocean surface waves, it will support the development of many future civilian applications as well as others of more direct interest to the Navy. These potential civilian applications include (but are not limited to):

a) Radar-based coastal current mapping for prediction of pollutant flow. (See the IEEE Transactions on Geoscience and Remote Sensing, Vol 43, Nov. 2005 for an article presenting the results of a recent, related collaboration between NRL, the University of Massachusetts, and NOAA)

b) Radar-based monitoring of air-sea interactions (esp. via breaking waves) that effect weather and climate models

c) Radar-based systems designed to minimize wave-induced ship motion by first sensing incoming waves, then directing the ship through the smoothest path between them.

d) Radar-based detection of hazardous rip currents.

3.0 Safety and Environmental Concerns

3.1 Safety

As the radar we propose to deploy is a microwave source, care must be taken to ensure that all personnel, both researchers and the public, never occupy areas that receive even marginally unsafe levels of microwave power density. The Institute of Electrical and Electronics Engineers (IEEE) has established safe levels of microwave power exposure, and using these levels and the radar's characteristics, the NRL Safety Branch has determined that the minimum safe distance from the radar is 18.5 feet. Accordingly, we will clearly cordon off an 18.5-foot circle around the antenna pedestal, using orange plastic fencing or some other suitable material, and will post a guard to inform the public of its purpose. In the event that warnings to stay out of the cordoned-off area are not heeded while the radar is on, the guard will promptly inform the operator to turn off the radar.

The microwave power emanating from the radar is essentially identical to that emanating from a household microwave oven. In the case of a microwave oven, the mesh screen embedded in the glass door keeps the power density in the surrounding kitchen at a safe level. In the case of our radar, the power density is kept at a safe level by ensuring that people maintain a safe distance (in our case, at least 18.5 feet) from the transmit antenna whenever the radar is on. The power density drops off rapidly with distance from the antenna. At a distance of 18.5 feet, the average power density is equal to 10 mW/cm^2, the permissible exposure limit as set by the IEEE. At a distance of 500 feet, which is the distance down to the ocean surface from our proposed radar site on the cliff at Makapuu Point, it is well below 14 uW/cm^2, a factor of 730 below the IEEE standard. For comparison, the power density due to leakage from a typical household microwave oven (0.2 mW/cm^2) is approximately 14 times *higher* than that produced by our radar at the bottom of the cliff.

It should also be emphasized that the microwave power emanating from our radar poses no harm whatsoever to the plants, fish and mammals in the sea. To the electromagnetic

energy emitted by our radar, the sea is impenetrable. (This is in contrast to *sonar* systems, which emit *sound* energy. Sound can indeed propagate in water.) The signals detected by our radar are generated only by the undulating ocean *surface*.

3.2 Environmental

Migratory Birds: Migratory birds must be protected from the disorientating effects of exterior lighting that will be installed on the personnel trailers. As we will keep at least two people at the site 24-hours-a-day and may occasionally collect data at night, exterior lighting is needed for security and safety reasons. However, such lighting has been known to disorient birds to the point that they injure or even kill themselves. We have contacted Special Agent Keith Swindle of the Fish and Wildlife Service, the point-of-contact on Oahu for this issue, and he has given us guidance on how to shield our exterior lights. The key is to construct a shroud that prevents a direct view of the bulb from the ocean. Also, in the vicinity of the light fixtures, darker colors on the exterior walls of the trailers are preferable. Both of these measures area relatively easy to implement: For the seaward-facing lights, shrouds will be either purchased commercially or simply built from sheet metal, and black poster board will be mounted on the trailer walls behind the lights.

Staking of Trailers and Installation of Temporary HECO Power Poles: To secure them in place, each of the two personnel trailers will be staked down in approximately 12 places. The stakes will measure approximately ½ inch in diameter and will be driven into place, to a depth of approximately 3 feet, using a hydraulic hammer. This will be done by the commercial vendor (Hawaii Modular Space) we have selected to supply the trailers. We also plan to secure our antenna pedestal using similar stakes.

A temporary power pole is needed to support extension of the existing HECO power lines over to our personnel trailers. Per HECO recommendations, we plan to use a 4" x 4" wooden pole at least 15.5' in length that is set into the ground by at least 1.5 '(leaving at least 14' above ground). HECO also recommends staking the temporary power pole at the bases of two "outriggers" using driven stakes similar to the ones we will use to secure the trailers.

Clean up: After the experiment, we will make sure we leave this beautiful site the way we found it. All stakes and the temporary power pole will be removed, and the hole required for the latter will be filled in. We will also rake the area near the cliff edge where the radar pedestal will be located in order to remove its footprint.

4.0 Proposed Schedule

August 11-15, 2008:	Equipment set-up at Makapuu Point Wayside Park
August 18-29:	Data collection
September 1-5:	Equipment break-down and site clean up

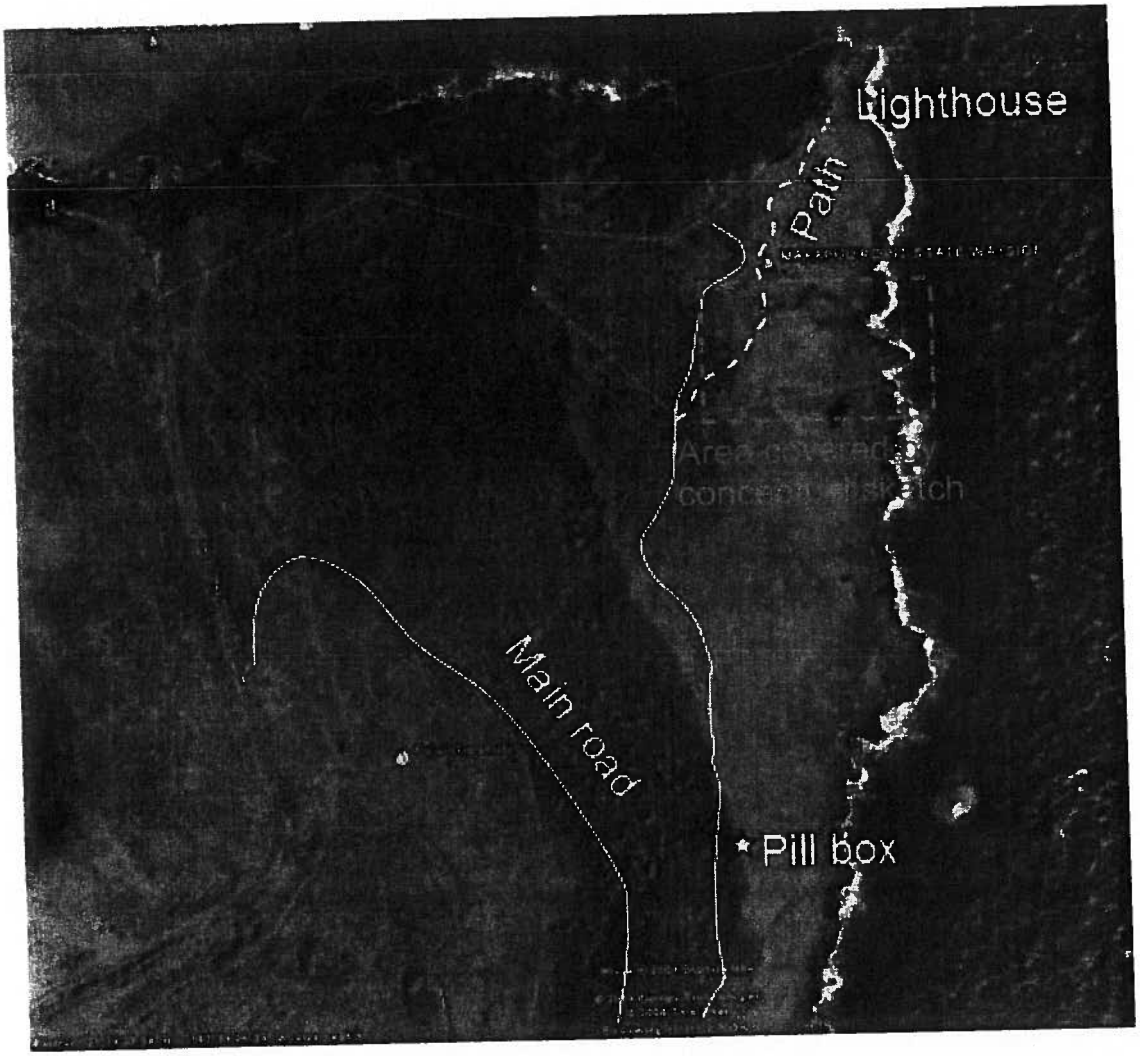

Figure 1. Satellite photograph showing the area in Makapuu Point Wayside Park where NRL proposes to deploy a radar and supporting personnel trailers. The Conceptual Sketch is shown in Figure 2.

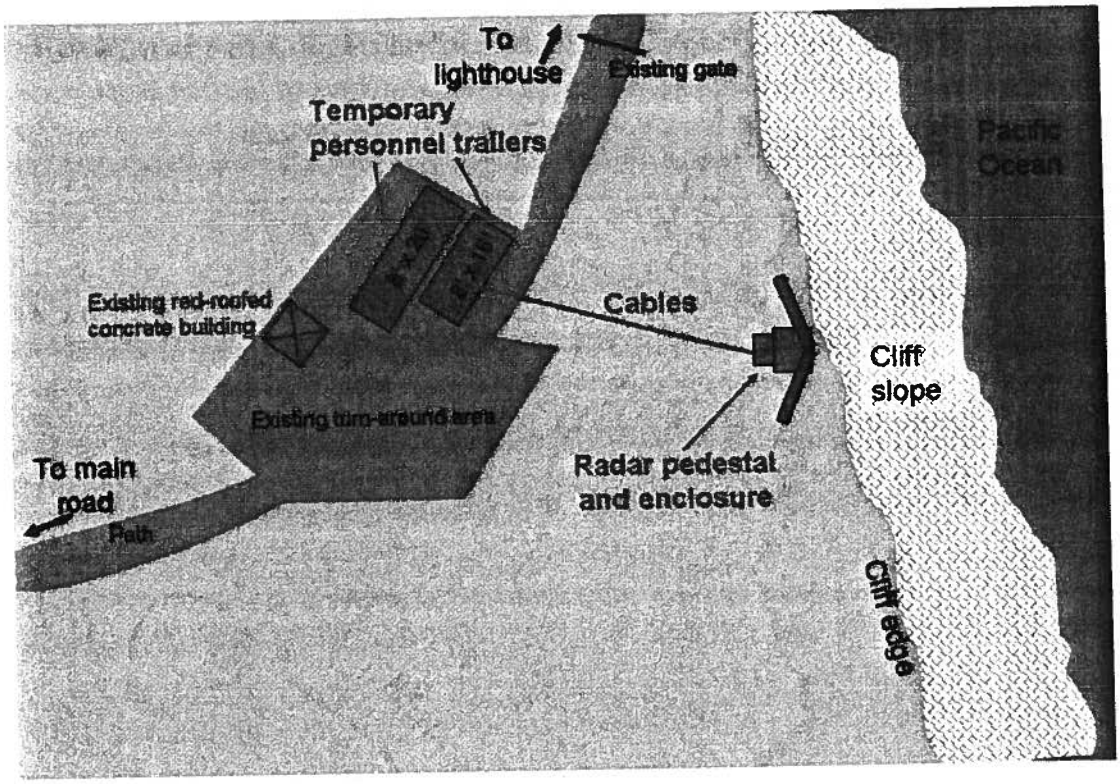

Figure 2. Conceptual sketch illustrating the placement of the radar pedestal and enclosure and the personnel trailers relative to the existing turn-around area

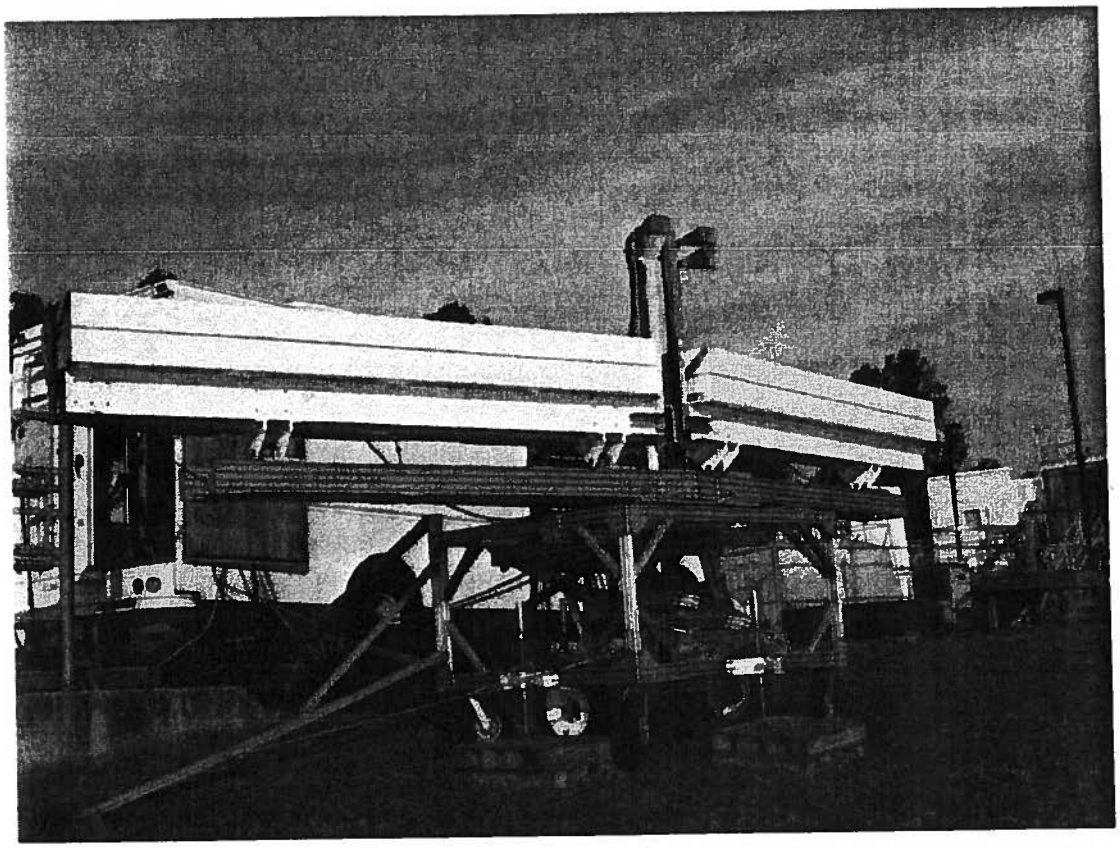

Figure 3. Photograph of the NRL radar antenna pedestal. When finished, the electronics enclosure (not shown) will be positioned on the ground directly behind the pedestal