

**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:** Donald C. Potts

**Affiliation:** Institute of Marine Sciences, University of California, Santa Cruz

**Permit Category:** Research

**Proposed Activity Dates:** 1 June 2010 - 31 December 2011

**Proposed Method of Entry (Vessel/Plane):** Plane: USFWS flights from/to Honolulu

**Proposed Locations:** Midway Atoll: multiple shallow sites (0-35 m depth)

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

10

**Estimated number of days in the Monument:** up to 75 days per year

**Description of proposed activities:** (complete these sentences):

a.) The proposed activity would...  
... test and evaluate the potential for successful restoration of the primary frame-building coral (*Porites compressa*) on nearshore patch reefs that have been severely degraded by past anthropogenic activities, including dredging, construction and sewage discharge. It will test the hypothesis that *P. compressa* is now absent from these patch reefs because recruits fail to reach them, and not because conditions are unsuitable for survival and growth. This activity will also contribute to a broader assessment of whether Midway Atoll can remain sustainable as a viable atoll ecosystem during the climatic and oceanographic changes expected over the next century.

b.) To accomplish this activity we would ....  
... transplant living fragments of the finger coral (*Porites compressa*) from healthy patch reefs to degraded patch reefs without *P. compressa*, and monitor subsequent survival and growth of the fragments.

c.) This activity would help the Monument by ...  
... providing initial groundwork and evaluations for planning nearshore coral reef restoration in accordance with Strategy HMC-1 of the Papahānaumokuākea Marine National Monument

(PMNM) Management Plan (December 2008, pp. 180-1): "...develop and implement a strategy for restoring the health and biological diversity of the shallow reefs and shoals where anthropogenic disturbances are known to have changed the ecosystem, using best available information about pre-disturbance conditions."

**Other information or background:**

Nearshore patch reefs built by actively growing corals in Midway Atoll's lagoon were severely impacted by large-scale dredging, island construction and discharge of raw sewage, especially between 1930 and 1990, but the major reef-building finger coral (*Porites compressa*) is now absent from most patch reefs. We have evidence that *Porites compressa* larvae are not recruiting to these reefs today. We propose that these reefs are excellent candidates for restoration by means of coral transplants because high cover by *Porites compressa* was reported in the 1970s, and because abatement of the major degradative sources occurred over 20 years ago. We will test this hypothesis by monitoring survival and growth of transplanted *P. compressa* fragments, and determine the effects of depth, distance from shore, and algal growth on transplant success.

Coral restoration may be particularly important for Midway Atoll because it lies near Grigg's (1982) "Darwin Point" (28-29°N), the latitude north of which natural processes of reef destruction (erosion, sediment export and subsidence) exceed rates of reef growth (by corals, coralline algae and sediment deposition). Midway is also ecologically marginal and many reef-building species (e.g. corals, coralline algae) appear to have relatively low growth and survival rates, while bio-eroding species (e.g. fish, sea urchins) are abundant, and capable of rapid destruction of new coral growth. Large transplants are more likely to survive than small recruits, and successful transplants may create environments likely to attract larvae and/or induce settlement.

This project builds on work begun in 2005 under USFWS permits and continued under permits PMNM-2007-013, PMNM-2008-056a, PMNM-2008-056b, PMNM-2008-065 and PMNM-2009-040.

**Section A - Applicant Information**

**1. Applicant**

Name (last, first, middle initial): Potts, Donald, C

Title: Professor of Biology

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

Cover, Wendy A. UCSC Ph.D. Candidate, University of California, Santa Cruz (Ecology & Evolutionary Biology)

[REDACTED]

[REDACTED]

Kristin McCully UCSC Ph.D. Candidate, University of California, Santa Cruz (Ecology & Evolutionary Biology)

[REDACTED]

[REDACTED]

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

[REDACTED]

Phone: Office: [REDACTED] Lab: [REDACTED] Cell: [REDACTED]

Fax: [REDACTED]

Email: [REDACTED]

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

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

Center for the Development and Evolution of the Land-Sea Interface (CDELSI)  
and Institute of Marine Sciences (IMS), University of California, Santa Cruz (UCSC)

**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):**

Assistants will come from the following pool. All UCSC personnel are AAUS certified research divers and DOI-qualified motor boat operators:

Helen O'Brien	UCSC Ph.D. student (Ecology & Evolutionary Biology)		
Anne Warner	UCSC Ph.D. student (Ocean Sciences)		
Rachel Fabian	UCSC Ph.D. student (Ocean Sciences)		

UCSC field assistant - to be named

Up to 5 Volunteers (from Mitsubishi International Corporation) - to be named

**Section B: Project Information**

**5a. Project location(s):**

<input type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<b><u>Ocean Based</u></b>	
<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 checked="" 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:

Lagoonal patch reefs west and north of West Beach, Sand Island, Midway Atoll. (See Fig. 1)

**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:***

With the largest land area in the PMNM, Midway Atoll hosts some of the largest PMNM populations of endangered species (e.g. Hawaiian monk seal, Laysan albatross), and is the only site capable of supporting extensive infrastructure and access for ships, aircraft and visitors. Persistence of Midway Atoll as a viable atoll ecosystem is vital both as wildlife habitat and as a key element for long-term development, management, public access and supervision of the entire PMNM. Sustainability of Midway Atoll depends on maintaining the integrity of its physical structures and on ensuring the long-term health of the marine ecosystems that build its physical structure, especially the reef-building corals.

Patch reefs in the shallow lagoon off Sand Island are severely degraded. They consist mainly of dead rock and/or rubble piles, have little live coral (~3% cover, mostly *Pocillopora* spp.) but high densities of cyanobacteria and turf algae, and experience intense urchin erosion. Rock and rubble specimens indicate these patches were built mainly by the finger coral, *Porites compressa*, a common reef-building species throughout the Hawaiian Archipelago. This species is now absent from most shallow patch reefs on Midway, yet divers and snorkelers in the early 1970s described healthy, thriving reefs in this area, with high *Porites compressa* cover similar to that on patch reefs of nearby Kure Atoll and elsewhere in the Northwestern Hawaiian Islands.

We have found few records or photographs showing reef and lagoon conditions before about 1970, and reasons for the decline of *P. compressa* on Midway are unknown. It is likely that much of the physical degradation stems from engineering activities begun in the 1930s by PanAm and continued by the US Navy. They included: destroying many patch reefs by removing the top 12' for seaplane runways; cutting the channel through the south reef margin; dredging anchorages in the lagoon; raising the average height of Eastern and Sand Islands by 2-4 m; and extensive land-filling and enlargement of Sand Island to build the main runway and the Inner Harbor. During much of the Cold War (~1960 to ~1990) the island had a population of ~5,000 people and large volumes of untreated sewage were discharged off West Beach. Although dredging ceased in the 1970s and direct sewage discharge ended in the 1980's, lagoonal patch reefs have not recovered.

New coral colonies establish naturally via larval recruitment or via fragmentation. In our coral recruitment studies since 2006, we have not seen a single *Porites* recruit on any nearshore patch reef, meaning that larvae are either not reaching or not surviving on the patch reefs. Since the reefs are isolated far from any source of fragments, we hypothesize that lack of recruitment is the major factor preventing recovery of patch reefs in this part of the lagoon.

To test this hypothesis and evaluate the potential for successful restoration we will supply fragments of living *P. compressa* to patch reefs. Manual transplanting of coral fragments is well-accepted as a method for restoring degraded reefs, because larger fragments survive better than young recruits, partly because they have advantages when competing with smaller organisms, and partly because they are less likely to be killed by predators. Our methods are based on coral restoration projects worldwide; and we have used them successfully to transplant corals for other research projects on Midway since 2006.

Lack of recruitment may not be the only factor hindering recovery. Complex environmental processes such as nutrient/contaminant pollution via groundwater discharge, algal/cyanobacterial proliferation, shifting temperature regimes, or altered circulation patterns may also be important. Therefore this pilot study is designed primarily to determine whether *P. compressa* is capable of surviving and growing on the patch reefs under current conditions. If these transplants do survive, we will propose larger-scale studies using transplants to restore Midway's patch reefs in critical locations. Successful restoration of patch reefs will also increase essential habitat for juvenile reef fish (e.g. research by Friedlander and DeMartini) and increase protected foraging habitat for juvenile Hawaiian monk seals.

**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?

1. Work will be done in conformity with all PMNM, USFWS, Midway Atoll NWR, UCSC, and OSHA regulations, standards and requests, and we maintain continuing discussions with Midway NWR staff while on Midway.

2. Numbers and sizes of samples are the minimum necessary to be scientifically and statistically valid, and they will be located to avoid adverse impacts on other aspects of the site.

3. We avoid all known historical and archeological sites, and locations of special conservation significance. Should potentially new historical or archeological sites be encountered, they will not be disturbed, but will be reported to Midway and PMNM staff.

4. Research structures are made with non-corrosable, non-toxic materials (e.g. plastics, marine grade stainless steel), and these are located on non-living surfaces, sand or rubble bottoms, and anchored securely to prevent entanglement or movement by wind, waves or currents. All markers are as small as technically possible. All items are removed at the end of the research.

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?

We are creating information directly relevant to the management of marine environments at Midway Atoll, and all activities are designed with this in mind. Any impacts will be small and much localized compared to ongoing anthropogenic disturbances. We do not anticipate negative

effects, but every site will be monitored for unanticipated impacts. All markers and experimental materials will be removed as soon as they are no longer needed.

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.

No. Our work is directed at understanding key ecological and physical processes acting on Midway reef today and in the future. As an isolated, ecologically and latitudinally marginal reef with a unique history of extensive, largely undocumented, anthropogenic disturbance during the 20th century, Midway Atoll has no comparable analogues elsewhere.

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

Our findings will provide essential data for enhancing the continued health and sustainability of the reef at Midway. Once tested, our methods could be used to increase the cover of a major reef-building species, the finger coral *Porites compressa*, or to establish new populations of this species on Midway. Experimental impacts are restricted to a few cm to a few m in extent, and most will be very temporary. Our findings will be relevant to other PMNM reefs and beyond, and can probably be transferred to other reefs without having to repeat extensive studies there.

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

Determining the viability of a population requires experiments and monitoring lasting several years to ensure that the experimental corals experience most environmental stresses likely to occur.

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

We have been visiting Midway Atoll since 2002, have conducted research there since 2005, and are very familiar with the reef layout, conditions, and organisms. We have successfully transplanted over a hundred coral fragments of three species for other research projects on Midway. We will be monitoring all corals from which fragments are taken as well as the fragments themselves, and will remove any markers when the project is completed.

Potts has studied the ecology and evolution of Pacific corals and reefs for over 30 years (mainly in Australia, Papua New Guinea, Hawaii), and worked on various aspects of reef paleo-ecology, past climates and geological processes for over 10 years (in Papua New Guinea, and Hawaii). He has been active in national and international organizations and committees concerned with marine science and biodiversity policy for over 15 years (see CV). In early 2010, he is participating (as a coral specialist) on a 2-month IODP drilling cruise (GBREC-325) along the Great Barrier Reef designed to obtain the highest possible resolution record of biological,

physical, chemical and geological responses of reefs to rising sea levels since the last glacial maximum.

Field P.I. Wendy Cover completes her Ph.D. in mid-2010 with a dissertation based on ecological studies of corals at Midway Atoll since 2005. She also has extensive experience of reefs elsewhere, including in the Caribbean and main Hawaiian Islands, plus 2 years working on Niue.

Alternate Field P.I. Kristin McCully completes her Ph.D. in 2012 with a dissertation based on ecological studies of pearl oysters and communities at Midway Atoll since 2006. She also has broad experience of other reefs in French Polynesia, Australia and Hawaii.

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.

Core funding comes from the Mitsubishi Corporation (Tokyo) under their Social Responsibility Program. These funds are currently committed for 5 years (2006-2011) at \$100,000 a year. Our Midway work is one of three complementary projects forming the Mitsubishi Corporation's Global Coral Reef Conservation Project (other sites are in the Seychelles and the Ryukus).

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.

Our methods are based on established coral restoration procedures that have been implemented worldwide and are tailored to the specific needs of Midway, with full consideration of appropriate statistical design, minimal impact, and promoting the health of the reef. They are all standard ecological techniques widely used by reef scientists, and are small-scale, largely non-invasive, methods designed to provide maximum information with minimum disturbance. All methods have been discussed with USFWS scientists (e.g. John Klavitter and Jim Maragos) and these discussions will continue in the field. Locations and details of each activity will be discussed with Midway NWR staff before beginning field work.

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 use Midway Atoll NWR's small boats, and we follow both USFWS and UCSC boating regulations and procedures

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

None Known

## 8. Procedures/Methods:

We will collect coral fragments from large *P. compressa* reefs living in the deep, northwest end of the lagoon. Fragments will be transported immediately in shaded coolers to the recipient patch and either epoxied directly to the substrate, or epoxied to ceramic or plastic tiles (ca. 15x15 cm) that are attached with a stainless steel screw to the substrate (Attachment method depends on surface condition of substrate). Restoration efforts will be focused on three sites: nearshore, mid-range, and far offshore from West beach on Sand Island See Fig.1 for area in which we will select the experimental patch reefs. Each site will have three focus patch reefs at three depths and, and we will transplant 20 coral fragments to each of three depths: shallow (~1 m), mid (~3m), and deep (>5m). In previous studies, we have documented detrimental effects of urchin grazing on small corals and so will place the transplants away from areas of obvious urchin activity. At each site and depth, we will remove fleshy algae from half of the experimental surfaces to test for the potential benefit of reducing competitive interactions. Each coral will be marked, photographed, and measured; and they will be monitored regularly for one month following transplant and again after three months, and one year. Progress will be measured as the number of coral transplants surviving and by the growth of transplants over time.

We have transplanted coral fragments for previous research projects on Midway with great success. All previous *Porites* transplants survived transplanting and most have grown substantially larger in the 2 years since then. The donor colony usually recovers from breakage by growing tissue over the region within a few days; we expect minimal damage to donor colonies: we will only remove "fingers" <10 cm long of *P. compressa* which will minimize the area affected and we will monitor the recovery of all donor colonies.

We will characterize each recipient patch reef by surveying fish and benthic organisms using standard line transect procedures. We will also monitor natural coral recruitment at these and adjacent sites.

**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:

finger coral

Scientific name:

*Porites compressa*

# & size of specimens:

540 fragments; 3-10 cm long for transplant experiment

10 fragments; 3-10 cm long for voucher specimens

Collection location:

Patch reefs with high *P. compressa* cover in the deep part of lagoon.

Whole Organism  Partial Organism

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

Surviving transplants will be left on the reefs

Voucher specimens will be deposited in the Bishop Museum (and other museums).

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

Yes - at the field transplant sites.

• 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?**

USFWS charter flights to Honolulu

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

We are in continuing discussions with researchers at USFWS, NOAA, HIMB and the University of Hawaii. We are not aware of any similar research being conducted on Midway Atoll. The permanent samples will be deposited in the Bishop Museum and other museums

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

SCUBA and snorkeling gear, underwater slates, plastic tags, cable ties, chisel, epoxy, PVC tiles, stainless bolts, transect tapes, subsurface marker buoys, GPS, ruler, underwater cameras.

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

None

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

We will attach temporary plastic tags and subsurface buoys to the rock to mark the location of the transplanted corals. PVC tiles will be attached with stainless bolts to the rock. All markers and tiles will be removed by the end of the study, estimated to be 18-24 months

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

Initial field setup and monitoring will be completed by December 2010, with follow-up monitoring in subsequent field seasons. We anticipate presentation of 1-2 years of data at the 2012 International Coral Reef Symposium.

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

Maragos, J.E., Potts, D.C. et al. (2004). 2000-2002 Rapid Ecological Assessment of corals (Anthozoa) on shallow reefs of the Northwestern Hawaiian Islands. Part 1: Species and distribution. *Pacific Science* 58(2): 211-230.

Cover, W.A., Potts D.C. (2009). Coral recruitment on Midway Atoll: unexpected patterns in degraded sites with benthic cyanobacterial blooms. Presentation at Western Society of Naturalists conference, Monterey, CA. November 2009.

Cover, W.A. (2010). Natural and Anthropogenic Impacts to Midway's Reefs. Ph.D. Dissertation. University of California, Santa Cruz. (anticipated June 2010).

Cover, W.A. Variation in coral recruitment on Midway Atoll, Northwestern Hawaiian Islands. (Submitting to Marine Ecology Progress Series)

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.

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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