

Request for Proposals

Heavy lift UAV broadcast application of conservation bait pellets to remove rats

INVASIVE RAT ERADICATION ON ULONG ISLAND, PALAU

CONTACT: ISLAND CONSERVATION, TOMMY.HALL@ISLANDCONSERVATION.ORG

Executive Summary

Island Conservation seeks proposals for a heavy lift drone capable of a minimum lift capacity of 25kg (preferably larger) with a dispersal system capable of evenly distributing bait pellets to target introduced, damaging, invasive rats on Ulong Island, Palau, protecting the island's at-risk communities and ecosystems. The project includes mapping the project site, development and testing of the aerial platform and bait dispersal system and providing a team to complete two bait broadcast applications covering the 120-ha island in Palau. Island Conservation will consider proposals for all or parts of the project as described herein. The operational window for the broadcast is February – April 2021 (or 2022 if global pandemic conditions prevent safe deployment to the field in 2021).



Figure 1. An aerial image of Ulong (Photo: Julien Cohen).



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Introduction

Island Conservation (IC) is a science-based nonprofit conservation organization committed to protecting island species and ecosystems. Island Conservation's mission is to prevent extinctions by removing invasive species from islands. Currently, we are in the planning stage of a project to remove invasive rats from Ulong Island, Palau. Our goal is to utilize UAVs to broadcast bait over the island to eradicate the predatory rats. This action will protect the island's native species terrestrial and near-shore marine ecosystems, and protect the local community's cultural heritage, livelihoods, and food security. We are looking to work with a UAV company that can map the site, provide heavy-lift UAVs, custom bait spreader buckets, and UAV operators to complete the project.

Statement of Purpose

Palau is a hotspot for biodiversity in the region. Invasive rats on Ulong Island threaten species found only in Palau. The loss of the terrestrial species, particularly nesting seabirds, also negatively impacts the surrounding coral reef system, which relies on the flow of nutrients brought by the seabirds. Island Conservation is partnering with the Koror State Government Department of Conservation and Law Enforcement (DCLE) to plan and execute a rat eradication project on Ulong.

Background Info

In 2019, Island Conservation completed the world's first rat eradication using UAVs in the Galapagos Islands. The project was implemented successfully and demonstrated a proof of concept. Our goal is to use UAVs to increase the scope, scale, and efficiency while reducing the cost of rat eradications on islands around the globe.

A project of this scale typically relies on the use of a helicopter with an underslung bait spreader bucket to apply bait across the island. However, there is not an equipped helicopter or experienced pilot in the region, and helicopter operations are expensive. Therefore, we are continuing the development of UAVs for aerial rodent eradication projects. We plan to apply the tools and technologies developed for this project on a multitude of island eradication projects (both in Palau and around the world), and we believe the technology may carry over to other markets, such as agricultural pest control.

The Project Site

Palau is a sovereign country in the Tropical West Pacific region. Ulong is a cluster of small raised limestone islets with intricate coastlines making up a total of 120 hectares in Palau's Rock Island Southern Lagoon, a UNESCO World Heritage Site. A tropical, limestone broadleaf forest densely covers the entire island, and the terrain is complex and rugged. Steep, sometimes vertical, limestone cliffs make up much of the coastline, often the coastal cliffs are undercut by the ocean. Interior cliffs and caves are present throughout the island. There are three interior bodies of water. There are a few small accessible beach areas, most of them covered by long-reaching tree branches, except for the largest beach on the North West side, which is open and could be used as a landing site. The island is uninhabited and has no permanent structures except for the covered picnic area and bathrooms. Access to the island is by boat only, which is dependent on the tide.



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How rats are eradicated

Rats are typically removed from islands using a highly palatable cereal grain-based bait containing a rodenticide. The Ulong project will use helicopters or UAVs to aerially broadcast bait, covering the entire island with no gaps. Aerial broadcast rat eradications use specialized spreader buckets to sow bait across the island and GPS guided flight to ensure proper coverage. For broadcast operations, the entire island is treated twice in two applications 21 days apart. The second application allows time for any sub-dominant or juvenile rats to access bait once most of the population is gone.

The following is a link to an informative video about a large scale rat eradication project on South Georgia Island: <https://www.youtube.com/watch?v=A3KxxcNL93c>

One of the essential parts of a broadcast application is ensuring every rodent on the island has access to a lethal dose of the toxicant (a single bait pellet). To ensure this, we determine the appropriate application rate in kilograms of bait per hectare of land area in advance of the operation. Then we follow good practice guidelines for baiting that have proven successful in more than 500 rodent eradication operations. The aerial bait application is completed by flying straight parallel flight lines across the interior of the island with bait broadcast in both directions out of the bait spreader. The coastal perimeter is treated by flying the actual coastline while spreading out of only one side of the spreader bucket to avoid bait getting into the water. GPS data collected during the operation allow eradication managers the ability to monitor bait coverage and density on the ground in real-time.

The bait spreading system

The spreader bucket is an essential component of the aerial eradication. The spreader has a mechanical gate either controlled autonomously or manually by the pilot; once opened, bait pellets flow downwards from the large chamber through a necked-down funnel into a motorized rotary spinner. As the pellets flow through the spinner, they are 'thrown out'. The swath the pellets cover must be uniform and achieve an even application rate. The application rate can be changed by speeding up or slowing down the aircraft, or by physically adjusting the flow rate. Such as changing the aperture of the opening into the spinner. When treating the coast or other sensitive areas, a directional swath are required, this can be achieved by blocking or deflecting the flow of pellets in one direction.

The bait spreader designed and used for this project must meet the following criteria:

1. Spread pellets between 1 gram and 5 gram out of the bucket with a swath width of 40 meters (20 meters each side) or greater
2. Spread bait uniformly across entire swath at our desired rate. (between 4 kg/ha and 20 kg/ha)
3. Capable of directional spreading of bait i.e. from only one side of the spreader in a 90-180 degree arc.
4. Demonstrate the ability to control application rate in bait calibration test
5. Demonstrate a rapid, reliable and straightforward method of refilling bait
6. Capable of quick field repairs including two complete sets of spare parts
7. The bucket must always have a live view camera to monitor bait volume and ensure proper functionality



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The UAV platform

1. Capable of autonomous bait spreading using pre-programmed flight with the ability to adjust flight speed, flight line spacing. Autonomous triggering of the bait spreader should be synchronous with entering/exiting the area targeted for baiting, allowing for precise application and bait only spread on the target area
2. Has the ability to maintain consistent height above ground level (i.e., terrain-following) based on the digital surface model
3. Ability to autonomously fly along coastal boundaries at a consistent speed based on pre-programmed flight paths derived from aerial Orthomosaic imagery
4. Ability to autonomously maintain half swath width distance from coastal cliffs to enable parallel flights along cliffs at multiple designated altitudes
5. Ability to record flight lines of the area treated including start time, end time, speed, and distance covered
Ability to export flight line data in the field to facilitate real-time monitoring of application progress

Ulong Project Specifications

Project area (land and water)	~320 ha; 788 acres
Application area*	120 hectares; 297 acres
Max elevation	80 meters; 286 feet
Total number of islets	14
Bait type	Conservation 25W, manufactured by Bell Laboratories
Bait specs	Cylindrical pellets; Diameter = ½"; Length ½" Mass ~2.3 gram; 0.08oz
Bait application rate on the ground	40 kg/ha; 35 lb/acre
Bait application rate out of the bucket	Between 4 and 20 kg/ha; 3.5 and 18 lbs/acre
Number of applications	2
Day between applications	21 (minimum)
Coastal perimeter rate	40 kg/ha; 35 lb/acre
Total bait to be applied**	9,600 kg; 21,165 lb
Operational landing and bait loading site	It is expected this will be a boat/barge based operation

*This area is an initial estimate based on a two-dimensional area using the coastal perimeter. The actual application area will be determined using the three-dimensional surface area calculated using the DSM.

** This total is based on the estimated area; the actual total bait applied will be calculated from the three-dimensional surface area.



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Figure 2. A google earth image of the Ulong island group. The red polygon represents the "project area." Only the land area will be treated.

Scope of Work

The objective of this project is to eradicate rats from the Ulong island group, by the aerial broadcast application of bait using heavy-lift UAVs. The UAV component of the project will have three distinct components

- 1) Development and Testing
- 2) Scoping and Mapping
- 3) Aerial baiting operation

Deliverables

The deliverables are split into one of the three phases above. Island Conservation will consider proposals for the entire scope, or for a distinct phase or deliverable. All proposals must supply information on achieving the following.

1. Development and Testing

- A. Provide heavy lift UAV(s)
 - i. Absolute minimum payload capacity = 25 kg; 55 lbs
 - ii. Ideal minimum flight distance at maximum payload = 10 km; 6.2 mi
 - iii. UAV will be capable of programmable autonomous navigation with precision payload triggering



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- iv. UAV(s) are provided on a service-based or lease agreement. (Proposals requiring the purchase of equipment will be considered but are a less desirable business model at this time)
- B. Build or source bait spreader bucket(s), compatible with the UAV, and capable of 40 m swath width and directional broadcast.
 - i. The capacity of the hopper should maximize UAV payload capacity
 - ii. The spreader may be designed or provided by a third-party subcontractor
 - iii. Directional broadcast refers to bait spreading out of one side only
- C. Identify mission planning software, customize as needed for aerial baiting utility
 - i. Must be easily programmable in the field
 - ii. It cannot rely on a connection to wifi or cell network
 - iii. Mission flights should be completely autonomous
 - iv. Meets all flight and bait application objectives identified in deliverable number 4 below.
- D. Complete a bait application rate calibration prior to the eradication to ground-truth the bait application rate on the ground and demonstrate terrain following, and the ability to treat cliffs. The location and timing of the calibration are negotiable.
 - i. Verification of at least 40 m swath width with inert rodenticide product following the company's bait calibration protocols
 - ii. Verification of ability to achieve a 20 kg/ha sow rate out of the bucket with inert rodenticide product and ability to adjust this rate by at least 2kg/ha increments based on flight speed and manual flow rate adjustments
 - iii. Verification of ability to autonomously fly along coastal boundaries at a consistent speed based on pre-programmed flight lines derived from aerial Orthomosaic
 - iv. Verification of ability to autonomously maintain half swath width distance from coastal cliffs to enable parallel flights along cliffs at multiple designated altitude.
 - v. Verification of ability to record flight lines of the area treated including start time, end time, speed, and distance covered
 - vi. Verification of the ability to export flight line data in the field to facilitate real-time monitoring of application progress

2. Scoping and Mapping

- A. Aerial mapping of the project site
 - i. Travel to Palau and complete mapping flights using vendor owned fixed or rotary-wing UAV
 - ii. Aerial Orthomosaic Image
 - iii. Digital Surface Model (DSM)
 - iv. Imagery should be accurate to 10 cm
 - v. RTK or GCP points should be used
 - vi. Maps will be used for programming bait application for automated bait dispersal



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3. Aerial Baiting Operation

- E. Execute aerial baiting operation, which will include two complete applications at a minimum of 21 days apart with each baiting application taking a maximum of three days
 - i. Support Island Conservation in Operational planning for UAV component of the project
 - ii. Support Island Conservation for Palau Bureau of Aviation compliance, permits and exemptions
 - iii. Travel to Palau and work IC and the DCLE team to complete aerial broadcasts covering the entire land area
 - iv. The broadcast baiting operation must follow the operational plan
 - v. Provide a post-operational report

Project management

The planning and management of the overall eradication operation will be led by an Island Conservation project manager based out of Santa Cruz, California. Island conservation will also provide experienced staff, and institutional knowledge of eradication operations, including GIS and aerial baiting expertise. The Department of Conservation and Law Enforcement (DCLE) of Koror State Government (KSG) in Palau is the land manager and has final decision-making power over the project. IC and KSG have a memorandum of understanding to complete invasive species removal projects on islands in Koror State.

During the baiting operation in Palau, Island Conservation will oversee the overall eradication project implementation and evaluate bait application progress, and the UAV team will lead the UAV operation.

Budget

Island Conservation is a nonprofit charitable organization incorporated in the state of California; our fundraising goals are to match the cost of completing the project. We are always interested in collaborative opportunities to reduce costs while benefiting all parties. This project offers a chance to field test products and provide a real-world case study, providing proof of concept and good communications and marketing materials.

- All travel to Palau and accommodations will be covered at actual cost.
- The total cost of mapping and scoping should not be greater than USD \$30,000 to Island Conservation
- The total cost of development, testing, and execution of baiting operation should not be greater than USD \$175,000 for Island Conservation
- Payment schedules and other fiscal considerations are negotiable.
- Proposals involving third party investors, donors, collaborators to mutual benefit consistent with the project mission and our not-for-profit business model are welcomed and encouraged.



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Project Schedule

DATE	MILESTONE
September 1, 2020	Proposals due to IC
September 30, 2020	Proposals selected by IC
November 1, 2020	Contract signed
October 31, 2021`	Scoping and mapping in Palau completed; Operational planning completed
January 15, 2022	Aerial baiting calibration
February 2022–April 2022	Aerial Baiting Operational Window
July 1, 2022	Operational reporting, close-out project:

Selection Criteria

The criteria that will be used to evaluate proposals are set out in order of importance below:

- 1. Skills and experience:** The successful proposal must provide evidence that that the company has the necessary skill and expertise to provide and operate the appropriate aircraft and bait spreading system. The proposal must demonstrate that the company will be able to spread bait reliably and accurately over the island. Considerations will be made of the:
 - a. Relevant projects and experience of the company and pilots
 - b. Availability to provide backup pilots.
- 2. Capacity:** The successful proposal must provide evidence that they can complete two bait applications on a 21-day interval, as described above, within three days between February 1, 2022, and April 30, 2022. Considerations will be made of the:
 - a. Number, lift capacity, and reliability of the UAVs
 - b. Design, functionality, and capacity of the bait spreader bucket system
 - c. Demonstration of efficient bait loading
 - d. Reliability of the GPS autopilot system with autonomous baiting
 - e. Demonstrate the availability of back up UAVs and equipment.
- 3. Replicability and catalytic potential:** Island Conservation have aligned its resources to innovate to increase the global scale, scope, and pace of island invasive species eradication. We are only one of dozens of practitioners doing this work globally. But we are the world’s only global not-for-profit whose sole mission is to do this work. We aim to help shape the market, tools, and technology available to reduce costs and risks associated with this work while increasing efficiencies. Proposals demonstrating potential for replication, scaling, or otherwise catalyzing the drones-for-invasive-species-management market will score best in these criteria.
- 4. Price:** Tenders will also be appraised on their financial competitiveness.



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Requirements for Proposals

1. If considering developing a proposal for this project, please notify the point of contact immediately so that any relevant information can be provided
2. Clearly identify if the proposal is for the entire project or one component
3. Clarify if you are planning to outsource a component of the work and name all subcontractors

Supporting info to provide with the proposal:

1. Background info about the company and how it is qualified for this work including letters of references, reviews, and other testimonials vouching for your skills and experience
2. Descriptions or case studies of similar or relevant projects would be useful
3. If there are any related business relationships or conflicts of interest, please identify them

Submission of Proposals

RFP Timeline and review process

Deadline to submit proposals: September 1, 2020

Expected timeline to review and notify bidders: September 30, 2020

Contract negotiation and signing completed: Nov 1, 2020

1. Proposals must be submitted by the time stated above.
2. Proposals can be submitted by email to the contact provided below. The document should be in PDF format and identified in the subject line that it is a proposal for the Palau UAV Rat Project
3. The proposal must clearly address each of the deliverables identified above.

Questions for Island Conservation

Questions about the project, proposal, or Island Conservation welcome. Please send all questions to the point of contact listed below. All questions and responses will be communicated to all parties known to be developing a proposal.

Acceptance of Proposal

Island Conservation will notify the party upon acceptance of a proposal via email. All submitting parties will be notified when a proposal has been accepted. If no proposal is accepted within a month of closing the deadline, each submitting party will be notified by email whether their proposal is or is not still under consideration.

Point of Contact

All proposals and questions should be directed to the contact below:

Tommy Hall

Project Manager – Island Conservation

Email: Tommy.hall@islandconservation.org

Mobile: +1 831.917.3123

Skype: hall.tommy

Location: Global Headquarters – 2100 Delaware Ave. STE 1, Santa Cruz, CA, 95060, USA



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