

Papahānaumokuākea Marine National Monument
CONSERVATION AND MANAGEMENT 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: Charles Littnan

Affiliation: NOAA Fisheries, Pacific Islands Fisheries Science Center, Hawaiian Monk Seal Research Program

Permit Category: Conservation and Management

Proposed Activity Dates: 8/1/16-7/31/17

Proposed Method of Entry (Vessel/Plane): NOAA RV Oscar Elton Sette or Hi'ialakai, Midway Flight

Proposed Locations: Nihoa, Mokumanamana, French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll

Estimated number of individuals (including Applicant) to be covered under this permit: 4

Estimated number of days in the Monument: 56

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...

Use the APH-22 Hexacopter for environmental and natural resource monitoring in the Northwestern Hawaiian Islands (NWHI). Specifically, the unmanned aerial system (UAS) will support monitoring and surveying of marine mammals and marine debris (and potentially other flora and fauna) in the areas of Nihoa, Mokumanamana, French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes Reef and Midway Atoll.

b.) To accomplish this activity we would

Utilize the UAS to meet the resource protection and management requirements of the Papahānaumokuākea Marine National Monument. We will deploy (hand launch) the UAS platform to survey select sites within the NWHI for Hawaiian monk seal population and health assessments, marine debris detection, and surveying Tern Island to document entrapment threats to wildlife. The UAS would fly at altitudes below 500 feet. Specific altitudes at certain locations will vary and are identified below.

Specific goals for this project include:

- 1) Continue to assess the ability of the systems to operate discreetly with minimal disturbance to sensitive seabird colonies or marine mammals.
- 2) Conduct population surveys of monk seals using UAS primarily at Nihoa and Mokumanamana.
- 3) Conduct aerial survey of Tern Island to assess degradation of island infrastructure and identify entrapment and other hazards to wildlife.
- 4) Develop techniques for photogrammetry (body condition assessment) for monk seals.
- 5) Potentially other efforts as requested by PMNM partners.

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

Providing the ability to survey resources on the remote islands without (1) interference; (2) the potential for the introduction of invasive species; and (3) human disturbance to the natural resources. The UAS would increase the monitoring and surveying capacity in the Monument. This effort will also ensure that counts of Hawaiian monk seals are successfully completed each year at Nihoa and Mokumanamana. These two locations account for 20% of the NWHI population of seals and have become important populations. Limited access to these sites undermine our ability to estimate population trends at Necker and Mokumanamana and develop survival enhancement strategies for monk seals across the archipelago.

Other information or background:

The UAS will be launched and recovered from land, the NOAA Ship, Oscar Elton Sette, or one of the ships' launches and/or rigid hulled inflatables and flown at altitudes below 500 feet. Specific altitudes and special considerations for each location are specified below.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Charles Littnan

Title: Lead Scientist, NOAA Fisheries, Pacific Islands Fisheries Science Center,
Hawaiian Monk Seal Research Program

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

2. Mailing address (street/P.O. box, city, state, country, zip):
Hawaiian Monk Seal Research Program

[Redacted]

[Redacted]

[Redacted]

[Redacted]

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

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

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):

Jessie Lopez, JIMAR, APH-22 Pilot

Mark Sullivan, JIMAR, APH-22 Pilot

TBD, NOAA Corps, APH-22 Pilot

CONSERVATION & MANAGMENT

Section B: Project Information

5a. Project location(s):

		<u>Ocean Based</u>	
<input checked="" type="checkbox"/> Nihoa Island	<input checked="" type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Necker Island (Mokumanamana)	<input checked="" type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> French Frigate Shoals	<input checked="" type="checkbox"/> Land-based	<input checked="" 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 checked="" type="checkbox"/> Laysan Island	<input checked="" type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Lisianski Island, Neva Shoal	<input checked="" type="checkbox"/> Land-based	<input checked="" type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input checked="" type="checkbox"/> Pearl and Hermes Atoll	<input checked="" type="checkbox"/> Land-based	<input checked="" 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: All missions will be launched from a small boat nearshore or from the beach (see below). Surveys can occur at any island or islet at the locations above. Shallow reef may be surveyed as well.

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 ****This was selected as we may need to retrieve platform from ocean in case of water landing.**

6. Purpose/Need/Scope *State purpose of proposed activities:*

The rich biodiversity of the PMNM stretches from the tops of basalt cliffs to the depths of the ocean. Extensive coral reefs found are home to over 7,000 marine species, one quarter of which are endemic to Hawaii. Many of the islands and shallow water environments are important habitats for rare species such as the threatened green turtle and the endangered Hawaiian monk seal, as well as the 14 million seabirds representing 22 species that breed and nest there. Land areas also provide a home for numerous plants and four species of bird found nowhere else in the world, including the world's most endangered duck, the Laysan duck. The research, management and conservation of many of these species is reliant on evolving new tools to aid partner agencies to conduct their work more efficiently while reducing impacts and disturbance to resources. UAS platforms could be incorporated into numerous monitoring and research programs within the PMNM. This mission will continue work conducted in 2014 and 2015 to assess the efficacy of UAS to aid in marine debris and marine mammal monitoring efforts, as well as habitat mapping in the Monument. These collection of images can help support a broad range of resource protection and management issues. In addition, the system is able to operate discreetly with minimal disturbance to sensitive seabird colonies or marine mammals.

The primary focus of this mission will be monk seal population and health assessment as well as documenting the entrapment threats at Tern Island. Additionally surveys will include marine debris monitoring and potentially other missions requested by PMNM partners.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species? Yes No

For a list of terrestrial species protected under the Endangered Species Act visit:

<http://www.fws.gov/endangered/>

For a list of marine species protected under the Endangered Species Act visit:

<http://www.nmfs.noaa.gov/pr/species/esa/>

For information about species protected under the Marine Mammal Protection Act visit:

<http://www.nmfs.noaa.gov/pr/laws/mmpa/>

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?

In 2014 and 2015, the UAS research team (including members from NOAA, USFWS and other partners) demonstrated that the PUMA (fixed wing plane) and APH-22 (multi-rotor aircraft) systems could operate with virtually no impacts to cultural and natural resources within the Monument. As in 2014 and 2015, the UAS will be operated by trained NOAA staff and affiliates and all relevant Monument Best Management Practices and protocols specific to deployment and retrieval will be followed. Interactions with birds and other wildlife will be closely monitored and should significant interactions occurs operations will be halted. Previous observations have demonstrated that while some birds are temporarily disturbed by launching of the platforms they return to roost shortly afterwards. We will minimize repeat launches near areas of birds so as to not repeatedly disturb the same individuals. Birds have demonstrated curiosity in the APH-22 during flight but have not come into contact with it. We will continue to avoid large groups of birds.

Different from previous years, we are requesting the use of the APH-22 at both Nihoa and Mokumanamana. Both of these islands and the cultural sites upon them are of great significance to the native Hawaiian community. Past discussions have identified at least two areas of concerns to Hawaiian cultural practitioners: 1) capturing images of cultural sites and 2) generally operating over the islands themselves as it is the land, sea and air around the islands that are sacred. We hope to gain access to conduct operations by only conducting flights over the coast (rocky shelves and beaches) of the two islands. There is no need to fly over the upper reaches of the islands and we will not photograph any cultural sites. We can also work to minimize the amount of time for operations. We will be engaging with OHA and the PMNM Cultural Working Group to further this discussion.

All photos and imagery captured by the UAS will be used internally for purposes of conservation and management activities. Images will be shared with all Co-Trustee agencies upon request and not disseminated for public consumption without first ensuring the appropriateness, from a cultural and natural resource perspective, of the information being disseminated.

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 UAS operates in a discreet manner, flying at altitudes of 500 feet or less, though most operations are lower. There is no disturbance to marine mammals and little disturbance to seabird colonies during deployment (only during launch when on land near bird roosts). The data captured would be managed by NOAA and shared with other managing agencies and aid in management decision-making.

As stated above, we want to ensure that these activities are designed and undertaken in a way that accomplishes the conservation goals while incorporating input from the Native Hawaiian community to ensure they occur with appropriate level of sensitivity and respect. To this end we have reached out to the Office of Hawaiian Affairs to discuss the project and receive any initial input or concerns. We look forward to responding to any questions from the Cultural Working Group or other partners to ensure that this mission is thoroughly and assessed and refined as appropriate. If any partners would like a briefing or have a discussion we are available.

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.

The work proposed here is intended to be a regular part of Hawaiian monk seal research and recovery activities. The recovery of Hawaiian monk seals requires us to conduct our work in the NWHI. The addition of Nihoa and Mokumanamana is especially important as the populations of monk seals on these two islands have grown more important to the species recovery (two sites that have remained stable or shown growth in the last 10 years). However, our data at the two sites is limited due to limited landing opportunities to do surveys (often sea conditions prevent our ability to conduct surveys). Multiple years can pass where we are unable to monitor the population. This impacts our data but also causes us to evidence of dangers to the population such as male aggression. The use of UAS ensures that we could successfully get population counts during each visit to the NWHI in the future.

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 is little evidence that the UAS platforms have lasting/significant adverse impacts to any Monument resources. Ultimately the platforms will likely allow for greater monitoring while reducing the impacts of human presence. These tools will provide better assessment of animal condition and enhance the data quality collected on the monk seal population which drives our recovery decision making process. These tools will also be valuable for monitoring other flora and fauna throughout the Monument.

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

The activity will occur in conjunction with other monk seal research and recovery activities. The schedule of operations are as followed:

1. Hawaiian Monk Seal Camp Pick-Up Cruise approximately Aug 3 - 24. This would include operations at Nihoa, Mokumanamana, French Frigate Shoals, Laysan, Lisianski, and Pearl and Hermes Reef.

2. Midway Research Trip, approximately two weeks with the date to be determined (possibly September). This would be done in conjunction with a larger study on the ecology and health status of Midway monk seals. This trip will be planned in coordination with Midway Atoll National Wildlife Refuge.

3. Hawaiian Monk Seal Camp Deployment, three week cruise on Hiʻialakai. Dates to be determined but likely in April or May 2017. This would include operations at Nihoa, Mokumanamana, French Frigate Shoals, Laysan, Lisianski, and Pearl and Hermes Reef.

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

Charles Littnan is the head of NOAA's Hawaiian Monk Seal Research Program, the primary group charged with understanding and recovering this endangered species. He has participated in two field seasons using UAS in the NWHI and is qualified to fly the APH-22. The HMSRP intends to use UAS as a future tool to aid in their research, monitoring and emergency response of monk seals.

All pilots and partners associated with this project will have training and experience relevant to the role they will play on the team.

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 applicant has adequate financial resources available to conduct the proposed management activities. Federal funding is provided through congressional appropriation.

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.

This mission will be following the same protocols and considerations that were developed for the UAS mission in 2015. The methods and procedures used in the conservation and management activities by the permit applicant are appropriate to achieve the proposed activity's goals. All activities proposed are required for effective management of the Monument and are conducted in a way that minimizes impact as required by law. Management activities assist the applicants to protect the Monument natural, historic and cultural resources, qualities, and ecological integrity.

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

All NOAA Vessels are equipped with required technologies.

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.

8. Procedures/Methods:

The APH-22 has a pilot and an observer and is launched from the observer's hand. Once launched the observer monitors the base station and scans the sky to see if there is any air traffic requiring the landing of the UAS. There will also be a wildlife observer who will note animal disturbance or interactions with birds in the air. The system will fly for approximately 15-20 minutes and will remain within the pilot's visual range (1-nm). The rechargeable battery will be replaced for each mission.

General Operation Guidelines:

Daylight hours only

Winds less than 25kts

Only NOAA Certified Pilots trained specifically for the APH-22 will operate the system.

Operations at Midway and Tern Island will require special authorizations and requirements that will be developed with NOAA, USFWS and the FAA over the next several months. Operating within 5 miles of an airport requires a licensed pilot so these operations will not occur unless all approvals have been received.

Nihoa Protocol:

Flights at Nihoa will only occur in three shoreline areas: the rock ledges near the landing site in Adam's Bay, the sandy beach and nearby rock ledges in Adam's Bay, and the rock ledge on the western side of the island (see attached map). No flights will be made over the island except in the identified shoreline zones.

Launches will occur via small boat located between 50 - 500 feet offshore from the survey location. Launch point will be determined by swell and other environmental conditions. The platform will be flown towards the island between 100-200 feet in altitude depending on wind conditions and bird activity. Aerial photography of animals and haul out areas will occur between 30 - 100 feet depending on wind conditions.

If the team lands on Nihoa to conduct landbased monk seal assessments then the APH-22 may be launched on land to survey the sandy beach (primary monk seal haul out) to photo-identify seals. The same altitudes described above will be in place for these flights.

Estimated number of flights and flight time for Nihoa surveys (this may change based on environmental conditions and number of seals): 5 flights, 75 minutes.

Mokumanamana Protocol:

Flights at Mokumanamana will only occur at five shoreline locations highlighted in the attached map. No flights will be made over the island except in the identified shoreline zones.

Launches will only occur via small boat located between 50 - 500 feet offshore from the survey location. Launch point will be determined by swell and other environmental conditions. The platform will be flown towards the island between 100-200 feet in altitude depending on wind conditions and bird activity. Aerial photography of animals and haul out areas will occur between 30 - 100 feet depending on wind conditions.

Estimated number of flights and flight time for Mokumanamana surveys (this may change based on environmental conditions and number of seals): 6 flights, 60 minutes.

All Other Sites Protocol:

All surveys at other locations will be land-based launches. Maximum altitude will be 500 feet and will be generally during transit. Habitat mapping and marine debris surveys will generally occur between 200 - 400 feet. Animal photo-identification and disturbance monitoring will occur between 30 - 165 feet. Seal condition studies will occur between 30 - 100 feet.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding.

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:

& size of specimens:

Collection location:

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

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

APH-22 Hexacopter
Omni RF controller unit
Gimbale Camera System
Battery Charger
Computer Base Station
LiPo Batteries
Field Repair Kits

13. List all Hazardous Materials you propose to take to and use within the Monument:
lithium polymer batteries.

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

NONE

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

Photographs and video can be available to PMNM partners immediately on request.

Data analysis for population assessment will occur by January 15th 2017 for our annual population summaries.

Analysis of condition estimates will occur during 2017, but won't be published until later (dependent on sample size etc.)

Report on aerial survey of Tern Island will be completed and provided to PMNM partners in early 2017.

A summary of the total number of flights, flight time, bird disturbance/interactions, seal disturbance, and other specific data will be available shortly after each cruise and will be provided to the PMNM MMB and other stakeholders who are interested. A final report will be provided at the conclusion of the permit as required by the PMNM protocols.

16. List all Applicant's publications directly related to the proposed project:

Samantha Brooke, David Graham, Todd Jacobs, Charles Littnan, Mark Manuel, Robert O'Conner (2015). Testing marine conservation applications of unmanned aerial systems (UAS) in a remote marine protected area. Journal of Unmanned Vehicle Systems, 3(4): 237-251, 10.1139/juvs-2015-0011

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

3/21/2016

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

Nihoa Island: Three survey sites are highlighted in yellow. All flights below 200ft.



Mokumanamana: The five locations are highlighted in yellow. All flights below 200 ft.



Specifications for UAS Platform: APH-22

Prepared for PMNM Permit Application for Aug. 2016
and April/May 2017 Operations



Utilizing unmanned aerial systems (UAS) for natural resource monitoring and marine debris detection in the Papahānaumokuākea Marine National Monument



The use of UAS is to help develop tools to fulfill the resource protection and management requirements of the Papahānaumokuākea Marine National Monument (PMNM). UAS platforms will be used to survey select sites within the NWHI for marine mammal activity as well as marine debris. Other missions may be added. We will be using multi-rotor UAS platform, APH-22.

APH-22

The APH-22 is a hexacopter regular used by NOAA and other agencies for a variety of work. It was used to conduct monk seal and marine debris surveys at Laysan and Lisianski Islands and Pearl and

Hermes Atoll in 2015. It has been used to study marine mammals and birds from Canada to the Antarctic. These links demonstrate the platform in action in research with sea lions (<http://1.usa.gov/1KqknOb>) and killer whales (<http://bit.ly/1EFnXTO>):



APH-22 (Hexacopter)

Range: Line of sight

Endurance: 18-25 min

Speed: 20 m/sec. (39
Knots)

Wing Span: 32.4 in

Length: 32.4 in

Weight: 6 lbs (2.7 kg)

GCS: Laptop or Tablet
Computer with Radio
Telemetry (915Mhz)

Launch Method: Vertical
Take Off and Landing
(VTOL)

Recovery Method: VTOL



