Virgin Islands National Park 2017 Hurricane Maria UAS Operations

National Park Service
Department of the Interior

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Photos of Hurricane Irma and Maria impacts on Virgin Islands National Park (clockwise from top): Lind Point NPS housing; displaced vessels at Princess Bay; Cinnamon Bay Warehouse; Biosphere NPS offices; Hassel Island cultural site; displaced vessels at Princess Bay; Island Fancy NPS housing; Cinnamon Bay beach and concessionaire facilities.

Overview

In November 2017, NPS-fleet Unmanned Aircraft Systems (UAS) flights were conducted in the Virgin Islands National Park (VIIS) on St. John Island and Hassel Island to assess the damage sustained by park infrastructure and resources from Hurricanes Irma (September 5-6) and Maria (September 15-17). The flights were conducted over park housing, visitor facilities, beaches, displaced vessels, archaeological sites, and an educational center to collect video and stereo photos. Real-time footage on-site increased situational awareness and provided input to the IMT for damage assessments; curated video products were used to brief Washington, D.C. officials; and final video products were used as public outreach tools. Video and mapping products were also created for cultural resource advisors in planning site access and assessments.

Justification

Flights over St. John Island were necessary to assess damage from vantage points not accessible by ground or boat and with a resolution not obtainable with other aerial sensors. Flights over Hassel Island cultural sites were necessary to reduce the time and costs of ground surveys; dense vegetation and heavy debris across unmaintained or damaged trails prevented cultural resource advisors from accessing the sites and ruins.

In addition to the higher resolution, lower costs, and lesser risk of UAS imagery collection, UAS imagery provides a wide-angle, high altitude view of the extensive damage sustained along large swaths of beach. UAS provide a view of the beaches from the air above the water, facing the same direction the high winds and storm surges of hurricane, giving a first person view (FPV) of damage done to the land cannot be acquired by boat, which is limited to the horizontal view and inhibited by marine hazards.

Authorizations

Emergency approval for the NPS administrative use of UAS was requested by VIIS andwas granted verbally by the NPS Associate Director of Visitor and Resource Protection, with a formal approval submitted post-flight, as outlined by the NPS Director's Memo 14-05 and the NPS Reference Manual 60. The Southeast Region (SER) Regional Director and Regional Aviation Manager were briefed by the National Aviation Manager's office after addressing any concerns with the DOI Office of Aviation Services (OAS).

NPS retained operational control over each flight, and all flights launched, landed, and operated from or over park lands and water. For flights over Hassel Island in Class C airspace, an emergency Certificate of Authorization (eCOA) was filed by the DOI Office of Aviation Services and approved by the FAA to operate in the controlled airspace near Charlotte Amalie International Airport on St. Thomas Island. Provisions in the eCOA were followed to ensure safety for non-compliant operators.

Methods

Flights on November 10 were flown with a GoPro Hero 4 to collect video and a Ricoh GRII to collect still images. Data was gathered at Cinnamon Bay, Maho Bay, Mary Creek, Island Fancy, Princess Bay, and Lind Point. Public Information Officers (PIO2) and the Incident Commander acted as directors and Visual Observers. At Cinnamon Bay, the payload was switched out to conduct missions related to photogrammetry

work. Flights were conducted at 100' AGL, and covered a 1500-square foot over the oldest structure on the island, which had also served as a repository for artifacts and as an educational center.

Flights on November 17 were flown with a GoPro Hero4 to collect video of cultural sites at Careening Cove and Creque Marine Railway. Water operations (DIVA and LEO) assisted with transportation and acted as Visual Observers, while the cultural resources READ acted as video director.

Products

The video footage from UAS flights conducted on St. John Island was included in a briefing to the NPS Director, Deputy Director, and Deputy Secretary of the DOI on the damage sustained by the park. Following the briefing, a decision was made to extend a Type 2 IMT.

Full Motion Video (FMV) products were created for all flights, providing the IMT GISS with the ability to digitize damage for estimating work orders costs. FMV products for the Hassel Island flights were also given to the cultural resource READ for digitizing site footprints.

Structure-from-Motion software created a georeferenced sub-centimeter orthomosaic (3mm/pix) and 3D model (5 mm/pix) of the Cinnamon Bay warehouse/education center. Products for viewing the orthomosaic and DSM in ArcMap and in Google Earth were given to the cultural resource READ to compare to imagery previously collected for the area.

After Action Review

Further discussions to assess the success of the emergency UAS authorization process and incident response field operations should take place between the IMT, UASP, NPS, and OAS. A short list of immediate assessments follows:

Successes

- Authorizations/Planning
  - DOI OAS, NPS NAO, NPS SER, and the VIIS IMT all cooperated and put forth extra effort to assist with the mission;
  - FAA eCOA application and approval was short and efficient.
- Data processing
  - With a UASP/GISS and PIO2, data and video were immediately processed for presentation the next day.
- Outreach/Education
  - Social media posts of the videos reached more than 100K viewers, with almost 1,000 viewers sharing the video.

Challenges

- Authorizations/Planning
  - Outdated OAS-36U and 30U required extra effort of UASP to reach out to OAS for renewal;
  - PASP creation for an incident requires more specific language to identify hazards and due to

unexpected flights in different airspace, a second PASP needed to be created;
  - The adherence to following the procedure for the Approval Template post-flight seemed unnecessary;
  - The WIMT was eager to use UAS as a resource and trusted the UASP's word on the process required, but there needs to be a more formal way to present UASP as a resource beyond a leap of faith by IC and agency authorities;
  - Caching maps is not possible in an area without internet, but caching maps prior is also not possible given the size and extent of possibly affected areas.
- Communications
  - Cellular and internet services at ICP were non-existent or unreliable, making it difficult to follow a formal process of authorization;
  - Cellular service within Class C operations on Hassel Island was also limited, making it difficult to notify ATC by phone.
- Operations
  - Severely limited by battery life; need to brainstorm how to physically transport enough Li-Po batteries on commercial flights, since shipping was not possible given time and postal services suspended;
  - Without an Aviation Branch Manager on incident, aviation operations were left to the UASP (e.g., 204 form) who has no formal ICS aviation experience or training;
  - Severe glare on tablet would have been reduced if PIC had brought PFV goggles (left behind to save on baggage);
  - Humid climates such as Texas and the Virgin Islands reduce response of touch-screen tablet, requiring table stylus.
- Incident Assignments
  - There is no "standardized" kit for all UAS missions/incidents; each UASP needs to be prepared for all types of airspace (including international), incidents, and sensors;
  - UASP position descriptions for All-Hazard Incident Response and Wildland Fire are still in development stages, and therefore currently lack standards.

Summary

With the NPS UAS program in its nascent stage, most flights introduce a combination of new factors. Many of the challenges identified here are related either to implementing policy, limitations of the platform, or the unestablished standard for UAS within ICS. Further discussions with the NPS UAS program and the DOI OAS regarding All-Hazards Incident Response UAS operations are vital to future safe and successful UAS missions.

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