Solution to COMAP 2019 MCM Problem B: *“Send in the Drones: Developing an Aerial Disaster Relief Response System”*

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**Abstract.**

In 2017 the island of Puerto Rico was struck by Hurricane Maria causing extensive damage. Our problem was to investigate the use of drones to provide medical aid and video reconnaissance to relieve the situation. Based on the specs of the medicine packages, drones, and containers, we were able to decide the most optimal packing using the Less Flexibility Principle and choosing drone B to carry these deliveries. In order to optimize the drop location for the ISO cargo containers we developed a Python code that would create a grid of Latitude/Longitude coordinates and then use the Haversine Formula in conjunction with our Maximum Sum Method to create a data frame of optimal drop locations. The locations provided a maximum distance from the drop location to the hospital delivery sites within the drone flight radius. We modeled our drones flight pattern on polar functions of the for which allowed us to select a pattern with a simple rotation scheme to maximize radial coverage within the drone flight radius. Here , k is the number of petals and , in radians, is the angle swept by the curve. In order to ensure that the drone’s industry standard camera would capture all the information required, we calculated a drone flight ceiling of 200m (656 ft) would be optimal to capture all desired features. If implemented, this model would provide optimal surveillance pattern to over 50% of Puerto Rico with a focus on the Eastern side of the island where hurricanes typically land. Initial surveillance could be effectively completed in 10 days to give detailed analytics of all the roads in the surveyed area. Medical supplies included could supply the 5 hospital locations for ~30 days.

* Puerto Rico…Drone, Cargo, ISO… restate
* Packing Cargo
  + Drone Selection
* Choosing Locations
  + Haversine
  + Maximum Sum Method

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* Drone Flight Patterns
  + Polar n-Petal Roses
  + Rotation Scheme

We modeled our drones flight pattern on polar functions of the form which allowed us to select a pattern with a simple rotation scheme to maximize radial coverage within the drone flight radius. Here , k is the number of petals and , in radians, is the angle swept by the curve.

* Drone Video Capacity
  + Camera Footprint

In order to ensure that the drone’s industry standard camera would capture all the information required, we calculated a drone flight ceiling of 200m (656 ft) would be optimal to capture all desired features.

* Results

Supply timeline

Island coverage (51.35%)

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