Optimization of Drone Flight Patterns for Use in Extraterrestrial Cave Mapping

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Caves are found on Earth and some extraterrestrial planets (e.g., Mars) where mineral precipitation and microbial growth allows for the formation and preservation of microbial biosignatures in mineral deposits. These biosignatures can be used as a record of aqueous processes and microbial activity and will prove useful in the search for life outside of Earth. Additionally, these biosignatures can indicate possibilities of human shelters on many extraterrestrial bodies. In this project, we attempt to answer the question “How can current drone technology be optimized to explore caves on terrestrial surfaces to detect traces of life identified through biosignatures?” We hypothesize that current drone technology can be optimized with advanced drone communication for collision avoidance, faster and more efficient cave exploration with autonomous flight, and incorporating artificial intelligence for the detection of biosignatures. We will develop Python algorithms to simulate a flight pattern of flocks of drones through randomly generated extraterrestrial caves and statistically analyze the efficiency of drone flight patterns.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Intel ISEF Category