Senior Design Options in Support of Bat Bioacoustics Research

Background

Mexican free-tailed bats are ideal animal models for investigating biosonar and swarming flight behavior. Females form large maternal colonies of populations up to several millions, and each night they undergo a mass emergence from their cave. During emergence, they form a dense stream of bats that undulates throughout the sky as the bats travel to their foraging locations at speeds of approximately 25 mph.

While emerging, these animals continuously use echolocation, or biosonar, to navigate. Each individual produces an intense (100-120 dB), short (~10 ms), ultrasonic frequency-modulated downsweep (from 60 kHz to 20 kHz). The question remains: how are these bats able to echolocate while flying at high speeds and high densities? How are their echolocation signals not jamming each other?

Project 1: The "Bat Pack"

Objective: To build an electronics package that can be attached to a bat to monitor their flight behavior.

Design: The pack will include several sensors (an Inertial Measurement Unit (IMU) and barometer), a real-time clock (RTC), storage and a Pic microcontroller to manage and control the collection of data.

Major Issues: The pack's weight should be on the order of 1 gram.

Project 2: The "Falcon Pack"

Objective: To build an electronics package that can be attached to a falcon so that the falcon can assist in data collection about the bat colony

Design: The pack will include a video camera and an ultrasonic audio recording mechanism. A Pic microcontroller will be used to manage and control the data collection.

Major Issues: The pack's weight should be on the order of 20-30 grams. The audio and video data collection should be synchronized.

Point of Contact: This project will be overseen by Dr. Robert Stevenson (rls@nd.edu) and Dr. Laura Kloepper (lkloepper@saintmarys.edu). Dr. Kleopper is a Biology Professor at St. Mary specializing in Bat Bioacoustics. Questions about the project can be directed to Dr. Stevenson.