BluDart: Autonomous Solar Integrated Quadcopter

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1 Overview

Automated solar integrated quadcopters (ASIQs) have many potential applications in conservation, agriculture, and transportation. Photovoltaic powered flight is desirable because it allows for sustained flight, longer expeditions, and larger ranges of operation as compared with current drones, which are limited by the single charge capacity of their battery pack.

The goal of the BluDart project is to create the world's first successful ASIQs, and the first prototype will be designed for Peruvian rainforest conservation. In collaboration with Conservation International, MIT ESI, and the MIT Photovoltaic Research Laboratory, the BluDart team has built and tested ASIQ prototypes with the goal of year-long surveillance and data collection expeditions in rainforest areas where penetration and monitoring are dangerous or impossible by local law enforcement and researchers.

2 Intermittent Flight

The BluDart project collaboration has created the first working ASIQ prototype, different from previously attempted ASIQs in several key aspects. Previous attempts have failed because their use of solar power was intended to sustain quadcopter flight indefinitely. While the sun is an infinite resource, it does not provide a necessarily stable supply of power, and conversion to electrical energy is insufficient to power a quadcopter motor indefinitely.

The BluDart ASIQ uses an intermittent flight (IF) approach, introducing several features. The BluDart quadcopter charges while flying to extend battery life, but primary charging takes place after the drone has landed. When battery voltage is low, battery sensing allows the drone to safely land and charge to the necessary level before taking off again. This unique approach allows the drone to carry out missions over long periods of time and large distances, since this charging method can occur repeatedly.

3 Navigation and Sensing

The current BluDart prototype is capable of GPS waypoint navigation, battery sensing, integrated solar charging, and audio and visual data collection. BluDart can be pre-programmed with a destination, and will fly intermittently while collecting data, and will then return to its original takeoff location.

4 Looking Forward

BluDart is currently in the prototype phase. We plan to eventually integrate and perfect several features to allow for complete autonomy and advanced sensing.

- Canopy landing: The BluDart drone will be able to land in the forest canopy for charging. This will allow for maximum sunlight and will obscure the drone from sight.
- Computer vision: BluDart will be able to autonomously navigate the jungle using computer vision and machine learning to identify and avoid obstacles.
- Lidar: BluDart will use light detection and ranging to gather topographic and bathymetric data for environmental research purposes.
- Endurance: BluDart's ability to endure the elements for longterm missions requires further development.

We have also looked into several promising partnerships with entities interested in a wide variety of applications.

Future and potential partnerships include:

- Conservation International: CI will be a continued partner. The Peruvian branch has assisted us in visiting the Amazonian rainforest in Peru to gain a better understanding of the environmental challenges we face there.
- The Columbian Government: Interested in rainforest conservation applications, and potentially initiating an educational drone collaboration with ESI.
- General Electric: Interested in BluDart drones for the purpose of oil pipeline surveillance and oil spill prevention.
- Northrop Grumman and Airbus: Interested in general autonomous and sustained flight technology.
- Other potential applications include African wildlife tracking and solar farm surveillance

5 Drone Parts

Figure 1: S500 Glass Fiber Quadcopter Frame 480mm - Integrated PCB Version

Figure 2: Flysky FS-i6X 2.4GHz 10CH Upgrade Flysky i6 AFHDS 2A
RC Transmitter TX with iA6B Receiver

Figure 3: USAQ Naze32 Flight Controller for Racing Drones Acro 6DOF Rev.6

Figure 4: MultiStar 350 to 450 Frame Size 2212 Combo Set With Self-Tightening Propellers CW/CCW Set Of 2

Figure 5: HobbyKing 30A ESC 3A UBEC

Figure 6: ZIPPY Flightmax 8000mAh 3S1P 30C Lipo Pack with XT90

Figure 7: Pololu 12V Step-Up Voltage Regulator U3V12F12

Figure 8: Turnigy Lithium Polymer Balance Charger

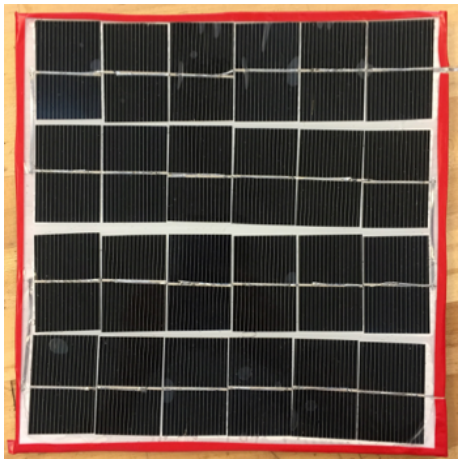
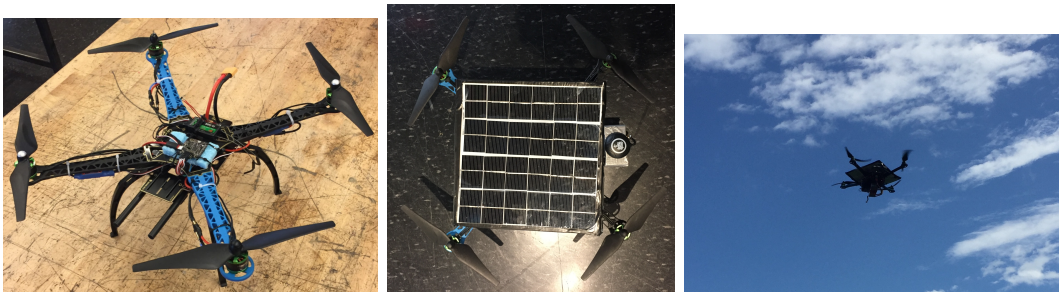


Figure 9: Custom 10.5x10.5 in. Solar Panel



BluDart

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