Self-Sustained Unmanned Aerial Vehicles

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Study Aim & Significance

The goal of this study is to better understand self-sustained unmanned aerial vehicles. This extensive literature review allows for an understanding of lighter-than-air (LTA) UAVs and sets the ground for future work in lengthening flight times for UAVs.

Project Background

- As **solar panels** become cheaper their use is growing in **small-scale robotics applications**.
- The use of **unmanned aerial vehicles**, or UAVs, is also becoming more popular due to their **size and maneuverability**. A major **downside** of UAVs is their **limited flight time**.
- **Self-sustained UAVs** with **onboard solar panels** to **lengthen flight time** have been created with the goal of **infinite sustenance**.

Solar Energy

- **Solar** energy is a **clean energy** source that is **abundant** and continues to get cheaper.
- There is a **wide range** of **solar panels** available. For this application, **flexible silicon** panels are of interest.
- A **silicon photovoltaic** cell has **three layers**, **p-type** layer, **n-type** layer, and the **junction** of the two. **Light** hits the n-type layer, **electrons** at the junction are **excited** and a **charge** is created. The **flow** of electrons is directed with a **metal wire**.

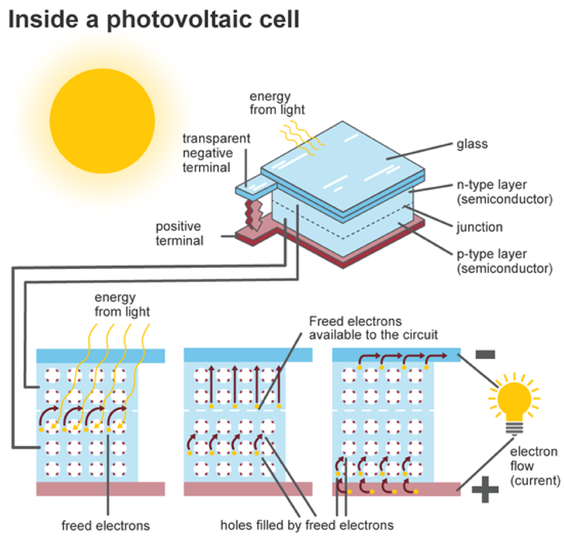

Figure 1: Diagram of silicon photovoltaic cell demonstrating how it works and the flow of electrons.

Lighter-Than-Air UAVs

- There are a **variety** of **UAV** technologies available. A lighter-than-air, **LTA**, UAV is one that is filled with **helium** to float. These look similar to a **blimp**.
- Similar to quadcopters, **LTA UAV**s also have **propellers**, **motors**, and **controllers** in order to be **balanced** and be able to **maneuver** their movement.

Figure 2: An example of an LTA UAV design with solar panels mounted on it to lengthen its flight time.

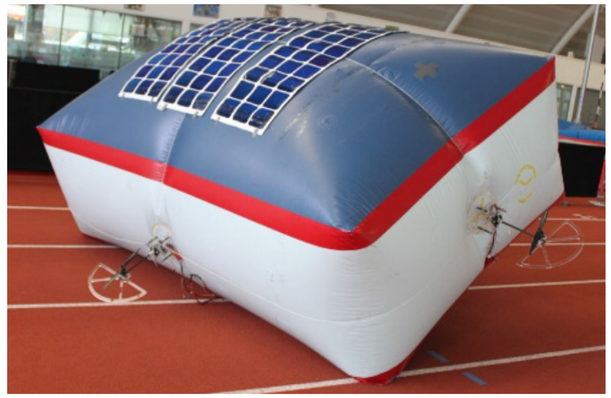

Figure 3: An example of a different LTA UAV design with solar panels mounted on it to lengthen its flight time.

- **Previous work** done on LTA systems has focused on **longer flight time**, **energy-independent**, **autonomous systems**.

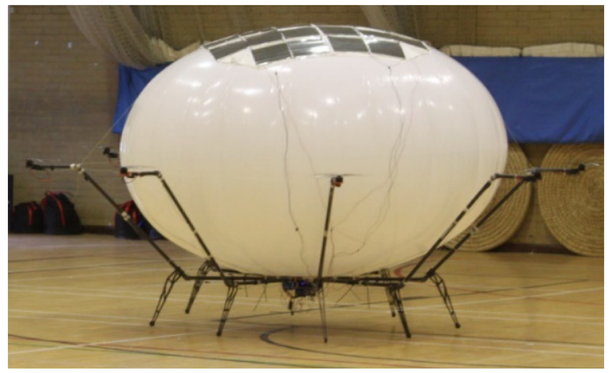

Figure 4: An example of an LTA UAV design with more propellers for control and solar panels mounted on it to lengthen its flight time.

- **LTA systems** can have **multiple designs** for ease of **control** and **maneuverability**.

Applications

- UAVs are currently **important** to many **industries**. This work is beneficial to even more industries.
- **Longer flight time**, and eventual **infinite endurance**, will allow for UAVs to be used in **more applications**.
- **UAVs** can **replace humans** in dangerous **situations**.

Next Steps

- Utilizing this base work and understanding developed, **future work** will be to create an **LTA UAV with a longer flight time**.
- Work will be geared towards more than just a **longer flight time**. Systems will also be **energy-independent**, **autonomous**, **low-cost**, **lightweight**, **safe**, and **low-maintenance**.
- Building **multiple functioning**, self-sustained **LTA UAVs** will allow for use in **more applications**.
- **Ultimate long-term goal** is to create an **LTA UAV** with **infinite endurance**.

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