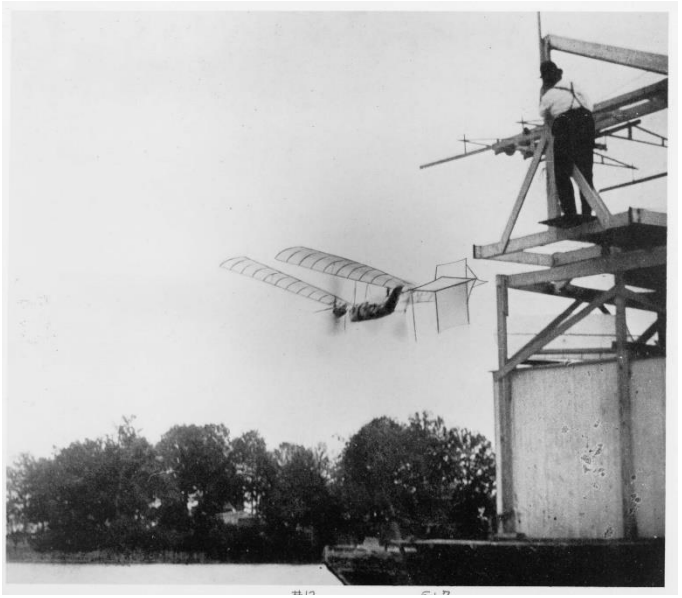
UAV’s (Drones)

History

- The first experimental use of a UAV was in the late nineteenth century.
- Samuel Langley invented the Aerodrome No. 5 with its first successful flight on May 6th 1896.
- Drone research continued though WW I and WW II.
- Reconnaissance missions and radio controlled aircraft have been used from WW II on by the US and other militaries.



Source: Smithsonian

Types

	Pros	Cons	Typical Uses	Price ($AUD)
Multi-Rotor	•Accessibility •Ease of use •VTOL and hover flight •Good camera control •Can operate in a confined area	•Short flight times •Small payload capacity	Aerial Photography and Video Aerial Inspection	$5k-$65k for pro drones
Fixed-Wing	•Long endurance •Large area coverage •Fast flight speed	•Launch and recovery needs a lot of space •no VTOL/hover •Harder to fly, more training needed •Expensive	Aerial Mapping, Pipeline and Power line inspection	$25-$120k for pro drones
Single-Rotor	•VTOL and hover flight •Long endurance (with gas power) •Heavier payload capability	•More dangerous •Harder to fly, more training needed •Expensive	Aerial LIDAR laser scanning	$25-$300k for pro drones
Fixed-Wing Hybrid	•VTOL and long-endurance flight	•Not perfect at either hovering or forward flight •Still in development	Drone Delivery	TBD, in development

Source: Australian UAV

Basic Principle of Flight

- https://howthingsfly.si.edu/flight-dynamics/roll-pitch-and-yaw

How a Quadcopter Works

- http://ffden-2.phys.uaf.edu/webproj/212_spring_2014/Clay_Allen/clay_allen/works.html

Applications

- UAV’s have become integrated in many parts of our society today. The following slides will address a few of the many applications which include:

-Agriculture

-Law Enforcement

-Industry

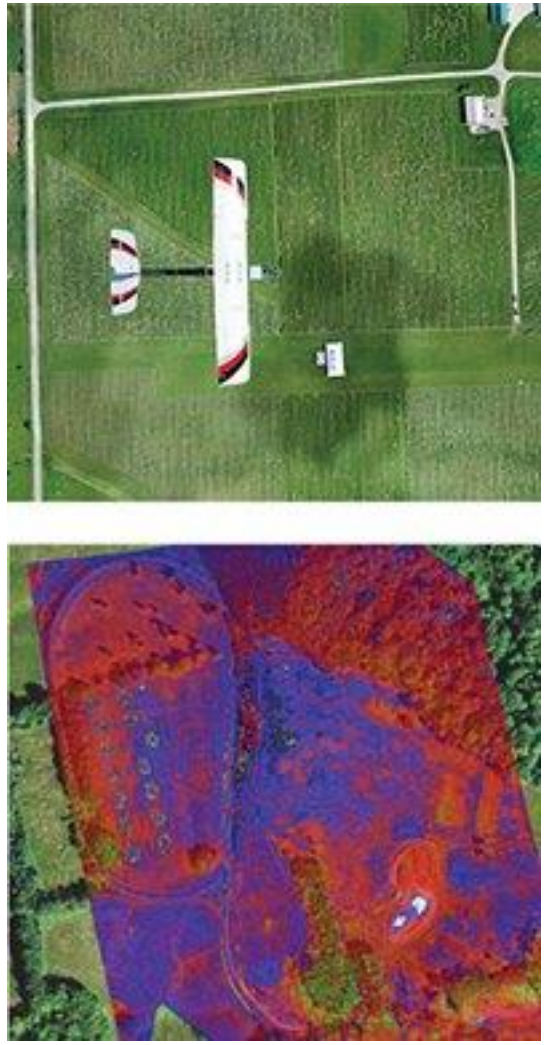
-Military

-Research

-Natural Disasters

Applications (Agriculture)

- Drones are used in agriculture to facilitate watering, spraying, and to monitor health and growth of crops.
- Image on the right shows a fixed wing drone flying over a field along with data collected from a sensor attached to the drone.



Source: MIT Technology Review

Applications (Law Enforcement)

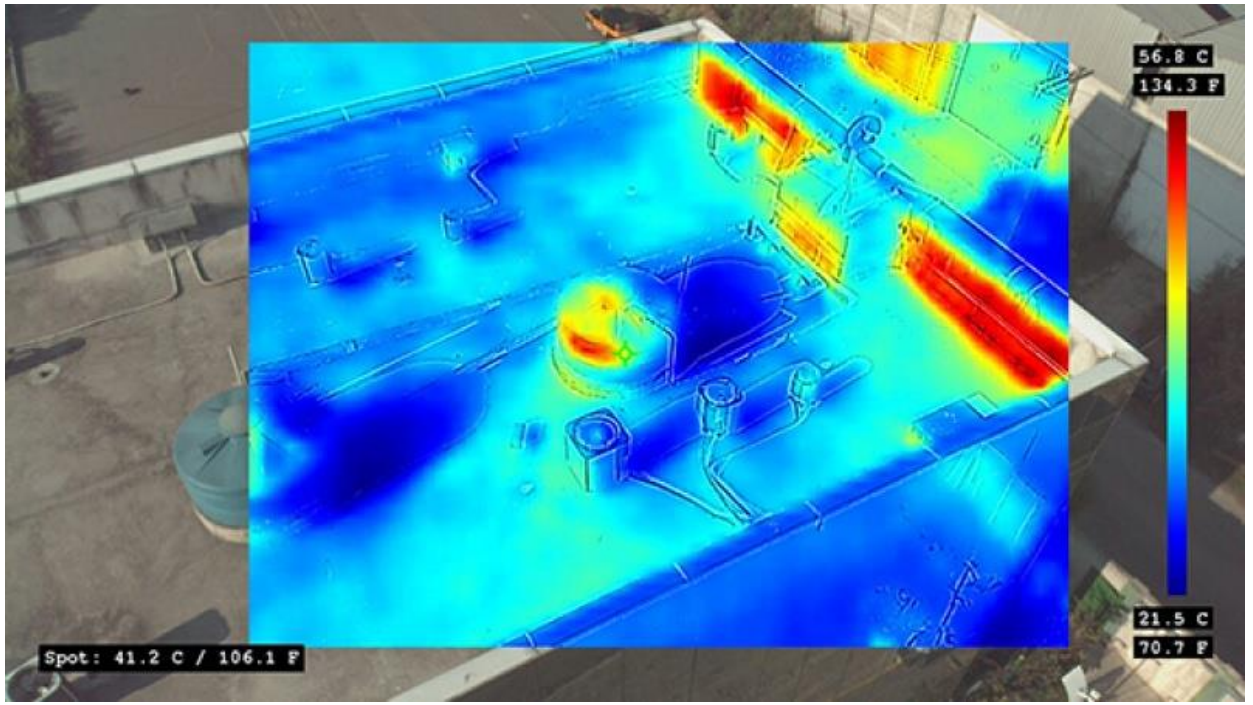
- Over 900 state and local police, fire and rescue departments across use UAV's for support. This includes the NYPD's Technical Assistance Response Unit (TARU).

Acceptable Uses	Unacceptable Uses
•Search & Rescue •Collision & Crime Scene Documentation •Evidence Search at Large/Inaccessible Locations •HAZMAT Incidents •Traffic & Pedestrian Monitoring at Large Events •Assistance at Hostage/Barricaded Situations •Other emergency situations with approval of Chief of Department	•Routine Patrol •Traffic Enforcement •Immobilizing Vehicles or Suspects •Never Used as a Weapon or Equipped with a Weapon •Search without a warrant

Source: NYPD

Applications (Industry)

- Firms are beginning to rely on drones attached with sensors to help with construction projects. The image below shows hot and cool spots on a building roof.



Source: Parrot

Applications (Military)

- Having roots in the twentieth century, UAV's have been used in the military to aid in reconnaissance and have also been fit with weapons.
- "Right now, we think of drones as tools," says **Mark Bowden**, of the unmanned aircraft, "but we're going to see them used in a broad variety of ways in the coming years." (Bowden, 2013)

Source: Smithsonian

Applications (Research)

- Drones are used in many different fields for research. They include both the natural sciences and social sciences. One example, is how researchers are using drones fit with cameras to take a lot of pictures of a particular area. The images are then used to create a DEM that can be used to study coastal changes.

Source: Earth Institute – Columbia University

Photo: Alessio Rovere

Applications (Natural Disasters)

- Research out of Dr. Souma Chowdhury's Adaptive Design Algorithms, Models and Systems Laboratory (ADAMS Lab) at UB is revolutionizing new methods using drones to map natural disasters and provide aid to those in need.
- Uses swarm technology
- Drones deployed immediately after a natural disaster

Source: UB Now

Outlook and Implications

- Drones have become a multi use tool seen in everyday life. As they become more and more popular, federal, state and municipal governments are beginning to regulate their use.
- Drones are regulated in the US under the Federal Aviation Administration (FAA)
- If interested, check out their website: https://www.faa.gov/uas/
- Drones will continue to offer new ways to address many different problems.

References

- https://www.auav.com.au/articles/drone-types/
- http://origins.osu.edu/article/aerial-torpedoes-buzz-bombs-and-predators-long-cultural-history-drones
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