Dinner and Data and Drones, Oh My!

Flying paper drones

What is the best design for a paper airplane drone?

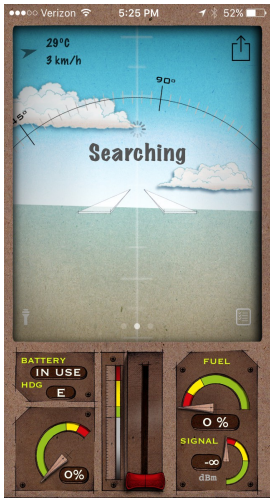
Unmanned aircraft systems technology is revolutionizing agriculture. UAVs (Unmanned aerial vehicles), more commonly called drones, can take photos with a variety of camera types and scout fields for signs of problems much more effectively and efficiently than a person on the ground and much more inexpensively than a fly over by a piloted helicopter or plane. Farmers can use drones with cameras to provide a view of the field that could show irrigation issues, soil variation and pest or fungal effects that are not viewable from the ground. Multispectral images (such as those from cameras that use infrared and the visible spectrum) can be combined to show differences between healthy and distressed plants leading to improved crop management.

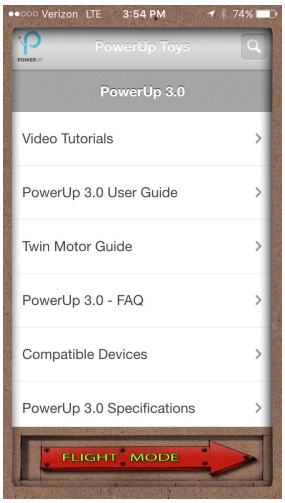
There are several regulations that affect the use of drones (see: https://www.faa.gov/uas/media/Part_107_Summary.pdf). The possibilities for this technology keep changing and improving.

Drones also come in a variety of types for use in agriculture: quadcopters and gliders of many shapes and sizes. Which design will fly the best? Use the engineering design process to try out various paper airplane designs (see student handout).

Materials:

- Paper airplane templates: Invader and Nakamura
- Powerup 3.0 Smartphone Controlled Paper Airplane Conversion Kit (charged)
- Mobile device
- Powerup 3.0 Smartphone app





Procedure:

1. Download the Powerup 3.0 app to your phone.
2. Fold the Invader template to create the Invader paper airplane (see instructional powerpoint)
3. Practice throwing your airplane gently, trying different angles of release. Adjust the flaps if you are having difficulty keeping it airborne. This may take several trials. (Refer to the engineering design process pictured)
4. Attach the charged Powerup 3.0 engine to the paper airplane.
5. Turn the Powerup 3.0 engine on and pair to a smartphone through bluetooth (this takes a few seconds, the drone double flashes when successfully paired)
6. Fly the plane using the controls on the phone. This will take several practice tries.
7. Adjust the flaps on the template to improve flight length
8. Fold the Nakamura template to create the Nakamura paper airplane
9. Repeat steps 2-4
10. Try a design of your own!

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Resources:
https://www.technologyreview.com/s/526491/agricultural-drones/
http://www.poweruptoys.com/ OR
https://www.youtube.com/watch?v=q9bpp7zmM_A (kickstarter campaign no longer active, but good information)

Questions:

1. What is the hardest part of using the engineering design process?

2. How many tries did it take to get your plane in the air? How did you adjust each time to improve your design?

3. How might you teach others to be successful in this process?

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Student Handout

Flying Paper Drones

1. **Ask**
   What design will fly the best?

2. **Imagine**
   Which plane will you choose?

3. **Plan**
   Fold an airplane following the design you chose and attach a photo here.

4. **Create**
   Fold your airplane and try it out!

5. **Improve**
   What might help your plane to fly? What can you change to keep it in the air longer or to make it fly higher?

6. **Reflect**
   What did you try that worked? What did you try that did not work?