# Robot Birds, Part 1

## It's a Bird, It's a Plane

### Learning from Nature to Make Very Tiny Flying Machines

Dayton, OH (Wright-Patterson Air Force Base) —Engineers are in the early stages of a project to construct micro air vehicles (MAVs) to be used for surveillance and intelligence gathering. Engineers are inspired by the hummingbird to create hovering vehicles. But engineers also use flying toys as tools for thinking about how to design the tiny flying machines.

*"We can learn lessons from the way nature does things."* **Ryan Carr, aeronautical engineer**

## Framework

Middle School

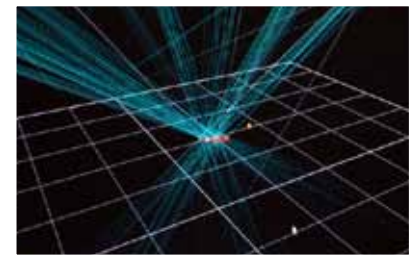
## Standards

| | |
|---|---|
| NSES - C.i.1 | Structure and function are complementary. |
| STL - 2.R | Requirements are parameters placed on development. |
| STL - 3.F | Knowledge from other fields has an effect on the development of technology. |
| STL - 9.H | Modeling and modifying are used. |
| STL - 18.G | Vehicles are made of subsystems. |

## Content Illustrated

- Strobe-lighting of wings shows how they move.
- Air flows quickly over a large plane wing, but the slower, higher viscosity air that flows over a small wing is analogous with a fluid flowing like molasses.

# Content



**Life Science**

- The micro air vehicle (MAV) has a relation to natural flight. Certain traits of hummingbirds or insects (such as the dragonfly) are desirable for MAVs. They are small, lightweight, can travel long distances with endurance, stop instantly, hover, and navigate through trees and other structures.

**Technology**

- Surveillance, materials science and aircraft engineering technologies are combined to meet new needs.

**Engineering**

- Prototyping and testing are steps of the engineering design process.
- Developers are using hobby-store aircraft (remote-controlled birds) as part of their research and observations.
- As one engineer puts it, "You have to understand the aerodynamics, the air as it flows over the wing, the structure as it bends and deforms, the controls, the electronics on board. Designing an MAV is not the same as shrinking down a big plane. With a 6-inch plane, the whole science of flight changes."
- Airflow over the MAV is very slow compared with how fast it flows over a large plane. Viscosity is taken into account.
- There are structural deformations of the wings–not what you'd want in a large plane but needed in these small craft. The deformation creates better lift.
- The vehicles must carry sensors, receivers, and a power supply and still be light enough to maintain stability in flight.

## Guiding Questions

*To think about as you watch:*

- What applications exist for small flying vehicles?
- What are some examples of how the study of nature inspires the building of human-made vehicles and structures?

## Suggested Activities

- Use the webisode to begin a unit on the engineering design process.
- Create a collection of different wing-beating patterns with slow-motion video clips.
- Watch this webisode in connection with the *Engineering Now* unit, *Blimps*.

## Keywords

aerodynamics
deformation
hover
hummingbird
lift
micro air vehicle (MAV)
navigate
propulsion
sensors
stability
viscosity

➤ *Robot Birds* can be found online at www.ndep.us/Robot-Birds. Visit www.ndep.us/LabTV for a list of process skills modeled in webisodes.