



# Flying Fuel Cells

## Fuel Cells Power Small Unmanned Aerial Vehicle



Dayton, OH (Wright-Patterson Air Force Base) -- Engineers have redesigned the power supply for a small "UAV" (unmanned aerial vehicle) to use fuel cells. The plane keeps soldiers safer by flying into dangerous or difficult areas and sending video signals to operators on the ground. The fuel cells enable the plane to fly for longer periods of time than it could under battery power.

*"I think anyone who wants to pursue a career in science or engineering can absolutely do so."*

**Lt. Mark Roosz, chemical engineer**

### Framework

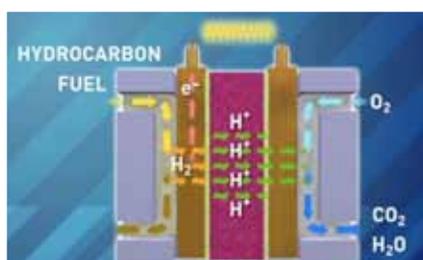
Middle School

### Standards

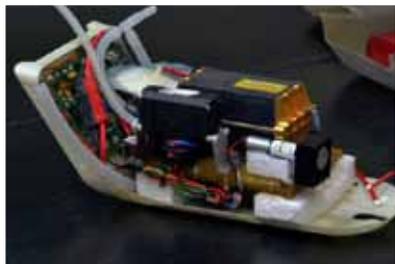
- NSES - B.i.2 ➤ Substances react chemically in characteristic ways.
- NSES - B.iii.4 ➤ Electric circuits transfer energy.
- NSES - B.iii.5 ➤ Chemical reactions transfer energy.
- STL - 2.P ➤ Technological systems can be connected.
- STL - 16.H ➤ Power systems provide propulsion.

### Content Illustrated

- Animation of how a fuel cell works.



# Content



## Physical Science

- ▶ Combustion engines burn gasoline. Expanding gases inside make the motor run.
- ▶ Batteries convert chemicals into electrical energy.
- ▶ A fuel cell extracts hydrogen atoms from fuel. Electrons are stripped from the hydrogen into a circuit, creating electricity. The resulting stripped hydrogen atoms combine with ambient air and become, simply, water and carbon dioxide.

## Technology

- ▶ UAVs are unmanned aircraft used by the Air Force. They can fly into dangerous or difficult places and record, store, and transmit video. One type of small UAV, called the Raven, weighs 4 to 5 pounds and has a wing span of about 4 feet. It can be carried in a backpack and launched by throwing. The UAV can be flown using a computer with live video feed.
- ▶ Fuel cells have a longer life than batteries and use the hydrogen extracted from fuels (such as gasoline) to generate electricity. The byproducts of the process are water vapor and carbon dioxide.
- ▶ Fuel cells are like a small generator, converting hydrocarbon fuel (natural gas, methanol, or gasoline) into power. The fuel cell is composed of a stack (that puts out the power), an air blower, a fuel pump, and lots of electronics.

## Engineering

- ▶ Engineers developed fuel-cells to fit into the battery compartment space of the Raven UAV. By replacing lithium polymer batteries with fuel cells, they have increased the Raven's flight time from 1.5 hours to 3 to 4 hours.
- ▶ Engineers have made new fuel-cell models that are the size of a deck of cards and plan that the models will power cell phones, radios, and other devices.

## Guiding Questions

*To think about as you watch:*

- ▶ How can chemical energy be converted into electrical energy through a fuel cell?

## Suggested Activities

- ▶ Demonstrate how a fuel cell works.

## Keywords

battery, combustion, engine, fuel cell, generator, hydrocarbon fuel, hydrogen, lithium polymer battery, motor, unmanned aerial vehicle (UAV), video feed

▶ *Flying Fuel Cells* can be found online at [www.ndep.us/Flying-Fuel-Cells](http://www.ndep.us/Flying-Fuel-Cells). Visit [www.ndep.us/LabTV](http://www.ndep.us/LabTV) for a list of process skills modeled in webisodes.