

## Warming Up to the Idea of HVAC&R Engineering

From winter hockey to summer baseball, ice cream to silicon wafers, mechanical engineering affects your daily life in more ways than you realize. If you have ever gotten a flu shot, flown on an airplane, eaten ice cream or frozen waffles, worked on a computer at school, swam in a heated pool, visited the penguins in the zoo, gone ice skating or even just stood under an air conditioning vent in your house to cool off—you've experienced a special kind of mechanical engineering called heating, ventilating, air conditioning and refrigerating (HVAC&R) engineering.

### HVAC&R ENGINEERS MAKE A DIFFERENCE IN THE WORLD BY...

- Designing building systems that limit the impact on the earth's natural resources
- Developing new refrigeration and cooling equipment
- Developing energy-efficient system to provide a comfortable and healthy environment for aircrafts
- Creating safe, comfortable indoor air quality for schools and hospitals

Your most important challenges will be meeting the requirements of energy conservation and the demands for a clean environment, while designing, installing or operating air-conditioning and refrigeration systems to maintain human comfort or to process and store food. To accomplish this balancing act, HVAC&R engineers must be familiar with all fields of engineering, from electrical and controls to structural and lighting. If we fail in our mission, people can die!

Cost effective energy efficiency is critical for the economy, the environment and energy security.

If you thought heating, air conditioning, ventilation and refrigeration was just a bunch of **hot** air before, you're about to discover how **cool** HVAC&R can be...

### Did You Know...

Heating, ventilating, air conditioning, refrigerating (HVAC&R) and water heating are responsible for about 75% of residential and 64% of commercial building energy use.



[www.ashrae.org/ashraek12](http://www.ashrae.org/ashraek12)



# There is no Planet B!

STUDENTS, INSIDE CONTAINS TOOLS TO HELP YOU EXPLORE AND EXPERIENCE HOW HVAC&R ENGINEERING IS SAVING THE EARTH.



## Recognize first-hand how engineering is all around YOU!



# HVAC&R:

## These Letters Could Use Some Breathing Room!

Engineers usually specialize in one particular area of HVAC&R. Let's break those letters up and see what they mean...

### HEATING, VENTILATING AND AIR CONDITIONING (HVAC):

Mechanical engineers who specialize in HVAC do a lot more than keep us cool in the summer and warm in the winter! Most of these engineers work for architectural and engineering firms that design the systems for homes and/or office buildings, hospitals, stores and schools.

Air planes, offices, schools, cars, homes, hospitals, malls, restaurants and even space shuttles all need good heating, ventilating and air-conditioning systems so that the people who use them are kept comfortable and have clean air to breathe while inside!

### REFRIGERATION:

You have a refrigerator in your kitchen, but mechanical engineers who specialize in refrigeration do so much more! These engineers usually work in the commercial and industrial sectors. The commercial refrigeration community designs refrigerated vending machines and systems for supermarkets and convenience stores, to name a few. The industrial refrigeration community designs food processing plants, cold storage warehouses and ice rinks. Refrigeration engineers have even changed what and how people eat by creating ways for fresh food from around the world to be shipped without spoiling!



**Did You Know...**  
Currently, buildings are responsible for 40% of all energy consumption.

## Cool Questions and Hot Answers

### WHAT DOES A CHICKEN HAVE TO DO WITH HVAC&R?

When Sir Francis Bacon, a British scientist who lived in the 1600s, wanted to see if the cold could keep food fresh, he killed a chicken and stuffed it with snow. Later, people who lived near where Bacon had conducted his experiment began to hear a chicken squawking in the night and swore they saw a half-plucked bird running up and down the road, only to disappear into a brick wall. Almost 200 years later, Clarence Birdseye patented quick-freezing food for freshness. Coincidence? Or does the ghost of the original frozen meal live on?



### SICK AND TIRED OF BEING SICK AND TIRED?

Vaccines—shots that keep you from getting sick, you probably got one during the flu season or before starting school—have to be kept cold in order to be effective. From the cold storage unit at the vaccine manufacturing plant to the refrigerator at your doctor's office, HVAC&R engineers help design and build the machines and systems that keep vaccines the perfect temperature for keeping you healthy.

### WHAT'S HOT AND COLD AND OUT OF THIS WORLD?

Manned space missions would be nothing without HVAC&R engineers, who design the ventilation systems that provide astronauts with life support. Space shuttles also use special technology to convert sunlight into energy while passive cooling techniques make use of reflective paints and shading. These same technologies are designed and used by HVAC&R engineers who create systems for energy efficient buildings. HVAC&R engineers increase the efficiency of resource use, such as energy and water, while reducing a building's impact on human health and the environment.



## Things are starting to heat up!

### DO YOU HAVE WHAT IT TAKES TO BE AN HVAC&R ENGINEER?

- Are you a good problem solver? HVAC&R engineers make the world a better place by answering the questions and solving the problems that no one else can.
- Do you use creativity to solve those problems? One of the reasons that HVAC&R engineers are good at problem solving is that they're not afraid to try a new approach to an old problem. Thinking outside the box is the key!
- Do you learn best by doing things "hands-on?" Designing, drawing, modeling, working on the computer and the ever-popular "poking around" are all crucial to HVAC&R engineering. Otherwise, how will your great idea ever make it out of your head?

## Now it's your turn!

### WHAT YOU'LL NEED:

A medium to large plastic container with a lid—we recommend the gallon-sized kind that ice cream comes in; a knife or scissors—parent's permission first, of course; water and ice; a dish cloth—bigger than a wash cloth, but smaller than a bath towel; a fan

### GETTING STARTED:

Make sure it's okay with your parents before you get started—we don't want a mess, with either water or any other liquid (ahem, like blood—knives are sharp kids)

1. Make two cuts in the middle of the lid of your plastic container to form an X. Each line should be 1 ½ to 2 inches long.
2. Fill the container with water and ice, the colder the better. Make sure there is just as much water as ice.
3. Pull the dish cloth through the X you made in the lid, about a third of the way. When you put the lid on the container a good portion of the cloth should be in the water.
4. Turn on the fan and place the container in front of it. Make sure the fan stays pointing in one direction.

### HOW IT WORKS:

As the water is soaked up by the cloth and evaporates, the fan blows the cooling mist into the room. Air conditioners work in a similar fashion by forcing air over coils filled with a cold liquid called a refrigerant.

**Did You Know...**  
Poor indoor air quality causes illness and can greatly diminish learning potential.