

EXPLORING Aerospace Careers

Cool stories about engineers solving problems on Earth and in space.



- On-the-job profiles
- 3D printing in action

Find out how
this drone helps
polar bears!





THE POLAR EYE PROJECT

SENSORS

Four sensors take high-res images for ice mapping.

5 feet

Width of the hexacopter from rotor to rotor

How a team of innovative aerospace engineers tackled a problem here on Earth: Designing a weatherproof drone that can track the loss of Arctic sea ice, which is threatening the lives of polar bears.

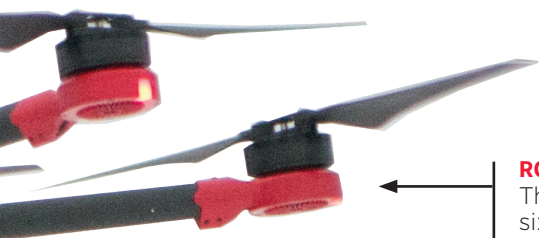
Imagine if every year the neighborhood you lived in got smaller, and you had to travel farther and farther away to find food just to survive. That's what life is like for polar bears: This threatened species' natural habitat of Arctic sea ice is shrinking because of climate change, which is making it more difficult for them to hunt for their primary food source: seals.

When polar bear researchers at San Diego Zoo Global wanted to gather data about the sea ice, they turned to engineers at Northrop Grumman, the aerospace and defense company, for help. The word "aerospace" probably makes you think of rockets and space shuttles, but aerospace engineers solve earthly problems, too.

The harsh wind and extreme cold of the Arctic—and the bears—make data gathering too difficult for humans to do from the ground. So Northrop Grumman's Operation PolarEye team built a drone, or **unmanned aerial vehicle (UAV)**, to do the job from the air.

The engineers **ruggedized** a **hexacopter** and outfitted it with a **high-tech camera, radar, and sensors** that could withstand brutal Arctic weather conditions. The UAV can map the ice and noninvasively track the bears using innovative data-gathering technology. "We wanted to see what was happening on a very fine scale in this habitat, to help the zoo researchers make critical decisions about conserving this species," says engineer Charlie Welch, Operation PolarEye's technical lead.

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ROTORS

The hexacopter's six rotors help keep it stable during flight.

RUGGEDIZED THERMAL PROTECTION

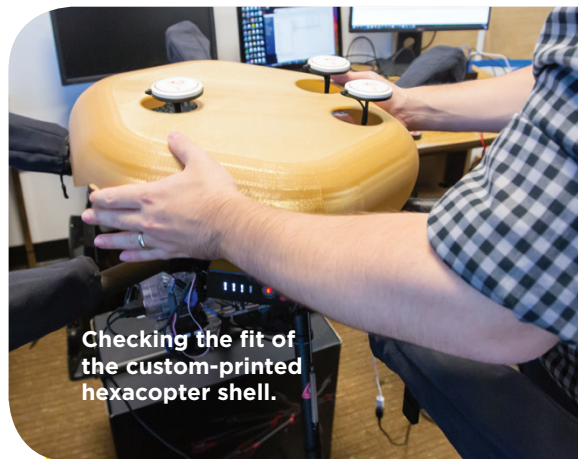
The shell protects the electronics and battery.

INFRARED VIDEO CAMERA

It's equipped with polar bear recognition technology.

10

Number of days Team PolarEye spent in the Arctic



Checking the fit of the custom-printed hexacopter shell.

Wait, You Can Print That?

If it's supercold outside, you put on a jacket, right? Team PolarEye knew the hexacopter was going to need an extra layer to protect its electronics and extend the battery range: In the Arctic, temperatures reach -13 degrees Fahrenheit. So engineers used a huge 3D printer—the size of a garage!—to print a custom shell. In 3D printing (also called additive manufacturing), multiple layers of heated-up plastic create a solid three-dimensional object. (Imagine a hot-glue gun squeezing out a bit of plastic over and over and you get the basic idea.)

MY AEROSPACE CAREER

Out-of-This-World Job: Human Spaceflight Systems Engineer



TONY CASTILLEJA JR. is a systems engineer at Boeing, an aerospace company.

What do you do in your job? I've worked on designs for military aircraft and spacecraft, and now I work in global sales and marketing for Boeing's human spaceflight portfolio. I help identify new technologies and meet with the people who supply materials that make our

spacecraft and help us reach the launch pad.

What made you want to work in the aerospace field? When I was 12, I was on a family road trip in Florida and happened to see a space shuttle launch. It was so cool and fast! In high school, a teacher recommended me for a NASA Johnson Space Center internship, and in college I spent summers interning with the space shuttle.

Did you ever encounter obstacles? I was one of the few Latinos in STEM courses. Today when I encounter students interested in space who wonder if they belong in STEM, I tell them, "You belong."



As their sea ice habitats melt, polar bears have a harder time finding food.

11

Number
of sea-mapping
missions the
hexacopter
has flown

After doing initial tests of the UAV in California, the Operation PolarEye team traveled north to test it in the Arctic. On the first test flight, they were faced with a problem: The hexacopter wouldn't fly! For the next 14 hours, the group huddled in their plywood cabin, making last-minute hacks and repairs.

With their updates complete, the engineers tried again—and successfully flew the UAV, which whirled over the remote Arctic sea ice. The hexacopter camera and sensors take six different kinds of images: One is in the **visual spectrum**, which is similar to how our eyes see things, and the other five images are taken near what's called the **infrared spectrum** (which our eyes can't see), helping scientists look at ice in a variety of ways. Engineers use software to stitch these images together and create pictures, 3D image maps, and other data for the zoo researchers.



Engineers
work on the
hexacopter
between test
flights in
the Arctic.

That's just the beginning. The power of technology—and partnerships between aerospace engineers and scientists—will continue to bring greater awareness about how to protect polar bears and the planet.

MY AEROSPACE CAREER

Out-of-This-World Job:

James Webb Space Telescope Systems Engineer



KAITLYN MURPHY works as a systems engineer at Northrop Grumman, an aerospace and defense company.

What exactly do you do?

I work on the **sunshield** for NASA's James Webb Space Telescope, which will orbit the sun and observe what the universe was like 13.5 billion years ago. The sunshield is an unfolding membrane system that keeps the telescope's mirrors cool by shading them from the sun. It's the size of a tennis court!

What inspired you to work in the aerospace field? I liked mechanical physics in high school, but I didn't know where

to go from there. Then one night my dad and I watched the International Space Station passing overhead. It was really amazing to me that the speck in the sky was actually a large human-made structure housing people in space.

Any advice for students interested in aerospace?

You will face challenges, and not everything works perfectly the first time. Learn from these experiences. Failure is honestly the best teacher, particularly in engineering.

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