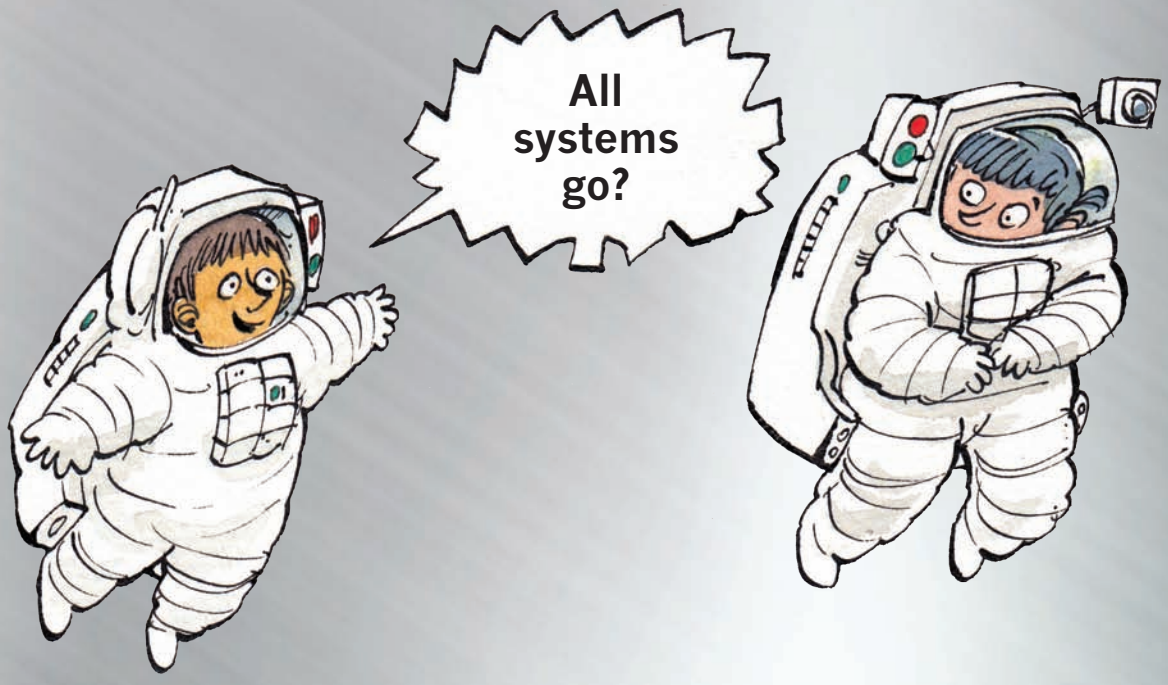
Dr. Dave ASTRONAUT

To Burp or Not to Burp

A Guide to Your Body in Space



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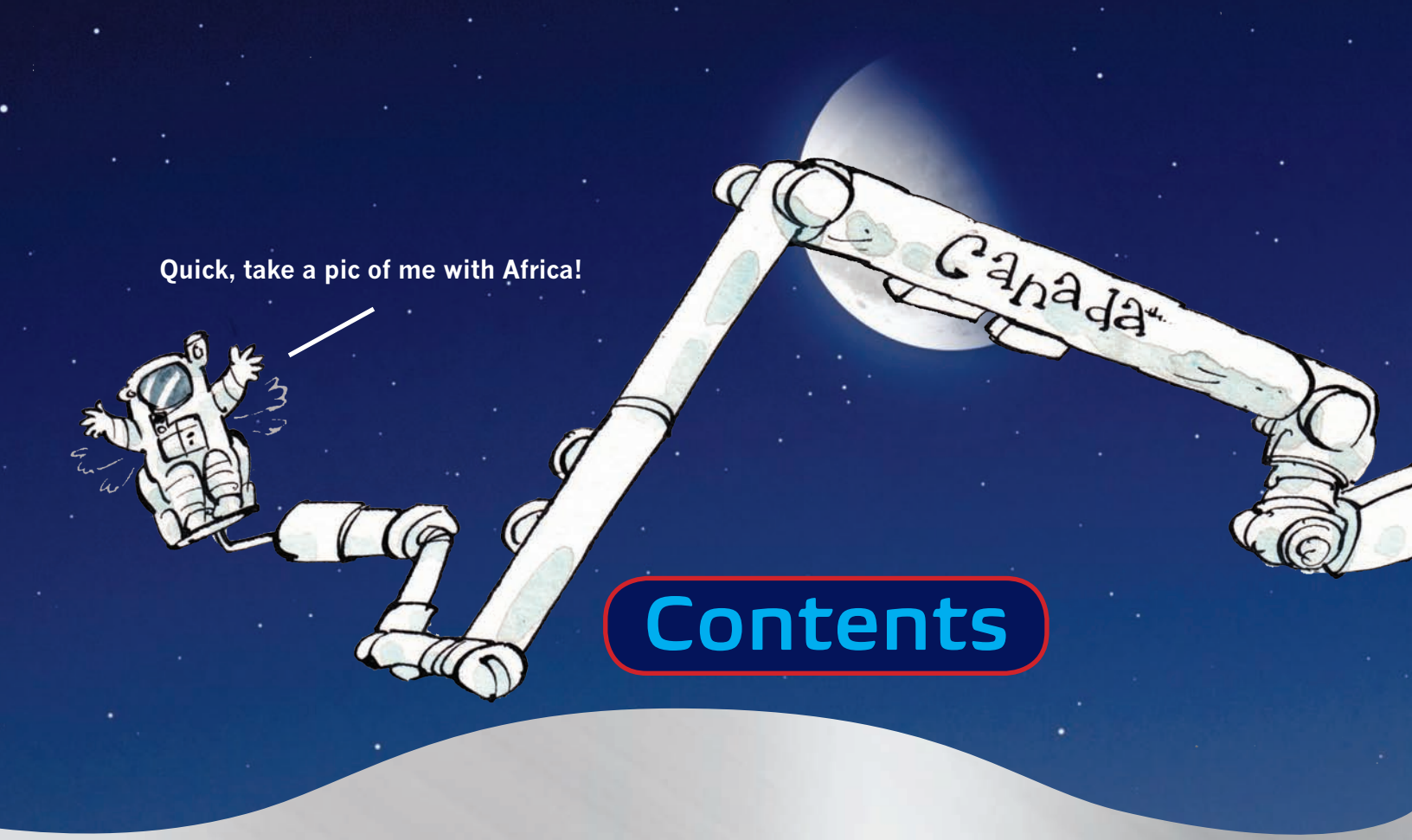

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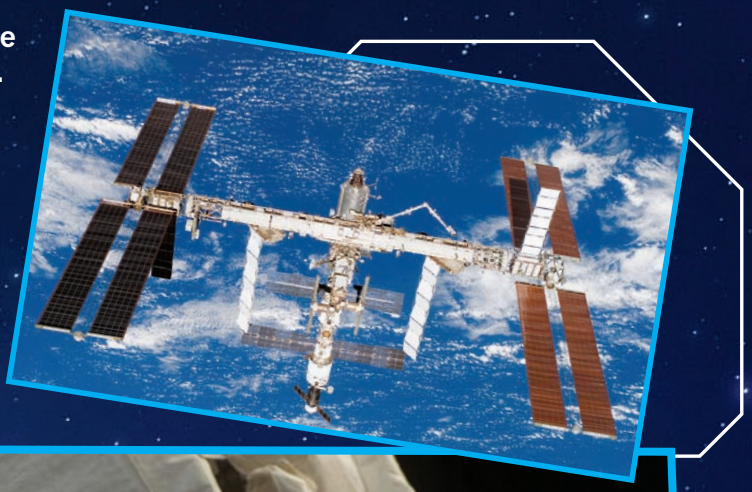
Humans are driven to explore. Our curiosity leads us to ask questions, learn all that we can, and expand our horizons.

Dr. Dave Williams



The International Space Station orbiting Earth.

Dr. Dave at work on a space walk

Throughout my career, my curiosity and quest for knowledge have taken me to the depths of the ocean, the frontiers of space, the inner workings of the brain, and a doctor's care for his patients. My passion for science took me on a remarkable journey of discovery in space. As you read this book, I hope you will share in the fun I had on my journey as an explorer and scientist.

—Dr. Dave

What's Up?

Actually, the question we should really be asking is, What's down? The answer: everything, in a world with gravity! All of the amazing things we know about the way our bodies work come from living in a world with gravity—that incredible force that keeps our feet on the ground and everything else from flying off into space. But what happens to the human body when we no longer feel the effects of gravity, at least not in the same way we do on Earth? What happens in space?

The crew of the STS-90 mission

What happens to our bones and our hair? Our appetites and our, um, bodily functions? Do we burp, and fart, and snore like we do on Earth? How do we eat dinner if gravity isn't holding the food on our plates, or our plates on the table? And the number one question astronauts are asked: How do we go to the bathroom?

For astronauts and scientists—and anyone else interested in learning more about life in space—these are important questions, especially if we want to go where no human has gone before.

Flight engineer Clayton C. Anderson at work

FUN FACT

All planets have gravity. Planets that are bigger than Earth have a stronger gravitational pull, while planets that are smaller don't have as much.

G Is for G-Force!

Everything on or around Earth is constantly being pulled toward the center of the planet. This force is called gravity, and the unit of measurement used to describe its strength is g-force. Earth's g-force is 1—or 1 g. That 1 g is strong enough to hold down almost everything on the surface of our planet. And whether you live in Australia or America, "down" is toward the center of Earth.

When you go to sleep, you lie down.

When you brush your teeth, you spit down into the sink.

When you jump up in the air, you come back down to the ground.

Zero Gravity? Not Quite

Technically, there is gravity up in space, just very little of it, which is why it's called microgravity. It might not seem like it, but gravity is still at work in an orbiting spacecraft like the International Space Station (ISS). In fact, at the altitude of the ISS, the force of gravity is only 10 percent less than it is on the surface of the earth.

Free Fall

So why do astronauts float around up there? Because we (and the ISS) are in a slow free fall! To stay orbiting around Earth, the ISS has to travel really fast—roughly 25 times faster than the speed of sound. That motion minimizes the pull of gravity, which means the ISS is not falling as fast as, say, a skydiver who jumps from a plane. But it is still falling, and so are the astronauts inside. To prevent the ISS from falling slowly back to Earth over time, visting spacecraft that are attached to the ISS boost it back up to its orbital altitude.

Astronaut Tracy Caldwell Dyson trains for zero gravity in a spin chair

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The "Number One" Question

Welcome to Toilet Training

On Earth, we don't even *think* about going to the bathroom. We just do it. But how does it work if you're floating around?

Get the Vacuum Cleaner Out!

Astronauts don't use the P-words (pee or poop). We don't even say "number one" or "number two." We talk about liquid waste and solid waste. And in space, getting rid of waste relies on one important principle: "things" should move away from you.

On Earth, gravity takes care of this for us. But in space, a technological solution is needed to ensure that waste is moving in the right direction—away! Suction to the rescue!

Planetary Plumbing

On the ISS, special toilets use powered airflow or vacuum suction to move waste away from astronauts and into storage compartments. Since the air used to direct the waste is returned to the cabin, it's filtered to control odor and remove any small floating objects. And the waste? Some of that gets reused too. Advanced systems treat and purify liquid waste, turning it into drinking water. Talk about a recycling program!

FUN FACT

Will the houses of the future use this type of water recycling to reduce water demand? Scientists are working to find out.

Practice Makes Perfect

Space toilets look kind of similar to Earth toilets, meaning we can pretty much guess which body part goes where. But watch out! Using a space toilet is not as simple as it looks. Astronauts take part in mandatory training in simulators that imitate what it's like to be in a weightless environment. It takes a lot of practice to make sure things go where they're supposed to and don't get stuck. It's potty training all over again.

Space toilet

Bathroom Break

Okay, so we know about space toilets and suction. But how does it really work up there when you've got to go? How do you pee in space?

The Proof Is in the Position

It's hard to do your business when you're weightless! That's why space toilets have foot restraints that help us to stay in place. Liquid waste goes directly into a funnel, and the funnel is attached to a urine hose that takes it to the inner workings of the space toilet. If we aim properly, the fans suck in the air and our liquid waste; if we don't, we may have a free-floating mess to clean up.

FUN FACT

Getting the right fit is important! Over the space-exploring years, engineers have developed urine funnels to suit female and male astronauts. On the Space Shuttle program, they were even color-coded to make sure you didn't use your crewmate's by mistake!

Commander Suni Williams shows a bathroom funnel on the ISS