Donning the Spacesuit

On Earth, you breathe in air. Air is a mixture of oxygen, nitrogen and other gases. Your body tissues are filled with nitrogen. The amount of nitrogen that your body can absorb depends on the amount of pressure that's being exerted by the atmosphere. The higher the pressure is, the more nitrogen your body can hold. The lower the pressure is, the less nitrogen your body can hold. If you moved from an area of high pressure to an area of low pressure too quickly or if the difference between pressures was extreme, your tissues would get supersaturated--or overfilled--with nitrogen! Nitrogen would be forced out of your tissues as gas bubbles. Ouch! This causes a lot of pain!

In space, the air within the cabin of the Space Shuttle is at the same pressure as it is here on Earth. It contains the same mixture of nitrogen and oxygen. The spacesuit, on the other hand, operates at about one-third of the Shuttle's cabin pressure. That's because the lack of pressure in space makes the suit act like a rigid balloon. Keeping the pressure as low as possible makes it easier for the astronauts to bend and move in the suit as they perform their tasks. However, if the pressure were kept too low, the astronauts would be at a higher risk of getting "the bends".

To prevent "the bends" the spacewalkers slowly remove nitrogen from their bloodstream and body tissues by breathing pure oxygen. They do this by putting on the helmets from their launch and re-entry suits that are connected by a tube to a tank of 100% oxygen. They breathe in pure oxygen, but the air they exhale is a mixture of oxygen, carbon dioxide and nitrogen. This procedure is called pre-breathing.

About an hour or so after starting their pre-breathe (and at least 12 hours before going stepping into space), the Shuttle's cabin pressure is lowered from 101 kilopascals to 70.3 and the percentage of oxygen in the cabin air is increased.

The combined lower pressure and higher level of oxygen means the astronauts can take off their helmets and breathe the cabin air without the risk of loading any more nitrogen into their bodies. In fact, they slowly continue to lose nitrogen! This procedure usually occurs at the end of the day. The astronauts have a good night's sleep. The next morning, they wake up early to prepare for their spacewalk.

Step 2: The Urine Collector

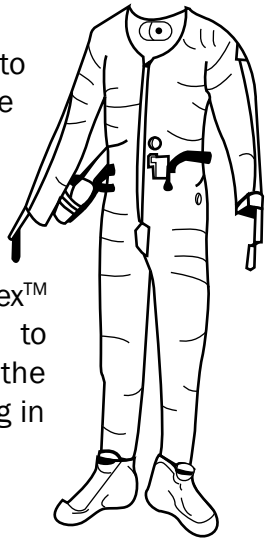
This is the day the spacewalk begins! The astronauts start to get dressed. The first thing on is the urine collector! This does not involve anyone collecting samples from the astronauts!

You can think of urine collectors as materials that absorb or collect urine during the spacewalk.

Male spacewalkers wear a Urine Collection Device while female spacewalkers wear Disposable Absorption and Containment Trunks. The male version is a pouch. The female version is like a pair of multi-layered shorts that contain an absorptive powder. Both can hold almost one whole liter of fluid.

Step 3: Stay Cool!

The astronauts now move into the airlock. They put on the Liquid Cooling-and-Ventilation Garment. This looks like a pair of long underwear with a series of tubes that run throughout it. The Spandex™ garment's tubes are used to circulate cool water to keep the body comfortable while working in the 114-kilogram suit.



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Other tubes are used to whisk away sweat, carbon dioxide and any contaminants into the Primary Life Support System to purify the atmosphere in the suit.

Step 4: Harnessing Electricity

Why would a suit need an electrical supply?

A power connection is necessary to hook up medical instruments that monitor the astronaut's heart rate. It's also necessary run the suit control systems and for radio equipment that serves as the commun-ications link between space and Earth.

To accomplish this, an electrical harness is hooked up to the Hard Upper Torso (HUT) of the suit.

Step 5: Putting the Little Pieces Together

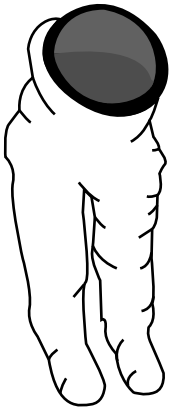
A number of little items need to be prepared. An anti-fog mixture is rubbed into the inside of the helmet. A wrist mirror and checklist are attached to the left arm of the suit.

On the inside of the HUT, a water bag needs to be attached with Velcro™. The In-suit Drink Bag is filled with about two-and-a-half cups of water from the galley. A straw reaches up into the helmet.

Next--the Snoopy Cap! This is a fabric cap that contains earphones and a microphone for commun-ication. It gets connected to the electrical harness and is left floating above the HUT until it's ready to put on.

Step 6: One Leg at a Time

Finally, the rest of the suit goes on. The bottom half of the suit (also known as the Lower Torso) gets pulled on. The Lower Torso consists of the pants, boots, joints for the ankles, knees, and hips, and a metal body-seal closure that connects the Lower Torso to the HUT. It also features a waist bearing which allows the astronauts to twist from side to side if they're locked into foot restraints while working in space.



Step 7: Dive In!

Or maybe we should say, "Dive Up!"

The HUT hangs on the wall of the airlock. To get into it, the astronaut has to raise his arms and dive up into the top half and squeeze his head past the neck seal.

Once inside, the Liquid Cooling-and-Ventilation Garment gets hooked up to the Primary Life Support System. The medical instruments are also hooked up to the electrical harness. Finally, the body-seal closure rings are locked together with the help of another crewmember.

The HUT is strong enough to carry the Primary Life Support System which goes on the back and the Displays and Controls Module which attaches to its front. The module remains plugged into the Service and Cooling Umbilical. It provides cool water, oxygen, and power from the orbiter. By remaining plugged into the umbilical, the "consumables" of the Primary Life Support System are conserved until needed.