

Exploration Brief

Keeping the Pressure On

Context

While pressure is essential to astronaut survival, the pressure exerted by a spacesuit does not have to match sea level pressure on Earth. If the atmosphere inside a spacesuit is pure oxygen, a pressure equal to about one third sea level pressure (about 33 kilopascals) is sufficient. However, such low pressures require a several hour oxygen prebreathing period to eliminate nitrogen from the spacewalker's blood stream. If a higher suit operating pressure can be achieved, an astronaut can don a suit and immediately exit the spacecraft for a spacewalk.

Operating pressures inside spacesuits are achieved by creating some sort of pressure shell around the astronaut. The shell can be made of rigid materials or a combination of fabrics provided they are nearly leakproof. The pressure layer of the Space Shuttle spacesuit encase the astronaut inside a human-shaped bag which has an inner layer of rubber and an outer layer of nylon. The rubber contains the atmosphere and the nylon prevents the rubber from inflating beyond a predetermined size and shape. Once the suit is fully inflated, additional gas pressure supplied to the suit pushes inward on the astronaut providing a livable pressure environment.

Objective

- To demonstrate one method for creating a workable pressure inside a spacesuit.

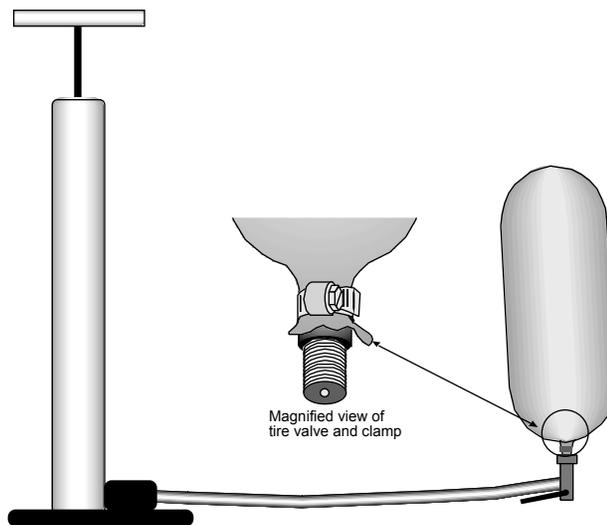
Materials and Tools Checklist

- 0.5 m ripstop nylon (available in fabric stores)
- Sewing machine
- Scissors
- Long balloon
- Bicycle pump with pressure gauge
- Small adjustable screw type, hose clamp
- Tire valve
- Screwdriver

Procedure

- Step 1. Using two pieces of ripstop nylon, stitch a bag as shown in the pattern on the next page. The pattern should be doubled in size. For extra strength, stitch the bag twice. Turn the stitched bag inside-out.*
- Step 2. Slip the nozzle of a long balloon over the fat end of the tire valve. Slide the other end of the balloon inside the bag so the neck of the tire valve is aligned with the neck of the bag.*





Step 3. Slide the adjustable hose clamp over the bag and tire valve necks. Tighten the clamp until the balloon and bag are firmly pressed against the tire valve neck. This will seal the balloon and bag to the valve.

Activity

Step 4. Connect the tire valve to the bicycle pump and inflate the balloon. The balloon will inflate until it is restrained by the bag. Additional pumping will raise the pressure inside the balloon. Check the tire pressure gauge on the pump (use separate gauge if necessary) and pressurize the bag to about 35 kilopascals (5 pounds per square inch). The tire valve can be separated from the pump so that the bag can be passed around among the students.

Step 5. Discuss student observations of the stiffness of the pressurized bag. square inch). What problems might an astronaut have wearing a pressurized spacesuit?

Extensions

- Compare the technology for pressurizing spacesuits to the technology for pressurizing automobile tires.

