

Why Astronauts Are Cool



It may seem kind of surprising, but things can get very hot on an orbiting spacecraft. While the vacuum of space itself is almost devoid of heat, energy from the Sun can quickly heat up any object that is exposed to sunlight. Equipment and astronauts also generate heat. Things could quickly become too hot for comfort for both astronauts and spacecraft equipment, which is designed to function properly in a limited range of temperatures. As a result, orbiting spacecraft need a way to keep things cool. Fortunately, it is very cold in space.

The Space Shuttle uses water evaporation during launch and landing to cool the shuttle. This works just like the human body using sweat to cool itself when it is working hard. On the shuttle, water is evaporated into space carrying off heat as it leaves. However, the water is soon used up and must be replaced with a cooling method that can last the entire mission. The system put into action to take over cooling is called the radiator.

You may have noticed that anytime you see a picture of the Space Shuttle in orbit, the payload bay doors are open. It makes sense that the doors would be open when the Shuttle is capturing and repairing a satellite, releasing something into orbit, or adding new components to the International Space Station (ISS). But, have you ever wondered why the doors are open even when the Shuttle is not doing any of those things? If nothing is being moved in or out of the cargo bay, why would the crew leave the doors open? Hasn't the crew been taught to close the outside door when they're not using it?

If you guessed that the payload bay doors have something to do with the radiators, then you are correct. On the inside of the doors are heat radiators, a special system which allows heat from the Shuttle to be released into the cold vacuum of space. Liquid Freon loops are used to circulate heat from the Shuttle's cabin and equipment to the radiators. While temperatures of orbiting objects in sunlight can reach 121 degrees Celsius [°C] (250 degrees Fahrenheit [°F]), temperatures in the shade drop as low as -157 °C (-250 °F). The radiators dump or "radiate" the unwanted heat into the dark shade of space. For this reason, the Space Shuttle's cargo bay doors have to stay open to prevent the Shuttle from overheating. Opening the doors is one of the first things the Shuttle crew does when it reaches orbit. If, for some reason, the crew was unable to get the doors to open when they first reached space, they would have to come home immediately. If they didn't the water used for evaporation cooling would run out and the Shuttle and equipment would begin to overheat causing them to malfunction.





The Space Station uses a similar system. Perhaps, you've noticed something on the ISS that looks almost like a crumpled-up solar panel. The ISS currently features five radiator panels (with four more awaiting deployment), attached to the Station's trusses. Each radiator consists of 14 panels. Heat from inside the Station is transferred to the radiators using a fluid-based system. Inside the Station, water is circulated through pipes, transferring heat away from equipment and cooling the interior of the Station. In pipes outside the Station, however, the water would quickly

freeze. To avoid this problem, the Station uses a system in which the heat from the water system is transferred to an ammonia system. Ammonia has a much lower freezing point. The ammonia is circulated through the exterior pipes to the radiators, which release the heat into space.

In addition to these radiators, other techniques are also used to control the temperature inside orbiting spacecraft. One of the simplest techniques is insulation, which helps maintain the internal temperature in the craft regardless of changes in the exterior temperature. The insulation also serves to block space radiation that would be harmful to astronauts. Because the insulation is so effective, it also traps the heat generated by equipment inside the spacecraft. As the radiators vent excess heat into space, airflow systems keep the spacecraft atmosphere circulating so that the cooler air is spread through the entire vehicle.

So, now you know why the Space Shuttle always flies around with its doors open. It's what all the cool astronauts do!

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