

## **Umbrella boots are perfect for getting around in microgravity**

**WHEN it comes to living in the reduced gravity of space, Mary Poppins could teach us a thing or two, according to two researchers in the US. They reckon that "umbrella power" will be one of the most efficient and controllable ways of moving about in microgravity.**

**Philip Watts of Applied Fluids Engineering in Long Beach, California, was considering the best way of getting people around a large space station under their own steam. Pushing yourself off from a surface in the direction you want to go is fine, he says, except that, once airborne, you have no control over speed or direction. "Moving at speeds of around 40 kilometres an hour, it could be downright dangerous," he explains.**

**Assuming normal Earth air pressure, Watts and his colleague David Carrier, a comparative physiologist at the University of Utah in Salt Lake City, simulated various propulsion systems used by creatures on Earth to see how they would fare in microgravity conditions.**

**To test a simple drag-based system like that used by winged seeds, the pair flapped an open umbrella up and down while standing on a set of weighing scales, and calculated the forces that were produced. Taking into account the effects of gravity and their own mass, they then calculated the forces that would be produced by the same motion in microgravity. Umbrellas proved effective for propulsion, the researchers reported at a meeting of the Society for Integrative and Comparative Biology held in Chicago last week. This is because the air resistance differs significantly depending on whether the umbrella is moving up or down, resulting in a significant net force in one direction.**

**Donning wings or bat-like suits with webbed arms to simulate flying were less successful. In the absence of gravity, the net effect of upward and downward wing motion was negligible. And jet-based systems, as used by jellyfish, would be difficult to use in space without spinning out of control.**

**One of the biggest problems is that humans' relative lack of upper body strength appears to rule out arm-powered systems. "We wouldn't be able to sustain the motion for very long," says Carrier. "We are just too big to fly."**

**So Carrier and Watts favour leg-powered propulsion. Future astronauts might "jog" around the space station, powered by umbrella-shaped devices strapped to each foot. Another of their ideas is a vehicle something like a reclining bicycle, with directional propellers that can be turned by pedalling.**

**As well as providing a way of getting about, astronauts would get much-needed exercise. "Musculoskeletal and cardiovascular atrophy in microgravity represents one of the greatest obstacles to extended space travel," says Watts.**

New methods for  
moving around in  
microgravity

**Duncan Graham-Rowe**

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