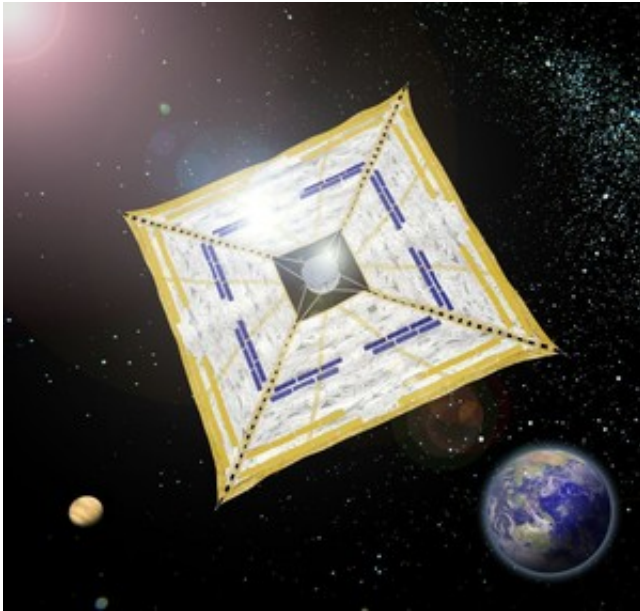


What is a solar sail?

January 20 2014, by Fraser Cain



IKAROS – solar sail from Japan. Credit: JAXA

I'm Fraser Cain, and I'm a sailor. Well, okay, I've got a sailboat that I take out on the water when it's warm and the weather's nice here on Vancouver Island. I think it's one of the reasons I absolutely love the idea of a solar sail.

Here's how they work: Light is made up of photons. Even though they have no mass at rest, they have momentum when they're moving, well, [light](#) speed. When they reflect off a surface, like a mirror or a shiny piece of metal, they impart some of this momentum to that surface. This effect is negligible here on Earth, but out in space, with forces perfectly

in balance, that additional momentum can really add up.

A spacecraft flying to Mars gets pushed off course by several thousand kilometers because of light pressure from the Sun. If mission planners didn't compensate for this drift, their spacecraft would miss the planet, or even worse, crash into it. Even though the total amount of pressure per square meter on a [solar sail](#) is minuscule, it's constantly streaming from the Sun, and it's totally free.... And propulsion that you don't have to carry with you is the best kind there is.

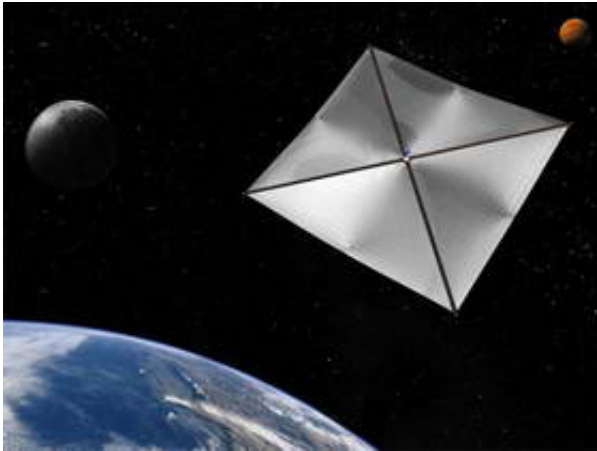
This is more than just an idea. Solar sails have already been launched and deployed in space. The Japanese Ikaros satellite unfurled a 14-meter solar sail back in 2010. NASA launched its own Nanosail-D spacecraft in 2011. An even bigger solar sail, the Sunjammer, is planned for launch in 2014. The Planetary Society is working on a solar sail project as well.

The closer to the Sun you are, the better they work. In fact, a solar sail would be an ideal vehicle to explore the regions of Mercury and Venus, since they receive so much radiation. But you're probably wondering how a solar sail could get down to those planets because light is streaming from the Sun in all directions. It's all about raising and lowering your [orbit](#). If you want to raise your orbit around an object, all you have to do is speed up. And if you want to lower your orbit, you just need to slow down.

A solar sail launched from Earth would start out with the same orbital velocity around the Sun as the Earth. To get into a higher orbit, it tilts the sail so that the light from the Sun speeds it up. And to get into a lower orbit, it tilts in the opposite direction, and the light from the Sun acts like a brake.

A solar sail might even be the ideal spacecraft to make the journey to another star. An interstellar solar sail could lower its orbit so that it's just

above the surface of the Sun. Then, it would unfurl the full sail and capture the most possible photons. A series of powerful laser beams would then target the sail and increase its velocity to a significant fraction of the speed of light.



Solar Sail. Credit: NASA

Of course, you'd need a solar sail thousands of kilometers across, made of a material thinner than a human hair, and lasers putting out more energy than all of humanity. The idea is still intriguing, even though it's well outside our current technology. Once this technology gets better tested, we'll to see many more missions employ solar sails as part of their propulsion system.

Source: [Universe Today](#)

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