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Alternative plastic made from DNA is easy to recycle

Alice Klein

A NEW plastic made from DNA is renewable, requires little energy to make and is easy to recycle or break down.

Conventional plastics are bad for the environment because they are made from non-renewable petrochemicals, require intense heating and toxic chemicals to make, and take hundreds of years to break down. Alternative plastics derived from plant sources like corn starch and seaweed are renewable and biodegradable, but are also energy-intensive to make and hard to recycle.

Dayong Yang at Tianjin University in China and his colleagues have developed a plastic that overcomes these problems. It is made by linking short strands of DNA with a chemical derived from vegetable oil, which produces a soft, gel-like material. This can be shaped into moulds and then solidified using a freeze-drying process that sucks water out of the gel at cold temperatures.

The researchers have made several items using this technique, including a cup, puzzle pieces and a dumb-bell shape. The items were then recycled by immersing them in water, turning them back into a gel that could be moulded into new shapes (*Journal of the American Chemical Society*, doi.org/gngw3m).

Because the production of DNA plastic doesn't require high temperatures, its carbon emissions are 97 per cent lower than those of polystyrene plastic. It can also be broken down using DNA-digesting enzymes when no longer needed.

The two main downsides of the plastic are that it isn't as strong as traditional petrochemical plastics and it must be kept dry to stop it from turning back into a gel. As a result, it is probably best suited to applications like packaging materials and electronic devices, says Yang. ■

Anti-satellite weapons A Russian test that created a cloud of dangerous debris has inflamed tensions in low Earth orbit. Is there worse to come, asks Leah Crane

ON 15 November, astronauts aboard the International Space Station (ISS) were awoken and told to batten down the hatches and take cover. A cloud of debris from a smashed-up satellite was heading towards the station, so the seven astronauts had to shelter in their Soyuz and Crew Dragon capsules, which are more heavily protected than the rest of the craft, for two hours as it passed. They repeated this 90 minutes later as the detritus came around the planet again.

The debris came from a defunct Soviet satellite called Cosmos-1408, destroyed deliberately in a test of a Russian anti-satellite (ASAT) device. This created more than 1500 shards of satellite large enough to be tracked and hundreds of thousands of smaller bits, all hurtling around Earth about 485 kilometres up.

The ISS and all its passengers emerged from the cloud safely, and while it has since made several other close passes, none of them

has caused any serious damage. But the debris could remain in orbit for years, endangering spacecraft and forcing satellites to manoeuvre out of the way.

After the test, the US government reacted quickly with outrage. "Russia has demonstrated a deliberate disregard for the security, safety, stability, and long-term sustainability of the space domain for all nations," said James Dickinson, commander of the US Space Command, in a statement. "The debris created by Russia's [ASAT] will continue to pose a threat to activities in outer space for years to come, putting satellites and space missions at risk."

The Russian space agency, Roscosmos, made an announcement stating: "For us, the main priority has been and remains to ensure the unconditional safety of the crew." Of the seven crew members aboard the ISS during the test, two were Russian.

Others in the space flight industry say that this test endangered all the astronauts currently in orbit. "I'm outraged by this irresponsible and destabilizing

action," said NASA administrator Bill Nelson in a statement.

"With its long and storied history in human spaceflight, it is unthinkable that Russia would endanger not only the American and international partner astronauts on the ISS, but also their own cosmonauts. Their actions are reckless and dangerous, threatening as well the Chinese space station and the taikonauts on board," he said.

1500

Number of large pieces of debris created by Russia's weapon test

This isn't the only ASAT test that has been conducted, as the Russian defence ministry noted in a statement in which it also claimed that the debris "did not represent and will not pose a threat to orbital stations, spacecraft and space activities". China conducted a test in 2007 that resulted in some fragments that are still circling Earth – the ISS recently had to adjust its orbit slightly to avoid one. The US conducted a test in 2008 and India did as well in 2019, but both of those tests destroyed satellites in relatively low orbits, so the resulting debris fell and burned up in the atmosphere within months.

There is no international treaty officially forbidding ASAT tests, but like previous ones, this test was a display of force that won't go unnoticed by other space powers. The danger is that rather than resulting in laws against ASAT weapons, a subject that has long been contentious, this incident will provoke additional tests from other countries wishing to prove that they have similar capabilities. If that happens, it could make space a minefield of speeding rubbish for many decades. ■

The International Space Station's crew had to take cover



NASA