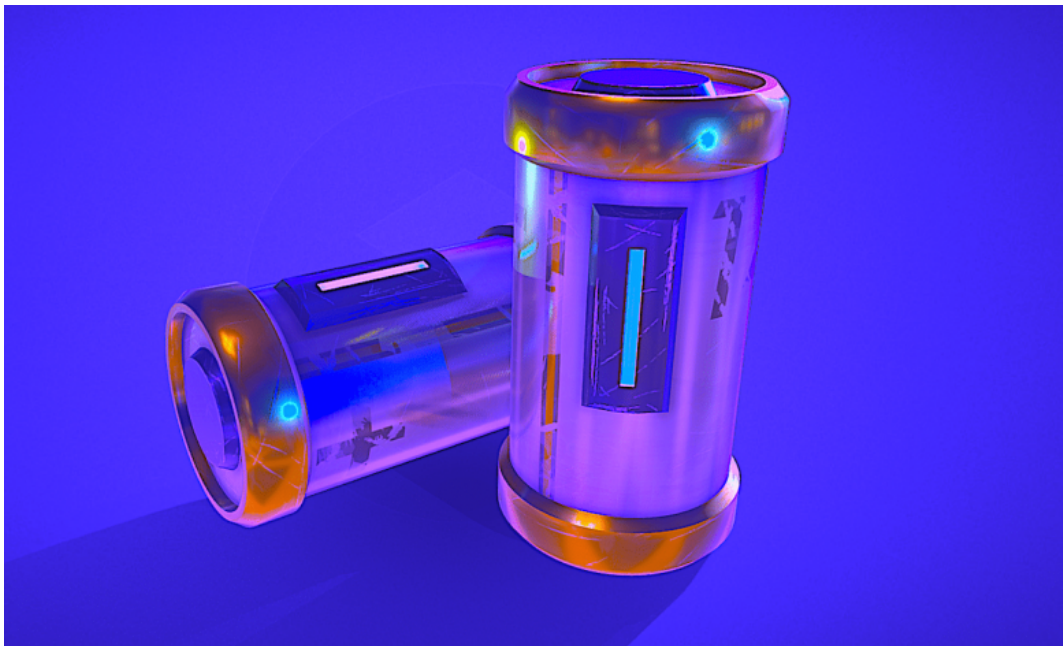


Science

The US military has developed a mechanical battery that could power laser weapons

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Flywheels are disc systems that store energy through rotation (inertia). They have been used since the beginning of the 20th century for industrial motor applications or since the 1950s in the field of transport, in order to recover the energy of the deceleration phase of a bus for example, to restore it at start-up. Recently, the US Navy has developed a powerful mechanical battery based on the same principle. This type of battery could be used to power laser weapons or electromagnetic cannons, or even to store energy in homes.

Conventional electric generators provide stable power, but cannot be boosted to provide brief power surges, which are particularly necessary for directed energy weapons and electromagnetic cannons. For this, the US Navy currently uses lithium-ion batteries. These can of course discharge quickly, but present risks for warships: they contain dangerous materials and are liable to heat up and catch fire. In addition, conventional (chemical) batteries do not perform well at high and low temperatures.

To solve these problems, researchers at Vishwa Robotics (Massachusetts) and the Massachusetts Institute of Technology (MIT) designed a mechanical battery that uses a set of flywheels placed in a disc-shaped box. Flywheels generally cannot compete with chemical batteries when it comes to energy storage, but this new mechanical battery has some innovative features. For starters, this is a collection of small inertia units rather than a single large flywheel.

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More energy storage than a lithium-ion battery of the same weight

" *By reducing the dimensions, each cell can turn much faster* », Explains Bhargav Gajjar, president of Vishwa Robotics. Specially created bearings make the unit more efficient and economical. According to Gajjar, this design can store more energy than a lithium-ion battery of the same weight, and release it more quickly without thermal risk.

To put this in perspective: a 5 kilowatt diesel generator is usually the size of a washing machine and weighs over 100 kilograms. This 5 kilowatt mechanical battery prototype is a disc just 10 inches in diameter, and the next version will be less than 8 inches wide. Multiple batteries can be stacked to power more power-hungry weapons, like anti-drone lasers.

The mechanical battery, based on a flywheel (a rotating system for the storage and release of kinetic energy), can provide energy peaks for high power applications, such as laser weapons. © Vishwa Robotics

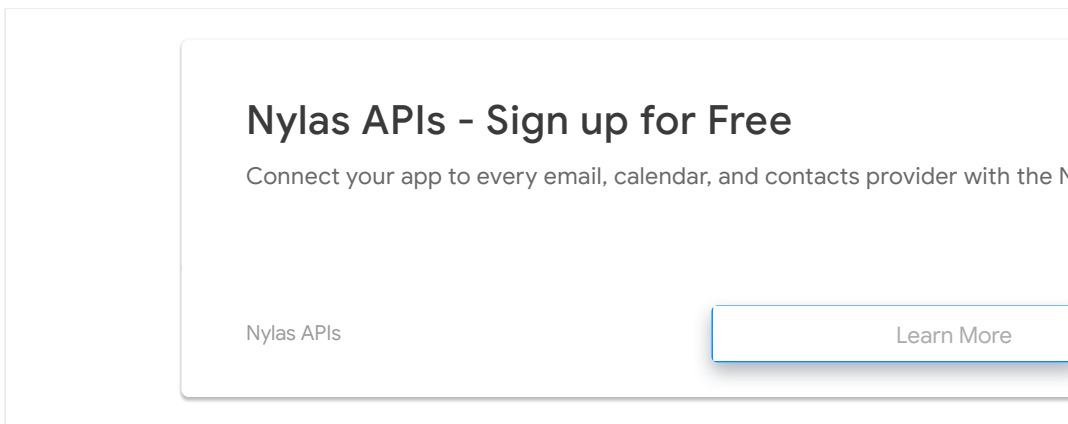
" *Currently available energy conversion and storage devices that can power such long-range drone killer weapon systems have two problems. They are made from explosive chemicals and they are very large. These two problems make it very difficult to integrate these weapons on ships, submarines, vehicles and unmanned systems.* », Explains Gajjar.

Potential for use in homes

Software manages the network of flywheels, monitors and draws energy from the various wheels according to demand. According to Gajjar, the mechanical battery is also suitable for home use. " A smaller 10 kilowatt-hour prototype is already running in my garage and powering my whole house at night », Explains Gajjar. Solar panels installed on the roof recharge the unit during the day.

Gajjar explains that the flywheel is a simple mechanical device and no scarce materials are needed to make it, so it could be mass produced at low cost. Chemical batteries lose efficiency after a few hundred charge / discharge cycles, but mechanical batteries show no effect after tens of thousands of cycles and should last for decades, he says.

Keith Pullen of City University of London believes the mechanical battery seems well suited for applications requiring sudden spikes in energy. But he doubts they produce more power than lithium-ion batteries for the same weight. The Navy's primary goal is to achieve better safety than chemical batteries, although there have been notable accidents with flywheels in the past, when they have thrown debris or become detached. in operation, injuring people.



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" Flywheels have a reputation for being dangerous "Says Pullen," but they are safer than chemical batteries if properly designed". The US Navy last month awarded a two-year development contract for the mechanical battery, which will include performance and safety testing under various conditions. The device will be evaluated to provide power not only for weapons, but also for sensors and propulsion, for example in unmanned submarines, and for emergency power supply.

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