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Huge 'launch ring' to fling satellites into orbit

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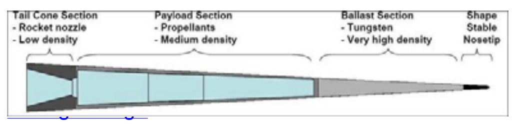
An enormous ring of superconducting magnets similar to a particle accelerator could fling satellites into space, or perhaps weapons around the world, suggest the findings of a new study funded by the US air force.

A ring of superconducting magnets fires a projectile off a ramp at 8 kilometres per second, fast enough to reach orbit (Artist's conception: J Fiske/LaunchPoint)



A cone-shaped shell would protect the payload during its passage through the atmosphere into space, and includes a rocket at the back end to adjust its trajectory (Illustration: J Fiske/LaunchPoint Technologies)

Proponents of the idea say it would be much cheaper than conventional rocket launches. But critics warn that the technology would be difficult to develop and that the intense *g* forces experienced during launch might damage the very satellites being lofted into space.

Previous studies have investigated the use of magnets to accelerate satellites to the high speeds required for launch. But most have focused on straight tracks, which have to gather speed in one quick burst. Supplying the huge spike of energy needed for this method has proven difficult.

The advantage of a circular track is that the satellite can be gradually accelerated over a period of several hours. And the setup is technologically feasible and cost effective, suggests a recent, preliminary study of the idea funded by the air force's Office of Scientific Research.

The air force has now given the go-ahead for more in-depth research of the idea. The two-year study will begin within a few weeks and be led by James Fiske of LaunchPoint Technologies in Goleta, California, US.

The launch ring would be very similar to the particle accelerators used for physics experiments, with superconducting magnets placed around a 2-kilometre-wide ring.

Mach 23

The satellite, encased in an aerodynamic, cone-shaped shell that would protect it from the intense heat of launch, would be attached to a sled designed to respond to the forces from the superconducting magnets.

When the sled had been accelerated to its top speed of 10 kilometres per second, laser and pyrotechnic devices would be used to separate the cone from the sled. Then, the cone would skid into a side tunnel, losing some speed due to friction with the tunnel's walls.

The tunnel would direct the cone to a ramp angled at 30° to the horizon, where the cone would launch towards space at about 8 kilometres per second, or more than 23 times the speed of sound. A rocket at the back end of the cone would be used to adjust its trajectory and place it in a proper orbit.

Anything launched in this way would have to be able to survive enormous accelerations – more than 2000 times the acceleration due to gravity (2000*g*). This would seem to be an obstacle for launching things like communications satellites, but Fiske points out that the US military uses electronics in laser-guided artillery, which survive being fired out of guns at up to 20,000*g*.

Long-range weapons

The US air force's interest stems from the ring's potential to launch small, 10-kilogram satellites into orbit, though the team says it has not been told what kind of satellites these are. Aeronautics researcher Alan Epstein at MIT in Cambridge, US, who is not on the team, says the ring could potentially be used as a weapon.

Aside from microsatellites, the launch ring would be ideal for delivering supplies to support human spaceflight, such as food and water, which are not sensitive to such high accelerations, Fiske says. "Nearly all of this materiel could be shipped via launch rings, resulting in major reductions in the cost of manned space activities," he told **New Scientist**.

Such a launch ring is technologically possible, but getting the projectile safely through the atmosphere would be challenging, says Epstein.

Among other things, it would be difficult to keep it from overheating and to make sure it follows the desired trajectory when subjected to winds and friction from the atmosphere, he says: "None of these challenges are trivial at all."

Team member Michael Ricci, also at LaunchPoint, thinks these difficulties can be overcome. "They're certainly not issues that can just be discounted, but we believe both of those are solvable," he told **New Scientist**, citing previous research on nuclear warheads, which are designed to move through the atmosphere at hypersonic speeds.

Cheaper by the dozen

If the ring launched hundreds of satellites a year, it would be cheaper than conventional rocket launches. With 300 launches per year, the team estimates the ring could put payloads into orbit for $745 per kilogram. If the launch rate reached 3000 launches per year, they calculate that would drop to $189 per kilogram. Today, it costs more than 100 times that to send payloads into space.

However, Epstein says he cannot imagine a demand for that many launches in the foreseeable future. Ricci counters that demand is currently being held back by the high cost of rocket launches: "If you had orbital launch capabilities at one-tenth or one-hundredth the cost, there'd be a lot more demand."

If the results of the team's upcoming, more detailed design study are promising, the team would like to proceed by building a small test version of the ring, measuring 20 to 50 metres across, although no funding has been promised for this as yet.

If everything went well with the test ring, the team would hope to attract funding to build a full-scale version, which would take about four years to build, Ricci estimates.

Although Epstein is sceptical about the prospects for such a ring, he cautions that if built, the ring itself could become a target for attacks. This is because of its potential for use as a weapon, launching missiles that could reach anywhere in the world. "The ring then becomes one of the most important targets on the planet," he told **New Scientist**.

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