Electromagnetic Propulsion

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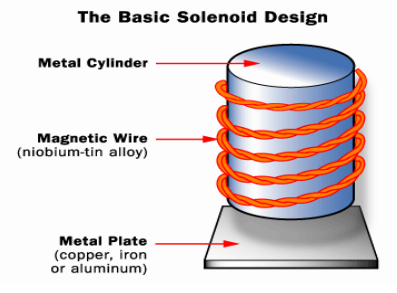
I. Introduction

For decades, the only means of space travel have been rocket engines that run off of chemical propulsion. Now, at the beginning of the 21st century, aerospace engineers are devising innovative ways to take us to the stars, including light propulsion, nuclear-fusion propulsion and antimatter propulsion. A new type of spacecraft that lacks any propellant is also being proposed. This type of spacecraft, which would be jolted through space by electromagnets, could take us farther than any of these other methods. When cooled to extremely low temperatures, electromagnets demonstrate an unusual behavior: For the first few nanoseconds after electricity is applied to them, they vibrate.

II. Theory

The U.S Department of Energy (DOE) is working on improving superconductors and very rapid high power solid state switches. So the DOE researchers considered the idea for a space propulsion system that using super-cooled, superconducting magnets vibrating 400,000 times per second. If this rapid pulse can be directed in one direction, it could create a very efficient space propulsion system with the ability to achieve speeds on the order of a fraction of 1 percent of the speed of light.



(The cylinder is super cooled electromagnet and the metal causes an asymmetry in the magnetic field)

The entire structure will have a diameter of 1 foot (30.5 cm), a height of 3 feet (91.4 cm) and a weight of 55.12 pounds (25 kg). The wire used for this propulsion system is a niobium-tin alloy. Several of these wire strands will be wrapped into a cable. This electromagnet is then super-cooled with liquid helium to 4 degrees Kelvin (-452.47 F / -269.15 C). For the magnet to vibrate, you need to cause an asymmetry in the magnetic field. Goodwin plans to deliberately introduce a metal plate into the magnetic field to enhance the vibrating movement. This plate would be made of copper, aluminum or iron. The aluminum and copper plates are better conductors and have a greater effect on the magnetic field. The plate would be charged up and isolated from the system to create the asymmetry. Then the plate would be drained of electricity in the few microseconds (millionths of a second) before the magnet were allowed to oscillate in the opposite direction. The key to the system is the solid-state switch that would mediate the electricity being sent from the power supply to the electromagnet. This switch basically turns the electromagnet on and off 400,000 times per second. A solid-state switch looks something like an oversized computer chip -- imagine a microprocessor about the size of a hockey puck. Its job is to take the steady-state power and convert it to a very rapid, high-power pulse 400,000 times per second at 30 amps and 9,000 volts.

III. Results

Now, the question here is, can we use this non-steady state condition in such a way that it only moves in one direction?" DOE researchers said. That's why they want to experiment it first. Together with the cooperation of Boeing, DOE is seeking funding from NASA to perform such an experiment.

RERENCES

1. The American Institute of Aeronautic (design concept of electromagnetic propulsion for interplanetary flight).
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3. Kevin Bonsor “Jolting Into Space”