LaRouche PAC Testimony

Fusion Power for Space Exploration

The following written testimony was submitted by Peter Martinson of the LaRouche Political Action Committee, to hearings on "The Next Generation of Fusion Energy Research," of the Subcommittee on Energy and Environment of the U.S. House of Representatives Committee on Science and Technology, on Oct. 29.

I submit this testimony as a representative of the LaRouche Political Action Committee, in order to ensure that a most important aspect of driving scientific breakthroughs in Fusion research is addressed during the course of these hearings. American statesman and economist Lyndon LaRouche has emphasized that a manned Mars program, led by the United States, is potentially the most important economic project for humanity today. Our government has flirted with a manned mission to Mars since the beginning of our space program, but it has been understood since the days of Goddard and von Braun, that manned Mars missions would require nuclear power. A robust, forward-leaning program in developing fusion technology is necessary for any serious interplanetary spaceflight by humans. In this short testimony, I will give a sketch of a manned Mars proposal, illustrating the importance of fusion research throughout.

A reasonable manned mission to Mars today would be planned on a physical, not budgetary/monetary, basis. In other words, a budget would be hammered out for the mission that reflects 1) the necessity of manned colonization of the Solar System, and 2) the physical realities and unknowns faced by such a mission. Such a mission could proceed as follows:

The first step to Mars, will be back to the Moon. The United States, in cooperation with the other three major nations—Russia, China, and India—must lead the charge to set up permanent, semi-automated bases on the Moon. These bases would be primarily concerned with studying the geochemical history of the Moon, and with mining and processing Lunar resources. Since the Moon likely never supported a biosphere, the indigenous resources will not exist in concentrated ores. The immense energy flux densities possible with fusion make possible the concentration of these resources, to be usable in industry.

One resource that must be developed on the Moon is Helium-3, discovered in Lunar return samples in 1986. Along with deuterium, this stable isotope, rare on the Earth, is used in the most efficient and promising fusion reaction. Instead of producing neutrons which irradiate the reactor, as in deuterium-tritium fusion, D-3He produces protons which, because of their positive electric charge, can be contained by a magnetic field, and could potentially be used for direct-conversion electricity, or directed out a rocket nozzle.

Lunar manufacturing will become the most important source of materials for the growing space infrastructure around the Earth, and Lunar Helium-3 will probably be a very important fuel for electricity and other applications on the Earth. Because of the low force of gravity on the Moon, it will be an excellent site for constructing large components for things like spaceships destined to travel to Mars. If production at this point is continuously vectored towards manned exploration of the Solar System, beginning with Mars, then we will have begun seeing the benefits of the necessary breakthroughs which will have been made in fusion research, here on Earth. New materials and manufacturing processes will have been made possible with the advances in fusion, and the number of people employed in and around the fusion business will have exploded, having economic benefits also due to the increased education of the labor force.

When fusion-powered space infrastructure is sufficiently built up around the Earth and Moon, we will be ready to begin preparing to send a flotilla of 3-5 ships to Mars. This presents the most important, immediate goal for fusion research. We know that the biomedical effects of long-term exposure to microgravity makes long-distance space travel quite risky. In order to send astronauts to Mars and return them safely to the surface of the Earth, they must not be stuck in a spacecraft for 200 days or so, moving on a ballistic trajectory, both there and back. Thus, the first missions to Mars must be astride spacecraft capable of accelerating and decelerating for the duration of the voyage from the Moon to Mars, ideally at one Earth gravity acceleration ($\sim 9.8 m/s^2$), in order to create a true artificial gravity environment for the astronauts on board.

Obviously, on chemically fired rockets, such a

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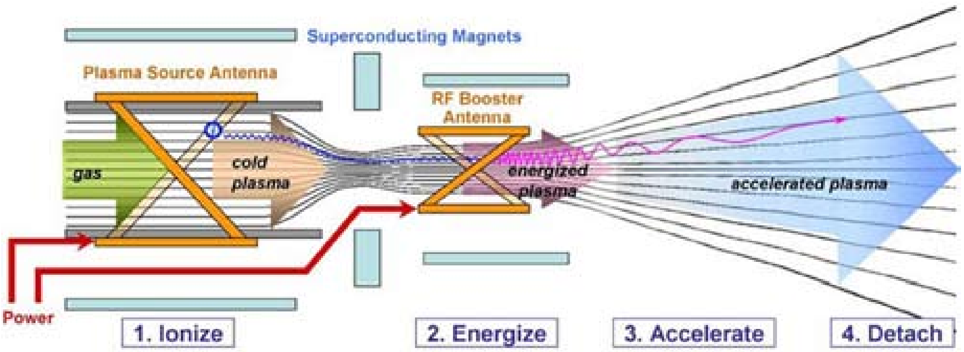

Ad Astra

Ad Astra's diagram of the VASIMR Rocket. The Plasma Source cell involves the main injection of a neutral gas like hydrogen to be turned into plasma and the ionization subsystem. The RF Booster cell uses electromagnetic waves to energize the plasma to the desired temperature. The Magnetic Nozzle then converts the plasma energy into directed motion and ultimately useful thrust.

voyage would require an absurd amount of fuel, and would actually be impossible. On the other hand, a wonderful solution would be to use the output of fusion reactions to propel the ship. In that case, the amount of fuel could be reduced dramatically, and the heat produced by fusion implies several magnitudes hotter exhaust, which translates into immense increases of thrust available to the ship. The technical hurdles for this application of fusion technology are daunting, but American scientists have successfully faced similar challenges in the past.

One such proposal for a fusion rocket, presented in the early 1990s by fusion scientists at the University of Wisconsin, called for a tandem mirror, linear magnetic confinement device, which would fuse deuterium atoms with helium-3 atoms (found in abundance on the Moon). Such an engine could produce powers upwards of 2,000 MW, and could be propelled either by directing the resulting 1,000,000 K plasma out the exhaust nozzle, or by heating a working fluid to be hurled out the nozzle. Many other proposals exist, such as an inertial confinement system; there is not a lack of ideas for the use of fusion for rocket propulsion.

We shall test our constantly accelerated fusion rockets with robotic treks to Mars, then with animal subjects, to determine if creating such an artificial gravitational field is enough to preserve life for such a journey. Traveling beyond the Earth's magnetic field, it may be necessary to provide special electromagnetic fields for life to survive. These artificial fields could easily be produced with advanced fusion power plants.

Finally, fusion rockets will take human scientists from Lunar orbit to the surface of Mars; fusion will power their habitats and tools, and fusion will provide the necessities of life, such as water and air. They will look back to times like today, and see that there were no way they would have gotten successfully to Mars without fusion, nor would they have had hopes of using Mars as merely a jumping off point to the manned exploration of the outer Solar System. At the same time, they will be looking back at us with much more developed minds, with the future discoveries of universal principle the fusion/Mars mission will have driven scientists to make.

Were fusion research linked thus to a truly interplanetary manned mission, the discussion would leave the domain of simple production of electricity for human use, and become elevated to a discussion about the real source of economic progress: the discovery and mastery of universal physical principles. In our day, discussions of science tend to devolve into dollars and cents, but real value in an economy is found in the application of human creativity to seemingly impossible problems. The profit derived from the Apollo program, or even from the nuclear fission rocket program which was ended in 1973, is only partially described in monetary terms. The offshoot technologies, such as applications in cryogenics, but also the training of highly skilled engineers who go and work in the private sector making improved, new products, are some other aspects of profit. The most important result of this type of program, though, is the optimism engendered in the youth, and also some older folks, that Man really was destined to explore the stars, and that what they develop themselves to be able to do, will contribute their creative powers, and, indeed, their immortality, to that mission.

Thus, we believe that the future of fusion research lies in the application of human creativity and curiosity to space exploration. Without a serious American investment in driving the breakthroughs in fusion today, Man will never get beyond landing a few explorers on the Moon, much less on the surface of Mars.