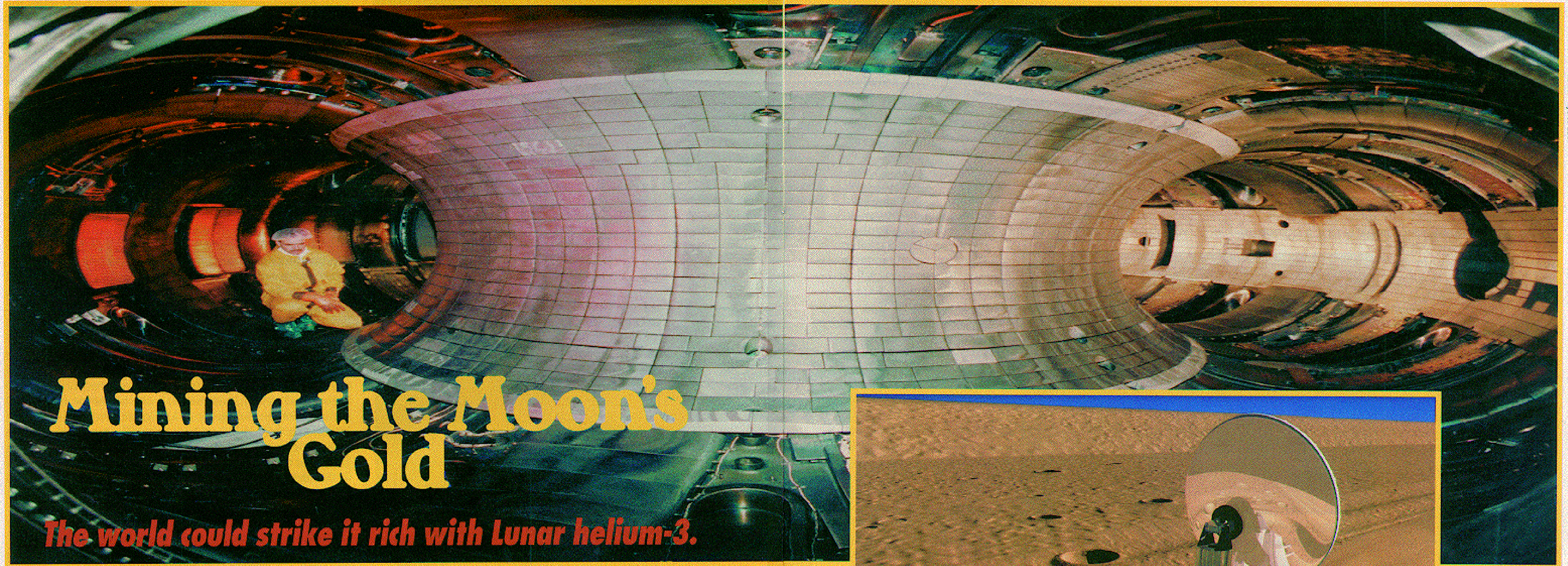


Photo: Princeton Plasma Physics Lab

Mining the Moon's Gold

The world could strike it rich with Lunar helium-3.

by Theresa Foley

"Magnificent desolation ..." so spoke Buzz Aldrin a quarter of a century ago as he gazed upon the Lunar landscape. They were apt words, though many space advocates would argue that the Moon is anything but desolate. They see the Moon as harboring immense riches for the Earth—that the Moon might, quite literally, be worth its weight in gold, and then some. While the Moon is not made of gold, it does hold something worth far more than its weight in gold—a very special kind of helium.

Helium, the second simplest of elements (two protons, two neutrons, two electrons—that's it), is ubiquitous here on Earth. Helium-3, an isotope of helium (two protons, *three* neutrons, two electrons) is nowhere near as plentiful on Earth as its plain kin helium, which is unfortunate, as helium-3 (^{3}He in chemical parlance) could prove to be *the* energy source for the future. Used as a fuel for fusion reactors, researchers have estimated that one metric tonne of ^{3}He could be worth nearly $1.5 billion—about $46,500 per troy ounce, more than 120 times the value of gold.

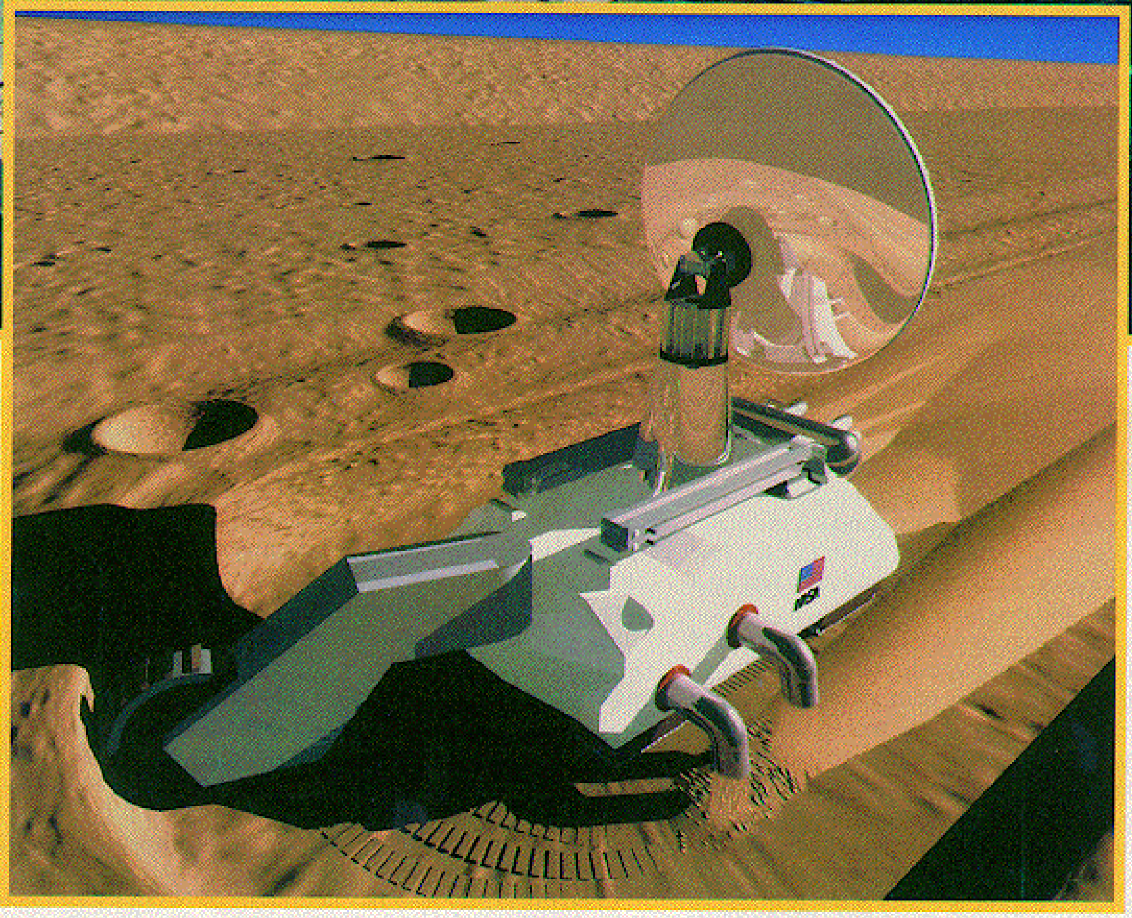
For several years, a small group of fusion energy advocates led by Apollo astronaut Harrison Schmitt and a group at the University of Wisconsin, have argued that ^{3}He can provide cheap, clean, nearly inexhaustible energy that could improve life on Earth and give space exploration a new urgency.

The technology to build and operate commercial fusion reactors, though, will not be ready for at least another 30 years. Even then, ^{3}He from the Moon would be used only in second or third generation reactors, since it is harder to work with than other fuels. And then there is the problem of getting to the source of ^{3}He—the Moon—in the absence of any program to establish a Lunar base.

Though it may seem that fusion has forever been "on the horizon" as an energy source, and ^{3}He perhaps somewhere over the rainbow, recent work has advanced the possibility of commercial fusion as an energy source in the 21st century.

Fusion powers the Sun and stars. Nuclear power reactors take the fission route to produce energy, splitting the nuclei of heavy elements into lighter nuclei and releasing energy in the process. Fusion reactors takes an opposite route, forcing the nuclei of light atoms together and, again, releasing energy in the process.

Replicating the power of the Sun on Earth, though, has been difficult. Fusion reactions here on Earth require



Graphic: Fusion Technology Institute, UW-Madison

The Tokamak Fusion Test Reactor (above) at Princeton's Plasma Physics Laboratory recently cranked six million watts of energy out of a fusion reaction, though for less than one-fifth of a second. Work at Princeton and the University of Wisconsin's Fusion Technology Institute could make helium-3 mining on the Moon (left) a reality in the 21st century.

extremely high temperatures—up to 10 times hotter than the center of our star. In practice, the physics of fusion pose engineering difficulties that are taking decades to solve. It has taken many more years to develop and demonstrate fusion than was predicted in the 1950s when civilian applications were first proposed.

Fusion energy researcher took a major step forward late last year. In December, the Tokamak Fusion Test Reactor in Princeton, New Jersey, produced a record six million watts of power and helped demonstrate that commercial fusion energy one day will be a reality.

U.S. energy officials hailed the shot at the Department of Energy's Princeton University Plasma Physics Laboratory as a remarkable step forward, one that took 20 years to achieve. Researchers at the lab produced controlled fusion power using a fuel mixture comprising