Pioneers 10 and 11; both spacecraft led to the first exploration of the outer planets, and one is the first manmade object to leave the Solar System.

In 1975, radioisotope systems were launched and went on to power the two Viking landers to help bring us the first pictures of the rocky and windswept surface of Mars. In 1977, the Voyager 1 and 2 spacecraft, powered by and heated with isotopes (plutonium-238), were launched and subsequently explored Jupiter, Saturn, Uranus, and Pluto on missions lasting a decade. The images of the planets are everlasting and have inspired scientists and students alike throughout the world.

The history of isotopic power in space was treated extensively previously.[6] What is the future of isotopic power in space? The Comet Rendezvous Asteroid Flyby (CRAF) mission in 1995 is to carry radioisotope power systems. This mission is to fly by asteroids, rendezvous with a comet, and deliver a penetrator into the comet's center. The Cassini mission, scheduled to be launched in 1996 and terminate in 2006, will orbit Saturn and its moon Titan and deliver a scientific probe into Titan's atmosphere.[7]

Later, isotopic power will have a major role in NASA's Space Exploration Initiative aimed at lunar bases, Mars Rover Sample Return (MRSR), and future missions to the outer planets. Can exploration of lunar surfaces, planetary surfaces, the other planets, and ultimately other galaxies be done without nuclear power? Very probably not; certainly not efficiently and reliably. Aside from two launch aborts where the isotopic power units were either recovered or safely disposed, all isotopic power sources have performed without failure for periods up to and exceeding 15 years.

Isotopic power has been used all over the world in terrestrial applications, including those in the Arctic, Antarctic, under the oceans, and in remote areas. These generators have varied in power level from a few tenths of Watts to 500 Watts and most have been fueled with strontium-90, a nuclear waste byproduct. The units are maintenance free and have provided continuous power for 25 years or more. Some of the first units made in the early 1960s have recently been retired. Paradoxically, it has historically been a problem for the manufacturers of terrestrial isotopic power systems to sell additional units because the service lives of the power conversion systems and half-lives of the heat sources are so long.

Nuclear Medicine

On October 1 of this year, Professor Henry N. Wagner, Jr., M. D., Director of the Divisions of Nuclear Medicine and Radiation Sciences at The Johns Hopkins University School of Medicine and an international authority on nuclear medicine, was interviewed by a coauthor of this paper. The purpose was to obtain his views on the most recent and promising advances in nuclear medicine. He cited a recent paper where, at the opening session of the Society of Nuclear Medicine's (SNM) 37th Annual Meeting, the Secretary of Health and Human Services reminded the attendees that President Bush has designated the 1990s as the "Decade of the Brain."[8]

The far reaching ramifications of the applications of nuclear medicine to the workings and treatment of the human brain are covered in a book entitled "Living with Radiation"[9] by Professor Wagner and Linda E. Ketchum. In the foreword written by Glenn T. Seaborg, the Nobel laureate, they are requoted, as follows: