

Dayton technology powered now-silent Ulysses

Tuesday, June 30, 2009

MIAMISBURG, Ohio – Another chapter in the Dayton region's history of space exploration ended today when the [European Space Agency](#) switched off its distant Ulysses spacecraft. Orbiting the sun in the cold reaches of space far beyond earth, Ulysses was freezing, but its plutonium-powered generator powered the spacecraft's radio until the end, more than 18 years after its launch.

A joint ESA/NASA mission, Ulysses is one of several deep-space projects made possible by a device two Dayton-area scientists invented at the old Mound nuclear weapons plant in the 1950s. It's known as a [radioisotope thermoelectric generator](#) – RTG for short.

An RTG converts the decay heat of a radioactive fuel directly into electrical energy. It has been the power source of choice for long space missions far from the sun, where batteries and fuel cells would soon be spent and sunlight is too weak for solar cells to be practical. An RTG powers NASA's [New Horizons](#) spacecraft, launched in 2006 and due at Pluto in 2015.

RTG power fades as its fuel decays, but the device has no moving parts to break. RTGs have powered space missions for years and sometimes decades. Voyagers 1 and 2 continue to beam back science data from the outer fringes of the solar system 32 years after their launches in 1977.

Perched on a hill overlooking Miamisburg, the Mound plant was a nuclear research and production facility operated by Monsanto Research Corp. and other contractors. Monsanto scientists Kenneth Jordan and John Birden invented the radioisotope generator in 1954, according to a [NASA history paper](#). RTGs for all deep space missions came together at Mound, where technicians would assemble them with plutonium-238 fuel pellets, test them and monitor their status until launch.

Ernest "Ernie" Johnson of Centerville retired as the RTG program's technical director at Mound in 1985, but he continued to work as a program consultant for 15 years.

Today, he said he recalled going to Kennedy Space Center for the Ulysses launch on Oct. 6, 1990, and watching the space shuttle Discovery blast off with the spacecraft stowed inside. "I was very deeply involved with the whole thing," he said of the RTG program.

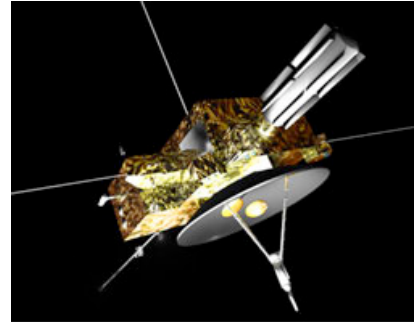
Ulysses was designed for a five-year science mission. ESA and NASA extended it several times. But while its RTG continued to provide electrical power, Ulysses was slowly freezing. A year ago, engineers thought the fuel lines for its control thrusters would soon ice up, crippling the spacecraft, according to ESA. Instead, they found they could keep the fuel lines open with short, frequent thruster firings.

But its transmission rate has slowed as Ulysses has moved farther from earth, while demand for the big ground stations that collect its data has gone up. This year, ESA decided to end it.

Johnson said Mound scientists, engineers and technicians found it highly rewarding to work on a piece of hardware that would be flung deep into space and help push back the frontiers of knowledge. But the spot where the RTG facility stood is bare now.

"It makes me sad every time I go up there," he said.

With the end of the Cold War, the Department of Energy decided to close the Mound plant as part of a nationwide consolidation. Most work ended in the 1990s, but the RTG program remained until 2002, when DOE shut down the RTG facility and relocated the mission to Idaho. The Mound site has been converted





Artist's impression of Ulysses with RTG at upper right. ESA (image by C. Carreau)

into the [Mound Advanced Technology Center](#). The RTG facility was removed.

The legacy of the Mound RTG program lives on – in deep space. Some parts that remained from the Mound program are Pluto-bound on the New Horizons spacecraft. The RTG-powered Cassini spacecraft orbiting Saturn still beams back discoveries. And RTGs allow the Voyager spacecraft to call back faintly from the edge of the solar system.

The RTG facility site is unmarked, but a group of Mound retirees formed the [Mound Museum Association](#) on the site to preserve the Mound's history.

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