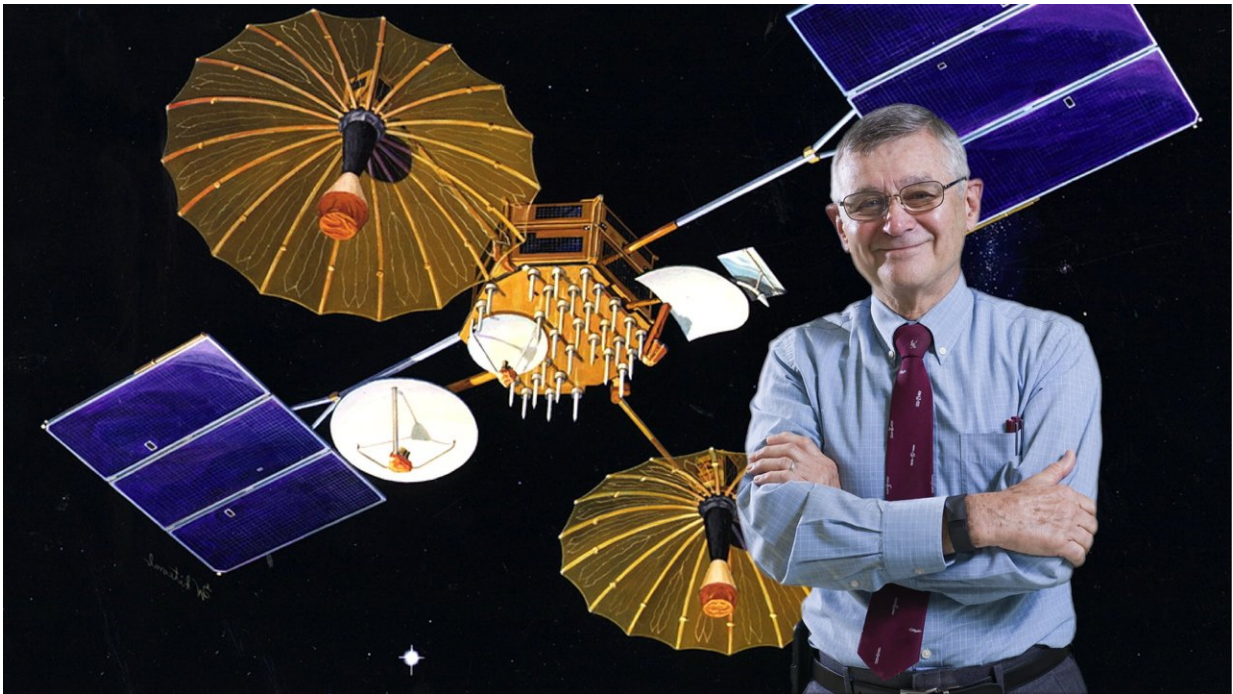


How spacecraft testing enabled bone marrow research

February 22 2018, by Danny Baird



Credit: NASA's Goddard Space Flight Center

In the 1970s, a NASA employee stepped up to a challenge posed by the National Institutes of Health or NIH: to freeze bone marrow.

"Most people don't know that NASA's work isn't just aerospace," said Tom Williams , an engineer working on NASA's space-based communications relay, the Space Network, who responded to the

challenge. "Our innovations help people who have nothing to do with the space program."

Bone marrow presented a unique challenge to medical researchers. To maintain a sample viable for transplant, the cells must be chilled to temperatures unattainable by traditional refrigeration units, colder than the lowest natural ground temperature ever recorded on Earth. Cooling marrow too quickly causes freezing water within the cell to expand and burst the cell wall. Cooling marrow too slowly can result in cell death.

Williams tested communications spacecraft components in artificial space environments at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and thought that process could be adapted to freezing marrow. Goddard's thermal vacuum chamber uses liquid nitrogen and helium to mimic the chill of space.

While continueing his work with NASA, Williams spent the next few years developing a [liquid nitrogen](#) freezer that chilled marrow without destroying the sample. He used a compound that modified the way water froze within the cell and identified a cooling rate and process that avoided [cell death](#). NASA and Williams patented the technology in 1978, making it available for licensing to the medical community.

"My last contact with the project was in 1981," said Williams. "A doctor at the Johns Hopkins Hospital called me and asked if I would let them use the device, so I set it up there for them to use. The last time I contacted them, they were preparing it for their first patient."

The development of these freezing techniques enabled donor marrow transport, facilitating transplants at a distance. Additionally, patients undergoing radiation treatments that damage marrow may now store samples for future transplantation. Using this method could, in the future, facilitate transplants through banks of frozen marrow.

A communications engineer developing breakthrough medical techniques may seem strange, but it's a familiar story at NASA. In 1958, Congress mandated the promotion of aerospace technology to the private sector. NASA's Technology Transfer Program makes agency patents and software available to the private sector, encouraging the development of commercial products and technologies.

"Innovation at NASA not only helps fuel economic growth; it advances the creation of new industries, companies, jobs, and the global competitiveness of U.S. products and services," said Nona Cheeks, chief of Goddard's Strategic Partnerships Office. "By leveraging the knowledge and experience of our scientists and engineers, NASA innovations help advance the medical field, which benefits us all."

Since its inception, NASA innovations have led to a diverse array of products, including cell phone cameras, enriched baby formula and memory foam. In the medical field, partnerships and licensing agreements benefit Americans by bringing transformative technology into the operating room, the hospital and the doctor's office.

Today, Williams is partially retired. He visits Goddard a few times a week, lending his expertise to the space-based communications relay he helped develop. He analyzes data, identifying and correcting problems in the constellation of satellites that make up the Space Network.

"People think NASA just launches rockets, but we're doing core research," said Williams. "Many medical products use technologies derived from those developed right here at Goddard. If you look through NASA's Spinoff magazine, you'll find some pretty neat stuff."

Provided by NASA's Goddard Space Flight Center

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