

TIROS I back in action at InfoAge after 40 years

Princeton scientists fire up dish, make more history

By Lianna Bass

WALL TOWNSHIP – Wall’s famous satellite dish, TIROS I, is ready to make history.

Again.

On Jan. 19, over three years of scientific and engineering efforts culminated with great success as members of InfoAge Learning Center joined a team of highly trained specialists from Princeton University to make TIROS I signal to the stars for the first time in over 40 years.

The team pointed TIROS I, located on Marconi Road, toward the horizon at an elevation of 45 degrees. What they received was a signal from the center of the Milky Way galaxy.

According to Stephen Fowler, creative director and assistant coordinator of the TIROS Visitor Center, the test’s success was

all the more special and significant because the project was many years in the making, and involved many moving parts.

IT ALL STARTED IN WALL

TIROS, or Television Infrared Observation Satellite, are a series of early weather satellites pioneered by the United States, beginning with TIROS 1 in Wall Township.

Originally constructed in 1958, TIROS I was used to track America’s first space launch, Explorer 1, according to InfoAge Director Fred Carl. The Explorer 1 mission followed the first two satellites the previous year: the Soviet Union’s Sputnik 1 and 2. This era marked the onset of the Cold War Space Race between the two nations.

“Three experimental weather satellites were built to determine if clouds could be observed reliably with a satellite,” Mr. Carl said. “After launch and upon command, the first satellite data download was received by the dish.”

It was here, right in Wall Township, that the science of observation of the earth by satellites was born. The first series of weather photos was printed successfully on site. These photographs were flown by jet to the White House and were presented to President Dwight Eisenhower that very same day.

On April 9, 1960, a hurricane was observed forming by TIROS I. The science of hurricane tracking was born that day. Since then, hurricane observation technology has saved the lives of countless people around the globe.

According to Mr. Carl, the dish was retired in the 1970s. InfoAge has preserved the dish since 2001.

Photos

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TIROS I, located on Marconi Road, Wall, was the first weather satellite of its kind in the U.S. Over the last three years, InfoAge has worked with a team from Princeton University to put the highly intricate piece of historical technology to use after four decades of dormancy. *Photo by RYAN MAYER, STAR NEWS GROUP*

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"In 2006, thanks to a generous donation by Harris Corp., the dish was completely repainted and preserved as an amazing artifact of the birthplace of earth observation by satellites," Mr. Carl said.

Last month, the dish was put back into service by collecting radio waves originating thousands of light years from earth far into the Milky Way.

This was made possible because over the past three years, a team of scientists, engineers, technicians and volunteers from InfoAge, Ocean-Monmouth Amateur Radio Club, Inc. [OMARC] and Princeton University has refurbished the mechanical systems of the dish and added a feed horn antenna at its focal point.

Mr. Fowler has expressed his gratitude to Princeton University for its support.

PRINCETON UNIVERSITY

MAKES SCIENTIFIC STRIDES

Princeton University has not only provided funding to the project, but has provided the assistance of an extremely strong scientific and technical team.

Dan Marlow, who is the Evans Crawford 1911 Professor of Physics at Princeton University, first became involved with the TIROS I project roughly three years ago after his colleague, Norman Jarosik, a research scientist at Princeton, told him it would be an excellent opportunity to get involved with.

"He has done much of the work to make this happen," Mr. Marlow said, referring to Mr. Jarosik.

Mr. Marlow holds a doctorate degree in physics from Carnegie Mellon in Pittsburgh and has been teaching at Princeton University since 1984. Mr. Marlow said it is his and Princeton University's goal to offer as many opportunities for student growth and enrichment as possible.

"The original motivation, which is still the most important motivation for us, was to have a tool that our undergraduates can use as part of their training," he said.

He hopes TIROS I will be utilized in one class in particular, an advanced science lab which is a requirement for all junior physics majors at the Ivy League institution.

"We want to give them access to a good radio telescope for them to make some observations," he said.

He said the Princeton University physics community is thrilled to be involved with this project.

"We are very excited about both the educational possibilities for Princeton students, and also for the general public and other schools," he said.

OVERCOMING OBSTACLES

Because TIROS I was dormant for approximately four decades, project engineers feared it would be in terrible working condition.

"It's not like a small telescope that you just steady with your hand," Mr. Marlow said. "There is a major mechanical system involved."

Though TIROS I did require restoration efforts, they were not nearly as intensive as originally feared. Minimal work had to be done to help the machine articulate azimuth directions, which are angular measurements in a spherical coordinate system.

However, the system struggled to adjust its altitude or elevation.

"The mechanism to adjust the elevation was badly corroded over the years," Mr. Marlow said.

The mechanical work involved constructing a special jib crane, which was used to lower the one-ton elevation motor and drive train from the top of the pedestal to the ground, where it was extensively reworked. The same crane was used to raise the elevation package back into place. Removing and repairing the elevation drive was a major task, Mr. Marlow said. The ball screw, a vital mechanical component, had to be recrowned, he added.

If you can't point the telescope, you're very limited as to what you can do with it," he said.

The team also replaced the original motor drives with modern regenerative drives that can be computer controlled. The new feed system uses components left over from a Princeton University cosmic microwave background experiment. It was found to work extremely well during early operation at a wavelength of 21 cm.

Once everything was refurbished, it had to be reassembled. After that, everything started to work wonderfully, Mr. Marlow said.

"Now, everything is moveable with a computer," he said.

Mr. Fowler said he was "amazed" at what was accomplished in getting everything up and running again.

Mr. Marlow believes one of his biggest contributions to the project is to recruit experts to join the project moving forward.

"It's amazing that a small group of preservation volunteers have enabled Princeton University to rehabilitate this historic dish into a new tool for science education," Mr. Carl said.

LET THE SCIENCE BEGIN

Mr. Fowler said he is thrilled that a piece of history is once again making strides in Wall Township.

Mr. Fowler said the "amazing data" of the Milky Way galaxy collected on Jan. 19 by the Princeton University team proved the 57-year-old dish is functioning beautifully.

According to Mr. Marlow, the data collected by the TIROS dish is in a very "raw" form.

However, he said, "there is a clear peak riding on top of the noise background at 0.4 MHz [actually 1420.4 MHz], which is the well-known 21 cm radiation from the Milky Way," he said. Meaning, signals from TIROS I reached into the depths of the Milky Way, the galaxy which contains the Earth's solar system.

The team is now in the process of implementing a readout for the elevation system.

"Once that is done, we will be able to measure the galactic rotation curve and observe pulsars and other objects of interest to radio astronomers," Mr. Marlow said.

On the educational front, one early group of users will be undergraduates at Princeton University, who will use the dish as part of a laboratory course. The longer term plans include providing public access to educational institutions including K-12 schools, colleges, and universities. They also hope to extend offers to interested amateur radio astronomers.

"We are working with educational partners to develop programs aimed at secondary and higher education," Mr. Fowler said. "Additionally, outside organizations and institutions will have the opportunity to schedule time in advance, and we hope to have weekly slots of time available to the general public to operate the dish under the guidance of staff."

AMAZING ADVANCEMENTS FOR WALL TOWNSHIP STUDENTS

Wall Township Public Schools Director of Technology Jeff Janover has expressed great interest in getting Wall students involved with this exciting project.

He hopes it will work in tandem with an observatory project the school district has already been working on for almost one year. An observatory on the grounds of Allenwood Elementary School is currently in the works.

Once completed, the telescope system and observatory dome will be controlled remotely via website, and students and family members will be able to request time on the system through an online form. They will be able to take control of the dome and telescope equipment to point at their desired target, take pictures and videos, then download their images to their local computer, all from their home or at school.

"Students will have the ability to do astronomy in the visual spectrum and then look at the same view in the radio spectrum," Mr. Janover, an avid astronomer himself, said. "That is something a lot of people don't have the chance to do."

He believes the central idea of connecting TIROS I to feasible in-class curricula is to help expand the district's science, technology, engineering, art and math [STEAM] programs.

“I am just so excited about it,” Mr. Janover said.

He hopes that in getting a firsthand experience in radio technology and telescopic technology, students will be able to better understand it on a deeper level.

“It is one thing to produce results that are very difficult for everyone to understand, but it is something else entirely to be able to produce those results and convert them in a form or presentation that any person would be able to understand easily,” he said.

He also hopes that students who are artistically inclined can develop charts and other visual graphs based on data collected from both the observatory and TIROS I.

VISITOR CENTER

As a result of TIROS I’s tests and overall success, Mr. Fowler said InfoAge is now planning to open the doors of the original TIROS I control room building, which is adjacent to the dish, to the public for the first time on April 1. This will work in conjunction with the 55th anniversary of its successful mapping of Explorer 1.

This will be the first of several phases of completion to the new TIROS I visitor center.

“Through this exhibition we hope to gain public awareness and funding for the final phase of the visitor center, which includes a fully renovated space, NASA-style control room and exhibition dedicated to the history and future of Earth-observing satellites,” Mr. Fowler said.

The planned visitor center will represent an excellent education resource, he said.

“Although much remains to be done, this accomplishment represents an important milestone in the TIROS restoration project,” Mr. Fowler said. “The dish will play an important role in the educational programs of Princeton University, affording its students access to a highly capable scientific instrument.”

FINDING FUNDS, MOVING FORWARD

Funding for repairs and maintenance has been donated by InfoAge, Princeton University and OMARC.

“However, InfoAge is seeking funding from local, state and federal grants, as well as private and corporate donations for future repairs and maintenance,” Mr. Marlow said.

Mr. Marlow said that global partnerships are certainly possible in the future, although to date the team has been focused on getting the dish up and running.

“Now that the dish is operational, we are in a better position to entertain collaborative proposals,” he said.

MORE ABOUT CAMP

EVANS & INFOAGE

Camp Evans is a decommissioned military base in Wall, which is listed on the National Register of Historic Places.

InfoAge maintains a science museum that is a continuation of Camp Evans and a home to new and different organizations.

InfoAge has an educational mission and its members are consistently working to preserve Camp Evans for future generations.

For more information, visit www.infoage.org.

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