ARECIBO: FACTS AND FIGURES

Completed in 1963 and stewarded by the U.S. National Science Foundation since the 1970s, Arecibo Observatory has contributed to many important scientific discoveries, including the first discovery of a binary pulsar, the first discovery of an extrasolar planet, the composition of the ionosphere, and the characterization of the properties and orbits of a number of potentially hazardous asteroids.

Location: Arecibo Observatory's principal observing facilities are located 19 kilometers south of the city of Arecibo, Puerto Rico.

Operation and management: Arecibo Observatory is operated and managed for NSF by the Arecibo Observatory Management Team, which is led by the University of Central Florida in partnership with the Universidad Ana G. Méndez and Yang Enterprises Inc.

NSF has invested over $200 million in Arecibo operations, management and maintenance over the past two decades. The observatory has undergone two major upgrades in its lifetime (during the 1970s and 1990s), which NSF funded (along with partial NASA support), totaling $25 million. Since Fiscal Year 2018, NSF has contributed around $7.5 million-per-year to Arecibo operations and management.

Technical specifications and observational capabilities*:* Arecibo Observatory's principal astronomical research instrument is a 1,000 foot (305 meter) fixed spherical radio/radar telescope. Its frequency capabilities range from 50 megahertz to 11 gigahertz. Transmitters include an S-band (2,380 megahertz) radar system for planetary studies and a 430 megahertz radar system for atmospheric science studies and a heating facility for ionospheric research.

THE HISTORY

Funding for initial radar design studies came from military sources, including the Office of Naval Research and the U.S. Air Force. The Advanced Research Projects Agency, or ARPA, agreed to finance the engineering and construction of the dish, signing a contract with Cornell University, which the Air Force monitored.

Arecibo Observatory was originally intended for ionospheric research and radio astronomy, but the former was of more interest to ARPA, which wanted to study and monitor the Earth's ionosphere as part of its Defender Program to develop ballistic missile defenses.

The Arecibo Ionospheric Observatory, as it was originally named, was the world's largest radio telescope at the time of its dedication in 1963.

By the late 1960s, however, Arecibo's fate was uncertain due to ARPA's shrinking research budget.

In 1967, NSF agreed to replace the Air Force as the government agency monitoring the Arecibo contract, beginning the transformation of Arecibo into a civilian facility.

In 1971, Arecibo received a new name: the National Astronomy and Ionospheric Center. That same year, NSF and NASA signed a memo of understanding to share the costs of major upgrades to Arecibo. NSF funded the resurfacing of the dish reflector and NASA funded the addition of S-band radar equipment.

In 1997, a second major upgrade, which included the Gregorian dome and a second line feed for the ionospheric radar, was completed.

As a result of the upgrades, Arecibo became a powerful tool for scientific research focused on ionospheric physics, radar and radio astronomy, and aeronomy.

EXAMPLES OF DISCOVERIES MADE BY ARECIBO

1967
Arecibo discovered that the rotation rate of Mercury is 59 days, not the previously estimated 88 days.

1972
Arecibo was used to simultaneously heat and observe the D- and E- regions of the ionosphere.

1974
Arecibo discovered the first ever binary pulsar. The 1993 Nobel Prize in physics was awarded to Russell A. Hulse and Joseph H. Taylor for this discovery.

1975
Arecibo made S-band radar observations of Mars to support NASA's Viking mission.

1981
Arecibo produced the first radar maps of the surface of Venus.

1992
Arecibo discovered the first ever exoplanet: In subsequent observations, an entire planetary system was found around the pulsar PSR 1257+12.

1994
Arecibo mapped the distribution of polar ice on Mercury.

1996
Detection of ionized helium layer in the ionosphere made by Arecibo.

2006
Arecibo used to make observations of ionospheric perturbations driven by a tropical storm.

2008
Astronomers use Arecibo to detect for the first time, methanimine and hydrogen cyanide molecules -- two organic molecules that are key ingredients in forming amino acids -- in a galaxy 250 million light-years away.

2016
Arecibo discovered the first-ever repeating fast radio burst. Repeating fast radio bursts are millisecond-duration radio pulses that appear to be extragalactic. The repeater demonstrates that its source survives the bursts and rules out a class of models requiring catastrophic explosions.

2017
Arecibo discovered two pulsars that seem to vanish and reappear intermittently, upending the widely held view that all pulsars are the orderly ticking clocks of the universe.

Image credit: University of Central Florida