Status and Future of Arecibo Observatory



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Status and Future of Arecibo Observatory





Heat Exchanger Replacement (Jul-Aug 2017)





3122 Florence



- Heat-exchanger replacement completed in time for Florence ullet
- Third near-Earth triple asteroid system
- Primary > 4 km; satellites < 300 m
- Primary rotation ~ 2.35 h; Orbital periods < 8 h, < 24 h

Arecibo Observatory/NASA/NSF

3122 Florence





Max. Wind Gust ~ 110 mph

Barometric pressure (adjusted)



hour of day [AST]

~20 inches of rain ~5 h



Before Maria



After Maria

Bad: Line feed snapped off and fell through the reflector **Good?:** Look how clean the Gregorian dome is now!

Damage from Hurricane Maria



12-m Antenna "cosmetic" damage



Floor of Catwalk



Scenic Lake Arecibo underneath the reflector ~ 10' deep









Holes punched by pieces of falling line feed



New panels replaced damaged panels







3200 Phaethon Full Rotation 75 m x 0.95 Hz

16/17/18 Dec 2017 Arecibo/NASA/NSF



3200 Phaethon: ~6 km diameter Bennu/Ryugu-like shape

3 km

1.2 km

600+ m

Flat spot?

Crater?





Arecibo Observatory/NASA/NSF

1981 Midas

2018 Mar 24 UT

Recent result: 1981 Midas: ~1.5 km diameter lobes, P ~ 5.2 hours

- Management: NSF awarded cooperative agreement on April 1, 2018 to:
 - University of Central Florida prime contractor
 - Science (planetary radar, radio astronomy, atmospheric science)
 - · Yang Enterprises, Inc.
 - Technical services (electronics, maintenance, etc.)
 - Universidad Metropolitana
 - Public engagement (Science and Visitor Center)

Funding profile prior to transition: ~\$8M from NSF, ~\$4M from NASA

- Staffing:
 - In the last year, half of the planetary radar (scientific) staff has moved to the Lunar and Planetary Institute (USRA), including Group Lead Patrick Taylor and Staff Scientist Edgard Rivera-Valentín
 - Current staff: Anne Virkki (acting group lead), Flaviane Venditti and Sean Marshall (postdocs), and Luisa Zambrano-Marin (data analyst)

- Klystrons: only one functional tube since December 2016
 - Two klystrons on order, expected by end of FY18, procured through USRA

- Generators:
 - Four 500 kW units three have failed in the last year likely due to age/ continuous use after Hurricane Maria
 - Currently relying on generators borrowed from FEMA for radar and emergency site back-up power
- State of the Reflector:
 - Gain reduced by ~30% across dish after Hurricane Maria
 - Gain worse for declinations north of +18.5 deg

- Funding:
 - NSF funding at \$7.7M in FY18
 - NASA funding at ~\$4M through bridge funding to UCF through CY18
 - Proposal submitted this month by UCF and others (including USRA) to NASA SSO/NEOO program for 2019 through 2023
 - USRA retains leftover NASA funding from prior to transition
 - Allows for klystron procurement and research activities at LPI
 - Congress allocated \$14.7M for hurricane recovery efforts at the AO site

Challenges Ahead for Arecibo

- Short Term:
 - Staffing: Job ads for UCF scientists and postdocs open or imminent
 - Klystrons: two tubes on order, likely have to procure more by 2022
 - Generators: repairs prioritized using congressional funds
 - State of the reflector: dish re-alignment studies underway; may be a years-long project using congressional funds
- Long Term:
 - Funding: NSF funding reduces from \$7.7M in FY18 to \$2.0M in FY23;
 NASA becomes the anchor tenant by FY20; NASA will not fix the shortfall

Summary

- The main concern is the long-term funding of Arecibo Observatory
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• This will depend on the future actions of NSF, UCF, NASA, and Congress All other issues can be resolved prior to the DART encounter with Didymos