UPDATE ON ARECIBO OBSERVATORY

# Emergency Cleanup

Photo Credit: University of Central Florida

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*UPDATED DEC 2021*

The National Science Foundation (NSF), University of Central Florida (UCF), Arecibo Observatory, and a team of contractors are performing emergency cleanup activities after the collapse of the Observatory's 305-meter radio telescope on December 1, 2020.

National Science Foundation

## Stay Connected

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The emergency cleanup aims to protect life and property and enable safe operations at the facility. The information provided here is intended to keep the community updated regarding the protection of environmental and historic resources as the removal or repair of the affected structural elements continues. The majority of the emergency cleanup efforts have been completed. The team continues to stabilize the remaining structures for continued safe operations and revegetate areas affected by the collapse. For additional updates on NSF's response to the collapse of the Arecibo Observatory's 305-meter telescope, please view the media page at https://www.nsf.gov/news/special_reports/arecibo.

## Environmental Status

### ENSURING SAFETY CONTINUES TO BE NSF's TOP PRIORITY

This includes not only the safety of personnel on the site, but also the protection of the environment. NSF, UCF, Arecibo Observatory, and the team of contractors have been communicating with regulatory agencies and identifying and addressing environmental compliance requirements, including those related to pollution prevention, biological resources, and historic sites. Since June 2021, the team, which includes field specialists and subject matter experts, has taken the following actions to address the effects on environmental and natural resources:

- Began revegetation efforts to stabilize the areas where natural vegetation had been disturbed by the collapsed structures or retrieval operations. UCF and Arecibo Observatory personnel will continue to monitor and encourage revegetation of the site until a majority of the exposed soil is covered with natural vegetation, which is anticipated to take several months to a year to occur.
- Continued stormwater pollution prevention measures throughout the work area to prevent erosion while the natural vegetation recovers.



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- Completed groundwater sampling and analysis to monitor water quality. No impacts to groundwater quality were found.
- Completed soil sampling, testing, and removal efforts at the reflector area. Sampling and testing was performed to determine if hydraulic oil was spilled during the collapse. Two areas were identified where the soil had been impacted. The affected soil was removed and disposed of. After the soil was removed, sampling was repeated in these areas to verify that no concentrations of oil above the residential standard remained. The results confirmed that the removal was complete.
- Monitored for sensitive species such as the Puerto Rican broad-winged hawk and implemented the Puerto Rican boa protection protocol during cleanup operations.
- Safely recovered two large concrete pieces from Tower 4 that had fallen down a slope as a result of the collapse, thereby preventing potential slippage down the hillside and implemented stormwater pollution prevention measures during this work, per the National Pollutant Discharge Elimination System Construction General Permit.
- Continued communication with the U.S. Environmental Protection Agency, the Puerto Rico Department of Natural and Environmental Resources, and the U.S. Fish and Wildlife Service (USFWS).

### TOWER 4 FALLEN PIECES RETRIEVAL

As part of the effort to retrieve two fallen pieces of Tower 4, NSF conducted informal consultation with USFWS to inform the planning for these emergency actions during May-June 2021. As a result, the team implemented measures to prevent loose soil from the construction of a temporary road from entering a nearby stream; conducted a tree and plant inventory to identify potential protected species; took measures to protect an identified rare fern; and followed protocols to protect the Puerto Rican boa. The retrieval effort is now complete and the site is being revegetated to its natural condition.

One of two fallen pieces of Tower 4 down the hill side

Tower 4 temporary access road

Erosion control measures after Tower 4 pieces recovered

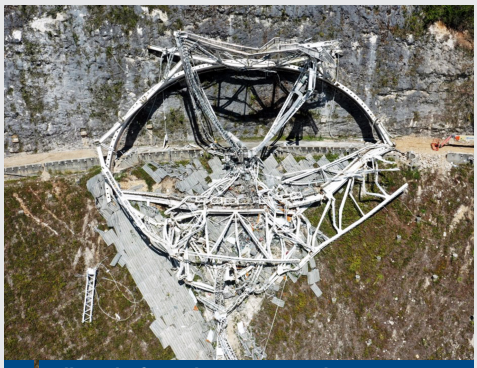
## Historic Preservation Overview

NSF and UCF have continued to address concerns about historic preservation and cultural resources. The team met virtually with the Advisory Council on Historic Preservation (ACHP), the Puerto Rico State Historic Preservation Office (SHPO), and other interested parties on June 3, 2021 to provide updates on the emergency cleanup activities. The team has continued in-kind repairs to restore and preserve the damaged resources in a manner consistent with the 2017 Programmatic Agreement and 2020 Preservation Principles and Management Plan. Both the SHPO and ACHP have agreed with the approach that NSF and UCF have implemented. Another meeting with the SHPO/ACHP is planned for Fall of 2021 to provide updates.

For information about the historic significance of the Arecibo Observatory, refer to the *National Register of Historic Places Nomination* (https://www.nsf.gov/mps/ast/env_impact_reviews/arecibo/section106/PR_Arecibo_County_NAIC_Historic_District_form.pdf) for the historic district, which was updated by NSF in 2020.

# What Were the Results of the Emergency Cleanup and Repairs?

The emergency cleanup team has completed the majority of the emergency cleanup and repairs, as highlighted below. Next steps include completing repairs to areas with damaged concrete, removal of work vehicles and equipment from the site, and storage of salvaged items.



1 Fallen platform during removal

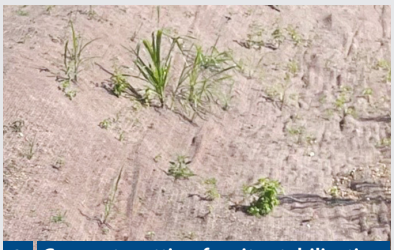
2 Rim wall repairs and erosion control measures

## REFLECTOR AREA

The team safely removed approximately 14,000 damaged panels out of 39,000 total panels, or approximately 35% of the reflector area.

Once the fallen platform was removed (Figure 1), the team began repairing approximately 225 feet of concrete rim wall and installing erosion control measures, including the use of coconut fiber matting and seeding, to stabilize the slope under the reflector area and encourage native vegetation growth (Figure 2).

*The coconut matting provides a better substrate than bare soil because it encourages seed growth, anchors natural vegetation as it grows through the matting, and accelerates site stabilization (Figure 3).*



3 Coconut matting for site stabilization

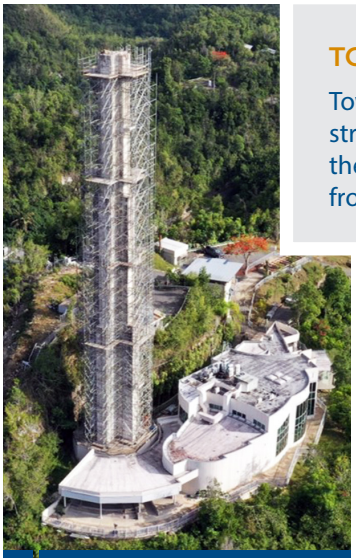
## BUILDING REPAIRS

Because of the significant damage to the Learning Center roof caused by fallen cables (Figure 4), the team has installed a hurricane-proof temporary roof to stabilize and protect the structure until permanent repairs can be made (Figure 5). At the Science and Visitor Center (Figure 6), the repair of minor damage to the building's roof structure and observation deck roof has been completed.

4 Learning Center damage from collapse

5 Learning Center temporary roof

6 Science and Visitor Center area



7 Tower 12 scaffolding

### TOWERS 4, 8, AND 12 CLEANUP, REPAIR, AND STABILIZATION

Towers 4, 8, and 12 are undergoing cleanup, repairs, and stabilization to preserve structural integrity and ensure safety. Temporary scaffolding was installed around the towers to provide a safe working platform to remove cracked and loose concrete from the towers and to perform structural testing (Figure 7).

### CABLE CAR HOUSE

The Cable Car House sustained damage to an area that was not part of the contributing structure and was successfully retained with minor repairs and stabilization (Figure 8). Erosion control measures have been installed and seeding has been completed to promote natural vegetation growth surrounding the building.

8 Cable Car House

## The Salvage Survey Committee

The Salvage Survey Committee is composed of professionals and community members knowledgeable about Arecibo Observatory, including Arecibo Observatory scientists, the NSF historian, Smithsonian Institution personnel, and Arecibo Observatory long-time users. Working at NSF's direction since early 2021, the Committee reviewed and evaluated the debris to identify objects of potential scientific, cultural, or historic value to be preserved for potential display at the site or in other museums. The Committee conducted site visits and surveys and held weekly meetings to discuss findings and form recommendations. The Committee provided a report to Arecibo Observatory management on September 1, 2021. The report includes a database of salvaged material; an evaluation of the potential historic importance or scientific utility of the salvaged material; and recommendations for preserving the salvaged materials and making sure the materials will be accessible. NSF recognizes the significant effort contributed by the Committee members to produce this comprehensive report, and will take this information into consideration during future decision making.

## Public Outreach

*NSF is committed to connecting with multiple stakeholders and providing information to interested communities, including the local and scientific communities, regarding the cleanup and next steps at the Arecibo Observatory.*

**Contact information:**

Arecibo-feedback@nsf.gov

**The latest public outreach activities include:**

### UPDATES PROVIDED TO THE AGENCIES

- **Congressional site visit** – Members of the U.S. Congress, including the Puerto Rico Resident Commissioner, visited the Arecibo Observatory on July 31, 2021 to observe firsthand the progress on making the site safe.

### PUBLIC ENGAGEMENT

- **Public workshop**s – NSF held an Arecibo Observatory Options Workshop in the summer to assemble a diverse, multidisciplinary group of researchers, engineers, and educators with the common goal of developing and expanding the breadth of radio science in Puerto Rico, as well as facilitating the generation of innovative ideas for the future of Arecibo Observatory.

*Source:* https://www.nsf.gov/mps/ast/env_impact_reviews/arecibo/eis/305-meter_collapse.jsp.