

August 12, 2021

Presentation by Francisco Cordova, Director of the National Astronomy and Ionosphere Observatory Center (NAIC) to the Arecibo Scientific Advocacy Partnership

### A Hopeful Assessment

Since the Arecibo Observatory in La Esperanza, Puerto Rico collapsed in 2020 an intensive cleanup has been underway on-site. The facility's demolition and removal are nearly complete with oil collected, other hazardous materials being removed, and mating seasons and habitat protection for nearby boas, hawks, and other animals are rounding out the environmental remediation work. Exposed soil has been wrapped with coconut netting to encourage plant growth. On the large telescope's primary reflector roughly 35%-38% of panels have been successfully removed. A request for funding to begin replacing the Learning Center has been sent to the National Science Foundation. Organizationally a Salvage Committee was established to find and store items of historical significance from the debris site and their work is included in a proposal for a new storage facility.

The investigation of the failure itself shows it started with the first auxiliary cable. This finding was by a company called WJE in conjunction with NASA's Kennedy Space Center. NASA adds that there may have been creep failure due to a potential overload of the structure. Thornton Tomasetti is doing the complete failure analysis and preliminary findings will be released in September with a final report emerging in December or January. Theirs will include complex modeling of wing, operational stress, and earthquake loading.

All is not lost however, as several scientific instruments are still intact and operational. The Lidar and Culebra instruments are functioning normally. For the HF Facility, some work is need it to have it operationally. The HF transmitters were not affected by the collapse of the platform since they were located outside of the main dish area. Three out of six of the HF antennas were saved and may be utilized in a future instrument. However, NSF authorization and additional funding will be needed to repair and hang the HF Mesh, as well as complete the main dish. From 2017's Hurricane Maria the Hurricane Repair Award has a request process ongoing. Without the 305-meter telescope getting its expected allotment due to the collapse the available funding is being shifted to a request for a 12-meter antenna refurbishment, new storage building, security cameras, Lidar roof and equipment repairs, optical building repairs, and other items. It is expected the funding from this will be \$6.5 million.

## Science – Short & Medium Term

Short Term Science Focus (2021)

Astronomy	SAS	PRS
<ul style="list-style-type: none"> <li>• 12m antenna</li> <li>• VLBI/EVN</li> <li>• Data processing</li> <li>• ML/AI – Historic datasets</li> </ul>	<ul style="list-style-type: none"> <li>• Lidar and optics facility</li> <li>• Culebra Facility</li> <li>• Meteor Radar</li> <li>• CARLA Lidar</li> </ul>	<ul style="list-style-type: none"> <li>• Re-scoping current grant</li> <li>• Focus on Data archiving &amp; analysis</li> <li>• 8 publications</li> </ul>

Medium Term Science Focus (1-3 years)

Astronomy	SAS	PRS
<ul style="list-style-type: none"> <li>• 12m antenna</li> <li>• Cryo receiver</li> <li>• RFI Mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• HF Heating</li> <li>• Revamped Lidar Systems</li> </ul>	<ul style="list-style-type: none"> <li>• Shape Modeling</li> <li>• Include ML/AI efforts</li> </ul>

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The short and medium-term focus of Arecibo's work will focus on the smaller instruments that are operational or can be built in 1-3 years. Due to NASA removing funding when Arecibo's radio telescope was no longer fulfilling its grant there has been a shuffle of supplemental funding requests with routine funding expected at \$7 million while construction and expansion will be filled with later Congressional action or NSF funding. Francisco made clear their goals now include advocacy and awareness for the importance of Arecibo's contribution to science. One of the key goals for the upcoming Next Generation Arecibo Telescope is to revolutionize the capability provided by the instrument compared to anything else available.

With that high note ending the presentation the audience were allowed to ask questions. The first question inquired about whether Arecibo was able to collaborate with China's FAST 1,000-meter telescope and whether its capabilities are considered when designing the NGAT. Francisco made clear that Federal and Florida law prevents cooperation with China's FAST and that its capabilities are to be exceeded by NGAT. The next questioner sought to know if 1+ gigabit internet was available for the facility. Local providers have made proposals for how much it would cost to implement, and an existing funding request has already included it.

When asked how COVID-19 has affected the wellness of staff its 'not a walk in the park'. Clear and transparent communication with staff, relocating staff roles from jobs that were lost with the facilities and instrumentation has been a journey for some. While managing uncertainty continues at a higher-level staff are motivated and resilient. He continued that not all damage was equal. One Lidar was damaged by humidity in Maria and repairing it for resilience helps with funding requests. Also, they have been studied the feasibility of bring back the 430 MHz incoherent scatter radar used in aeronomy,

since the transmitters were located outside of the dish area. The future for Arecibo seems bright.

