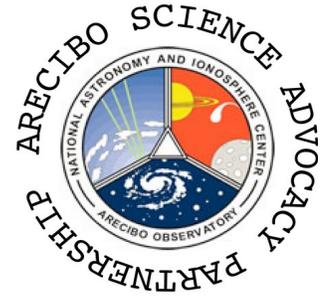


The Arecibo Science Advocacy Partnership



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February 7, 2023

Subject: Arecibo Science Advocacy Partnership Response
to the NSF Reply to Senators Blumenthal, Menendez
and Warren's Letter

Dear Senators Blumenthal, Menendez and Warren:

Thank you again for your invaluable support in challenging the NSF's decision to halt the science mission of the Arecibo Observatory and retain only its STEM activities. While their response does touch on some of the areas you and others questioned, it leaves other major points unaddressed. It is unimaginable that a "seamless transition" could be accomplished in only eight months for a world class facility with 78 buildings and a staff of approximately 100 people, millions of dollars worth of instrumentation, and in a tropical climate that is harsh on sensitive scientific equipment.

Nowhere does NSF address the specifics of how they arrived at their decision and on what basis. As far as we can discover, no public report has been issued from the NSF Arecibo Observatory Options Workshop held in June 2021. This time-consuming endeavor, to which many scientists devoted many hours, appears to have been window dressing.

Every week, the Observatory is losing staff who have highly specialized skills in the physical aspects and engineering requirements of maintaining the facilities and instrumentation, as well as in the required software, and in maintaining archived data from over 1,000 users throughout the U.S. By the time NSF completes the contracting process for "maintenance," those experts will no longer be available. Nor does "maintenance" mean the same thing for a specialized scientific facility that it does for a normal building, for example.

The NSF plan will destroy the science mission and staff of the Observatory, scuttle its precious equipment and human capital, and would then invite new research proposals at a point when the resources are no longer there to support the work: the computers, the specialized software, the staff, and the ongoing research which was the pride of U.S. radar and radio astronomy and atmospheric science.

The radio quiet zone surrounding Arecibo Observatory is a key element in the research done with the sensitive radio and radar instruments — for example, even a garage-door opener can disrupt important scientific projects. Maintaining the zone requires expert staff to critique applications for new transmitting stations, and engineering staff able to track down sources of

radio interference and assist the owners with engineering advice for eliminating the interference.

The Observatory's human and instrumentation resources and facilities represent over 60 years of investment, not only by NSF but by NASA, DARPA, DoD, and universities around the country and even around the world.

It is telling that, rather than being part of NSF's science side, the new organization will be located in the Directorate for STEM Education. These personnel are no doubt experts in education, but they do not have the skills to oversee the maintenance of intricate scientific instruments, much less specialized scientific research.

Nothing in the NSF response gives us confidence that they have thought through in detail such issues as:

- How long users will have access to the Observatory servers and archived data, and where it will be situated and retained after the transition period.
- What will happen to the instruments which are currently operating and producing invaluable science, such as the 12-m radio telescope, the LIDARs, and the Culebra facility.
- How NSF will train new people to maintain the facility, after throwing aside the irreplaceable human capital that has been developed over many years.
- How the new organization will provide fundamental IT and engineering services so that its "tenants" can use the facilities, install and restart existing and new instrumentation, and conduct scientific operations.
- How they propose to maintain the radio frequency quiet zone, known as the Puerto Rico Coordination Zone, which has been carefully and skillfully negotiated and enforced for more than fifty years. This takes personnel and vigilance, not just good intentions.
- What NSF intends to do with the 56 buildings not mentioned in the ASCER call. Will these taxpayer investments simply be left to rust? Many of these require specialized maintenance that goes far beyond air conditioning and mowing the grass.

The National Science Foundation's two criteria for selecting proposals are intellectual merit and broader impacts. Neither has been properly and adequately addressed by NSF in regard to Arecibo. Broader impacts are defined as the "potential to benefit society and contribute to the achievement of specific, desired societal outcomes." It is hard to imagine how removing a world-class research facility from Puerto Rico will serve the under-represented students on the island, or how intellectual merit could possibly be served by cutting a cost-effective, globally renowned scientific institution, leaving only the remnants of its educational programs.

Broader impacts, i.e., benefits to society, would be much better served by retaining the crucial role and workforce at Arecibo, and using the site to re-establish the U.S. leadership in radio and radar astronomy, space, and atmospheric sciences that the 305-meter telescope provided.

Oversight hearings to explore these questions further with the National Science Foundation would have many benefits. When Congress, in the CHIPS Act, instructed NSF to “explore opportunities for strengthening and expanding the role of the Arecibo Observatory in Puerto Rico through education, outreach and diversity programs, *and future research capabilities and technology at the site,*” it meant those words seriously. Sadly, the NSF has only taken one part of the message to heart. Attached please find our comments on their reply to your letter.

Thank you again,

The Board of the Arecibo Science Advocacy Partnership

Contact:

ASAP Secretary, secretary@areciboscience.org

(you will reach either Prof. Michael Nolan or Prof. Joanna Rankin)

The Arecibo Science Advocacy Partnership (ASAP, <https://areciboscience.org>)

NSF Reply Letter with ASAP Comments

January 19, 2023

The Honorable Richard Blumenthal

United States Senate

Washington, D.C. 20510

Dear Senator Blumenthal:

Thank you for your December 14, 2022 letter regarding the National Science Foundation's (NSF) planned future activities at the site of the Arecibo Observatory (AO) and its recently announced Arecibo Center for STEM Education and Research (ACSER) solicitation (NSF 23-505).

- The ACSER solicitation incorporates 21 of the 78 structures (buildings) within the site; but does not mention usage or availability of instruments currently operational.

NSF is committed to fostering vibrant scientific and engineering ecosystems throughout the country and we remain focused on exploring how the AO site can be a catalyst for inspiring STEM talent and innovation in Puerto Rico for decades to come.

Currently, the AO site is operated under a cooperative agreement with the University of Central Florida (UCF) that ends on March 31, 2023. After a careful review of the different options, NSF decided not to renew the cooperative agreement, given that the terms of the award are based on operations of the 305-meter telescope, which is no longer functional.

- Where is the documentation of this "careful review?" In particular, where is the report from the Arecibo Options Workshop NSF sponsored in June 2021, more than 18 months ago?
- NSF informed UCF of this extension less than 24 hours before making the public announcement. If they had intended a "smooth closeout," they would have given proper notice and consulted with UCF throughout the process.

However, NSF is planning to extend the cooperative agreement by six months, through September 30, 2023, to provide ample time to seamlessly close out the current award and ensure a successful transition to the next stage. NSF is currently working closely with UCF on planning this extension.

- A six-month time extension is not long enough to complete this transition. This statement demonstrates NSF's lack of understanding of the complexity of the Observatory, and what its unique situation entails. In particular, there appear to be no plans for the basic support for instruments that are still working well and making strong scientific contributions, and which the wider scientific community could propose to use for their research work far into the future.

Extensive considerations were given to short-term and long-term options for continued use of the site.

- Again, where is the documentation of these “extensive considerations”, and what short-term and long-term options were considered? Where is the report from the Arecibo Options Workshop NSF sponsored in June 2021?

At this juncture, NSF has decided to engage a site contractor to maintain the site on behalf of NSF in a manner that will allow for maximum flexibility and enable the possibility of multiple users (or “tenants”) to host a variety of initiatives on the site.

- Will the site contractor's tasks include providing internet and its support for the future “tenants”?
- What does “maintain” the site mean in terms of the more specialized infrastructure that goes beyond general maintenance?
- The discussion of “tenants” sounds like the difference between providing a buffet where people can compose their own meals, vs. requiring them to bring all the ingredients themselves, as well as cookware, personnel, and a camping stove.

NSF's engagement of this site contractor will ensure the continuity of site maintenance independent of the site use while other short-term opportunities are pursued, and longer-term options are explored.

- The statement “ensure the continuity of site maintenance independent of the site use” is premised on the notion that any contractor will be able to simply pick up where others have left off. Arecibo maintenance is far more complex than this. It involves sophisticated and specialized software, hardware, and equipment that a standard contractor will not have seen before.
- The maintenance and potential continuation of facilities are intertwined. If they are downgraded by improper and unskilled maintenance, especially in a tropical climate, the possibility of future uses will be foreclosed, and taxpayer dollars wasted.
- It appears that everyone from the electronics and operations teams will lose their jobs in August, if they have not left already. Many of them have contributed to the Observatory for years or even decades. Once that institutional knowledge is gone, it is unrealistic to think that those people could be hired back later, after they have moved on to other jobs. This staff continues to be crucial to enable the facilitation of both the “tenants” and a variety of initiatives NSF talks about. However, NSF does not appear to understand the practical requirements these involve.

To this end, NSF plans to utilize a direct contract for general maintenance and support through the Small Business Administration's (8a) process, the announcement of which is available now on the NSF's Forecast of Contracting Opportunities (<https://www.nsf.gov/about/contracting/nsf-acquisitionforecast.pdf>).

- This approach combined with the cutoff in August guarantees the loss of invaluable human capital representing decades of training and investment.
- This contractor will be required to find personnel with highly specialized skill sets. The Arecibo Observatory has been training such staff for decades, and right now they are about to be terminated. No Puerto Rican organization who is qualified for the 8(a) program could possibly have such employees on hand.

NSF is working expeditiously with the Small Business Administration to identify a contractor, preferably based in Puerto Rico, to take on this site maintenance role.

- Awarding the maintenance contract to a Puerto Rican firm would not compensate in any way for ending the scientific life of Puerto Rico's world class Observatory. It is a reduction in every way: in status, in contribution to society, in dollars, and in employment flowing to the island.
- No small company on the island who meets the 8(a) program's maximum income value requirement could be ready to take over the complexity of site maintenance, unless they hire and retain the current workforce. That cannot happen until the contract is awarded. NSF's award contract start date is September, which means that skilled people cannot be re-hired until that date at the very earliest. They will be long gone by then.
- A site visit by contracting officials is the only way for them to appreciate the complexity of the undertaking, or what it would take for the contract requirements to be fulfilled. Is there a plan for this?

The plan to enter into a direct contract for site maintenance and support does not preclude future astronomical or geospace science usage of the site. Instead, it provides a flexible foundation upon which such usage may continue alongside other potential uses. For now, NSF is proposing to prioritize investment in educational activities and research, an area in which there is a resounding consensus regarding the site's potential impact.

- Research requires infrastructure which NSF does not presently plan to support – specifically the servers, the data, and the specialized equipment and staff which are required for scientific endeavors. It will be like the shell of a buffet with no food.

These educational opportunities are identified in multiple community reports as well as in the CHIPS and Science Act of 2022 (P.L. 117-167), which highlights the need to “explore opportunities for strengthening and expanding the role of the Arecibo Observatory in Puerto Rico through education, outreach and diversity programs, and future research capabilities and technology at the site.”

- Most of AO's past and present educational programs require active Observatory scientific, engineering, and technical staff to mentor the students, in such programs as Re-

search Experience for Undergraduates (NSF's REU Program), the Arecibo Observatory Space Academy (AOSA), the STEM Teaching at Arecibo (STAR), and Enhancing and Nurturing Careers in Astronomy with New Training Opportunities (ENCANTO). Who will mentor them when those Observatory mentors are gone?

The ACSER solicitation calls for proposals to establish a STEM education and research center which would capitalize on the robust educational foundation established at the AO site. It also calls for projects that create and implement inclusive and innovative education research, as well as workforce development initiatives across a broad range of STEM disciplines for students, teachers, researchers, local communities, and the public within and outside of Puerto Rico. Through its research component and educational and outreach efforts, the proposed ACSER could play a significant role in modeling and advancing equitable and inclusive STEM education and research, especially in Puerto Rico and for those individuals and communities underrepresented in STEM.

- How would STEM research in Puerto Rico be advanced without scientific staff at the Observatory? NSF has suggested that professors from the local universities could be mentors. But this is asking Puerto Rico's existing STEM professionals to fill roles that had been filled by AO staff. If the AO scientific and technical staff are gone, and there is no new funding to replace them (within PR), that's clearly a net loss for Puerto Rico's STEM education efforts, and as such contrary to the [National Science Board priorities](#).

As exemplified by other world-leading STEM education centers (e.g., the Exploratorium in San Francisco, and the Museum of Science in Boston, etc.), ACSER would not require an active physical science research program. Such a research program could, however, be incorporated in responses to the ACSER solicitation or in future proposals.

- Research requires infrastructure which NSF does not presently plan to support – specifically the servers, the data, and the specialized equipment and staff which are required for scientific endeavors. It will be like the kitchen of a buffet with no food.
- References to museum programs indicate a basic misunderstanding of the nature of Arecibo's STEM programs, which were based on students working directly with living, breathing scientists who were doing active research. No teacher, however enthusiastic, can replace that.
- Both the Exploratorium in San Francisco and the Museum of Science in Boston have active, ongoing connections with researchers, active research projects, and scientists on staff, and their budgets vastly exceed the NSF plan for Arecibo funding. To be specific,

The Exploratorium in San Francisco has total financial assets of \$82.8M and a revolving line of credit of \$6.5M¹.

The Museum of Science in Boston has an endowment of \$167.3M, pledges of the order of \$15.4M², and an operating budget of \$61M³.
- How could NSF ever replace the dream of many Puerto Rican students, to participate as an intern mentored by engineers and scientists at a world-class observatory, by a budget

of only one million dollars per year for the STEM center, including administrative costs and overhead?

- This is the proverbial cart before the horse. Education follows science, not the other way around.

NSF's new site maintenance and support contract will also be able to support other current and future uses of the site for innovative ideas involving the 12-meter telescope, the Lidar and optical laboratory facilities, or new facilities yet to be imagined.

- The lidar and optical facilities are operated under cooperative agreements with other institutions and private companies. These facility users, many of whom have their own instruments there, do not know what will happen after September. Should they remove their instruments and take them elsewhere? Will they be kept at Arecibo, and can data continue to be acquired? How will they have access to this data? Will they need to bring their own personnel to use their own instruments as the word "tenant" implies? Neither the current contractor nor NSF has clarified this.

There are about six awards currently utilizing the AO site that are being evaluated to determine the best way to support their research goals.

- How are these awardees being consulted on their needs?

Future use of the infrastructure and research resources on the site, including the existing instrumentation, would be identified in proposals and evaluated through NSF's standard merit review processes. Meritorious proposals could be funded, including operational support as needed, and incorporated as tenant activities on the site.

- How can research continue if the instruments and scientists are part of a "tenant" program?

As part of exploration of longer-term options, NSF has engaged with NASA and other federal agencies in the development of NSF's plans for the future of the AO site. Specifically, NSF has collaborated with NASA to begin a study of the next-generation radar needs. The study will include a comprehensive evaluation of the needs of NASA's planetary science division, including the need to support planetary defense, the Department of Defense, and the needs of the NSF research community for future planetary science studies that could be supported by radar technology. We anticipate this study to be complete by the end of FY 2023. Its findings will inform future potentially longer-term and larger investments in radar systems by other agencies in support of the planetary science needs and national security.

- This makes sense if the panel includes a diversity of experts and genuinely applies itself to creating feasible possibilities which have the support of the affected communities, including scientists.

NSF's current plan for site maintenance and support provides the flexibility to support potential short-term exploratory initiatives that may develop out of the ongoing discussions with NASA and other agencies.

- How will the access to these “exploratory initiatives” work? What will be the basis and process for selecting those?
- Will currently operating instruments which are still producing good science be taken into account?
- What will be the fate of instrumentation which is ready to be assembled and used, or for which the purchasing process and deposits were given after the release of pre-awarded funds from Hurricane Maria recovery? Are these to be discarded?

This plan will also allow time for catalyzing greater possibilities, including potentially longer-term and larger investments in support of the planetary defense directive and national security. I am committed to keeping Congress informed of the progress on the planetary radar study and will provide a copy of the report upon completion.

I appreciate your interest in the work of NSF. If you have additional questions, feel free to contact Amanda Hallberg Greenwell, Head of the Office of Legislative and Public Affairs.

Sincerely,

Sethuraman Panchanathan

Director

Footnotes:

1 <https://www.exploratorium.edu/sites/default/files/pdfs/FY20AuditExploratorium.pdf>

2 https://www.mos.org/sites/dev-elvis.mos.org/files/_v4/pdfs/annualreport/15481_MOS_AnnualReport.pdf

3 <https://www.mos.org/sites/dev-elvis.mos.org/files/MOS%20FY22%20Financial%20Statements.pdf>