Sample Letters Relevant to the NSF AST Environmental Impact Statement (EIS) Call for Email Responses

LETTER #1—

Date: June 4, 2016
To: NSF Astronomical Sciences envcomp-AST@nsf.gov
RE: Arecibo Observatory Environmental Impact

I am writing in response to the invitation for public comments on environmental impacts of the Arecibo Observatory, and regret that I cannot be present at either of the public scoping meetings. I am offering comments related to the impacts of Arecibo Observatory on cultural resources, health and safety, and socioeconomics.

As a national facility located in the US territory of Puerto Rico, the Arecibo Observatory is a major cultural resource on the island. The facility attracts large numbers of tourists, both from the island and from the rest of the world, forming part of Puerto Rican cultural identity and a strong point of pride. Even more importantly, the Arecibo Observatory is a very important part of STEM education on the island: thousands of school children visit the facility to learn about the scientific and engineering accomplishments made there and become inspired about their own futures.

Hispanic STEM professionals are still vastly underrepresented: in spite of being 20% of the college-age population, only 5-9% of physical sciences, mathematics, and engineering degrees (https://www.aps.org/programs/education/statistics/hispanicmajors.cfm) are awarded to Hispanic college graduates. The Arecibo Observatory educational programs get children interested, and the student research programs (summer and Saturday) have a huge impact in recruiting and retaining talented Latino/as into the STEM workforce. This is a cultural as well as socioeconomic impact that extends way beyond the island itself.

Finally, it is probably a larger, bigger-picture safety impact than is often considered in the Environmental Impact Statement, but the Arecibo Planetary Radar plays a pivotal role in the investigation and characterization of potentially hazardous asteroids (PHAs). This highly sensitive capability is not matched anywhere else in the world, and without this radar, we will be significantly less able to assess asteroid impact hazards, which affects the health and safety of the entire planet.

I urge you to consider these factors as you prepare the EIS for Arecibo Observatory: in addition to being a unique scientific facility which has served as an international model for interdisciplinary scientific and technical accomplishment, it has important cultural, safety, and socioeconomic importance in PR and across the Earth.

LETTER #2—

13 June 2016

To: NSF Astronomical Sciences envcomp-AST@nsf.gov

Re: Arecibo Observatory Environmental Impact Statement (EIS)

This letter is in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to operations at Arecibo Observatory (AO). I find that AO is a scientifically and culturally unique institution that has amazing potential for a future positive impact in both arenas. The scientific contributions stemming from AO have been outstanding and the scientific future remains bright indeed. The cultural contributions to Puerto Rico and the world are incalculable. I outline of few of these:

- The primary and secondary contributions to STEM education are huge via the visitor center but also via the large number of AO "graduates" who have entered careers in education both in Puerto Rico and worldwide.
- Over the life of AO many students and scientists have lived in Puerto Rico for various extended periods. Several have spent their entire careers at AO—one of the original scientists from the early 60's still lives in Ramey. Their children were born in Puerto Rico (one of mine was born in Mayagüez), went to school in Puerto Rico, and left the island as Puerto Ricans to attend at least Stanford, Cornell, Harvard, and Cambridge University. These AO families have made a major socio-economic impact on Puerto Rico.
- AO is culturally unique in that it brings together many fields of endeavor and many cultural "ideas" that encourage global thinking—both cultural and scientific tools and concepts mix. It has and will continue to attract visitors and users in many fields from around the world. Longer-term users of AO capabilities have come from EU countries, Japan, India, Australia, etc.
- As AO has always provided a de facto institution of higher education in Puerto Rico, I point to the possibility of placing AO as the central component of a degree granting graduate and post-graduate research and education institution that would be unique to Puerto Rico and to Latin and South America. This proposed institution has been discussed elsewhere as the Puerto Rican Institute for Advanced Studies (PRIAS). It would greatly leverage the already firm impact that AO has made across many communities.

Sincerely yours,

LETTER #3—

Subject: Arecibo Observatory

To whom this may concern:

The proposed changes to Arecibo Observatory will be highly detrimental to the education of underprivileged children on the Island of Puerto Rico.

The current activities of Arecibo Observatory include more than just scientific research. Approximately 20,000 K-12 students travel to the Arecibo Observatory Visitor Center each year, most of which come from low-income families. The Visitor Center resembles a miniature air and space museum and is inspiring to say the least. Students need such exposure so that they see what higher education brings and how it offers a path to an exciting and productive career. Also Arecibo upgrades the teaching capabilities of high school teachers through STEM learning and conducts a Saturday School Space Academy for local high school students. This essentially gives the students advanced placement. No other observatory worldwide does more to advance the socioeconomic development of the underprivileged.

I am convinced that very few people understand what it means for a child to be a member of a poor family when it comes to education. The family tends to have a very limited educational background, and the child is provided little support or encouragement to excel in school. The educational problem that will arise from the proposed Arecibo Observatory changes will be much deeper than even the unemployment disaster of laying off more than one hundred local Puerto Rican residents who work at the Observatory. In the current Puerto Rican economy quality jobs are almost impossible to find.

LETTER #4—

From:

Subject: Comments as a researcher on Arecibo Observatory Environmental Impact Statement

I write to strongly urge that NSF choose alternative 1 of its "Notice of Intent to Prepare an EIS . . . ", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."

As a scientific user of Arecibo Observatory for over 44 years, I can attest to its historical and continuing importance for studies of general relativity, pulsars, and the interstellar medium. Its enormous collecting area (the largest in the world) has been and continues to be crucial in studies of faint objects such as pulsars. Most importantly, although the facility is over fifty years old, it has undergone two major upgrades, each of which created an essentially new, far more powerful telescope. Consequently it remains in the prime of its scientific life, still able to make important and useful scientific discoveries.

While most radio astronomers now use multiple-dish interferometers for their observations, there remains an important need for large single dish telescopes such as Arecibo, for observations of objects too faint to be studied with interferometers. I will cite a prime example from my own research. For thirty-eight years, I have been involved in observations of the first binary pulsar, B1913+16, which earned its discoverers Joseph Taylor and Russell Hulse a Nobel Prize. It was too faint to be discovered by any other telescope in 1974. It is also so faint that essentially all useful observations of it have been done from Arecibo, despite the fact that it is a crucial object for the study of general relativity. For example, it was Arecibo observations of this object that first demonstrated the existence of gravitational waves, thus paving the way for this year's stunning LIGO detection of them. Even today, we continue to observe this object from Arecibo and to derive from these observations new, meaningful measurements of general relativistic phenomena. For example, our latest observations and analyses were just accepted by Astrophysical Journal (J.M. Weisberg and Y. Huang, "Relativistic Measurements from Timing the Binary Pulsar PSR B1913+16," Astrophysical Journal, in press). Furthermore, there is more to learn from this system in the future, and Arecibo will remain the only telescope able to adequately observe it for at least the next several years.

I could cite several other examples of the role that Arecibo alone can play in my other research, and many others can and will do so. The telescope remains a unique, powerful, and flexible instrument for the 21st century.

LETTER #5—

To: The NSF

From:

Subject: Comments as an educator on Arecibo Observatory Environmental Impact Statement

I write to strongly urge that NSF choose alternative 1 of its "Notice of Intent to Prepare an EIS . . . ", namely "Continued NSF investment for science-focused operations (No-Action Alternative)." I do so in my role as a science educator.

I have traveled regularly Arecibo Observatory for over 44 years, often in the company of students. The observatory is a profoundly inspiring installation for its users, and especially for students. Many of my students have been powerfully motivated to pursue scientific careers by their visits to the observatory. I will cite a recent trip as an example. A colleague and I brought seven students from a variety of institutions to the observatory for a week of study and observations. The observatory staff presented tutorials on a wide variety of topics related to observatory research, while the two tour leaders taught the students how to carry out radioastronomical observations, which the students then did. Because of the unique hands-on nature of the observatory, we were able to take the students behind the scenes and show them the full nature of the data gathering process, from antenna through radio receivers and into digital data acquisition devices. They connected an oscilloscope to the telescope in order to view a pulsar pulsing on the screen in real time, saw the complexities of the observatory's atomic clock, and helped to gather data for a real pulsar experiment. There is simply no substitute for the direct experience of the workings of an observatory, and indeed one student participant noted that the week had changed his life.

I am also delighted by the important educational role that the observatory plays though its Visitor Center, which educates and inspires a very large number of guests each year. There is no substitute, however, for the targeted education and inspiration that a working observatory, especially Arecibo with its hand-on tradition, can provide to more-advanced students.

LETTER #6—

To: NSF Astronomical Sciences envcomp-AST@nsf.gov
Re: Arecibo Observatory Environmental Impact Statement (EIS)

I write in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to operations at Arecibo Observatory (AO). Arecibo Observatory is a unique institution nationally and internationally culturally, educationally, scientifically and also economically in Puerto Rico. Arecibo's attributes have been cultivated over many years, are interconnected and mutually supportive, and can cannot readily be separated. The Observatory's contributions in all four areas continue to be very strong, and they could multiply in future with a more appropriate level of support. The scientific contributions from AO have been outstanding, and its scientific future remains very bright indeed. The Observatoriy's cultural contributions to Puerto Rico and the world are beyond reconning. Here are a few examples:

- In my experience, Arecibo is the most exciting observatory for students on the planet. Students sometimes describe their experience at AO as "life changing" and this can be traced in the lives of students who visit for scientific work.
- Arecibo is a work of art and is often apprehended in this manner by visitors. It is understood as a supremely elegant mechanical and electronic monument to the in service to the human imagination.
- The Observatory is iconic nationally and internationally. Its very existence has raised consciousness about science, to say nothing of its several prominent movie roles!
- AO is almost certainly the single best known and influential scientific institution in the Spanish speaking US and Caribbean basin. Puertoricans are very very proud of their "El Radar" and its presence has entered the culture and consciousness in a very deep and positive manner.
- In Puerto Rico, the Observatory is of very considerable economic value and could be much more so. Its staff salaries are highly important in the Arecibo Town region. Its educated staff has significantly contributed to building up a further generation or two of educated people in the area, and the tens of thousands of tourist visitors are also important to the overall island economy. Withdrawal of support now would compound what is already a difficult situation for Puerto Rico and is citizenry.
- Educationally, the Observatory is of key importances at every level: For the island high school students who visit AO in conjunction with their science classes. The Arecibo Institute students who go on to excel in STEM disciplines. Training programs for teachers in PR and elsewhere in Latin America. Graduate students in science and engineering both from PR and the mainland. Postdocs. As a facility for visits by US college students to do research with their mentors.

A primary environment principle is to use well and not waste—in this case waste its scientific, educational, economic and cultural value. AO has enormously greater value than the cost of its support. It is unique in the world in all three of its science areas. AO is hardly 20 years old since its Gregorian renovation, still very much in its prime years. It could multiply, 2-3 times, more important and productive with adequate, rather than starvation, support. Replacing AO would take years and many times the cost of dismantling it. All such facilities/institutions have finite lifetimes, but crippling the Observatory before it become outdated would indeed be an environmental crime.

LETTER #7—

To: NSF Astronomical Sciences envcomp-AST@nsf.gov Re: Arecibo Observatory Environmental Impact Statement (EIS)

I write this letter is in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to operations at Arecibo Observatory (AO). I strongly request NSF to choose ***alternative 1*** of its "Notice of Intent to Prepare an EIS . . . ", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."

AO is a unique institution that has incredible potential to continue: making scientific discovery, training future scientists and engineers, cultivating international collaboration, and perhaps transform higher education if AO becomes a degree granting graduate and post-graduate that would be truly remarkable to Puerto Rico and Latin America. The proposed higher education approach has been discussed elsewhere as the Puerto Rican Institute for Advanced Studies (PRIAS). With this avenue, there is an amazing opportunity to make stronger links between the United Stated and South America, a component that is missing; despite the fact that South America is not too far from the mainland. I can only envision high impact citation impact that is typically greater when research groups collaborate, as indicated in the article *Collaborations: The fourth age of research* by Jonathan Adams, Nature 497, 557–560 (30 May 2013), doi:10.1038/497557a.

The science applications of AO with the new HF-radar are unique and include meteor aeronomy and physics applications as well as radio science investigations. In these applications major issues include exploring the recently discovery—using Arecibo V/UHF observations—that the vast majority of meteoroids visible as radar meteors fragment rather than simply ablating. This process is likely a source of considerable aeronomically important nanometer “dust” in the 80-130+ km meteor zone. Other important science areas include studies of mid-latitude spread-F, sporadic-E instabilities, quasi- periodic echo (QPE) structures, low-altitude quasi-periodic echo (LQPE) structures, and detection of the D-region ionization enhancements associated with lightning-related elves using the radar in wave-interaction and/or partial-reflection modes. These types of research can only be conducted at AO.

I grew up in a very poor suburb of Lima, Peru, but was fortunate enough to study and complete my undergraduate education in Peru. I was also fortunate to have great mentors in Peru, whom guided and encouraged me to go an extra mile and pushed me to pursue an advanced degree in the United States. I did my Ph.D thesis at AO and I can attest of the impact that AO has had in my career and it continues to be a source of inspiration to underrepresented students. Undoubtedly AO has strong broader impact in reaching out to minority students and engaging them in pursuing a career in STEM fields. AO has also been a steady source of engineers and scientists. Many of my graduate students did their

research at AO and are working at SpaceX, Jet Propulsion Lab, DoD, and several national laboratories.

Sincerely yours,