

## **NSF Astronomy Senior Review Recommendations for NAIC: NAIC Statement and Implementation Plan**

The NSF division of astronomical sciences (AST) released the report of the Senior Review panel on November 3<sup>rd</sup>. The report, [http://www.nsf.gov/mps/ast/ast\\_senior\\_review.jsp](http://www.nsf.gov/mps/ast/ast_senior_review.jsp), includes three recommendations for NAIC. These are:

1. Reduce NSF astronomy division support for Arecibo to \$8M over the next 3 years;
2. Schedule the survey programs for 80% of the time used for astronomy on the telescope through 2010;
3. In 2011, plan either to close Arecibo or operate it with a much smaller astronomy budget; additional funds to be provided by other sources.

The Cornell/NAIC statement in response to the Senior Review report follows.

### **Cornell/NAIC Statement**

Cornell fully supports the goals the Senior Review and shares in the view that science is a forward-looking enterprise; new research facilities are essential to future progress. Cornell is also proud of the scientific achievements that been made at the NAIC Arecibo Observatory by creative researchers over the more than 40 years that Cornell has managed and operated the Observatory. We appreciate the supportive words of praise in the SR report congratulating Cornell on its effective operation of the facility.

The NAIC Arecibo Observatory is a facility of the National Science Foundation. Cornell manages NAIC on behalf of the U.S. scientific community for the advancement of radio science. The principal stakeholder in NAIC is the U.S. scientific community. If the U.S. scientific community, through the senior review or some similar community-based, informed, process recommends that changes should be made in the way NAIC is funded or in the scope of the services it provides to the community, Cornell/NAIC will work conscientiously with the community and its NSF sponsor to implement those changes.

The Senior Review recommends that over the next 3 years the NSF funding for support of the NAIC astronomy program should be decreased by nearly 25%, from an annual budget of \$10.5M to annual budget of \$8M. Cornell/NAIC is prepared to make the changes in the scope of the NAIC astronomy program, and in the operating structure of the Arecibo Observatory, that will enable the adjustment to a much reduced astronomy program to be made. In planning for such changes we recognize, as did the Senior Review report, that there is every reason to expect that the Arecibo Observatory can be scientifically productive for the next decade and even further into the future. In order for this to happen, Cornell has pointed out to the NSF that the long-term safety of the Arecibo telescope requires that the accumulated corrosion on the telescope platform must be removed and the platform re-painted. NSF has endorsed this view and a plan is in

place to clean and paint the platform in 2007, a multi-million dollar project to be done via a financial partnership between NSF and Cornell. The platform painting will give the telescope a structural lifetime of 20 years.

The Senior Review is less sanguine about the priority NSF astronomy funding for NAIC deserves in competition with that of other facilities, particularly new facilities, in the period beyond 2010. The SR report mentions that NSF may want to reduce NAIC astronomy operations funding even further, below \$8M/year, in 2011. The report also suggests that NSF may want to consider closing the Arecibo Observatory after 2011. And finally the SR report notes that the SR charge is to advise NSF for the period between decadal surveys, and hence issues that apply to the post-2010 years are subjects for the next decadal survey committee to consider; they are not issues on which the SR recommendations are germane. Clearly, there is no community consensus yet on the priorities for the next decade, and there cannot be until the decadal survey is conducted. In light of this situation, Cornell/NAIC will take no actions that will limit the options available to the decadal survey committee. In particular, no planning will be done, or actions taken, leading to closure of the Arecibo Observatory.

The primary recommendation of the SR report for NAIC/Arecibo Observatory, that funding for the astronomy program be reduced from \$10.5M annually to \$8M annually over 3 years, is one that Cornell/NAIC will implement by reducing the scope of the astronomy program. Although this cut of nearly 25% in the budget of the NAIC astronomy program will necessitate that major changes be made, it will also motivate NAIC to focus on developing new research capabilities, particularly those that enable high-priority, community-based, radio science initiatives such as the international Square Kilometer Array to proceed expeditiously to completion.

### **Response to Specific Questions**

1. The Senior Review recommends a decrease in AST support for Arecibo to \$8M over the next 3 years. Is it feasible to manage that large of a decrease in operations funding and still maintain a viable astronomy program at the Arecibo Observatory?

**Answer:** *The astronomy program at the NAIC Arecibo Observatory presently (FY2007) has an annual operating budget of approximately \$10.5M. These funds are used not only to operate the Arecibo telescope and maintain the Observatory site, but they provide support to the 250 scientists and students who come annually to the Observatory to conduct their programs of observational research. The budget reduction proposed by the SR, a reduction of nearly 25%, cannot be accommodated by trimming Observatory programs across the board. Instead, it necessitates a change in the scope of the astronomy program with the elimination of some research capabilities in order to maintain the viability of others, and to ensure the potential for future growth in research areas of greatest promise.*

2. Will a personnel layoff be necessary?

**Answer:** *The NAIC budget breaks down into costs that are either personnel costs (salaries, wages, benefits) or materials costs (utilities, supplies, services). Personnel costs are 75% of the budget, and materials costs are 25% of the budget. Just to keep the lights on after a budgetary reduction of 25% will necessitate personnel layoffs. To the extent possible, the reduction in force will be handled through voluntary retirements and elimination of open positions.*

3. What are some of the likely specific consequences of the reduction in funding for the NAIC Arecibo Observatory astronomy program?

**Answer:** *The scope of the astronomy program will change from one in which the NAIC Arecibo Observatory offers a full range of instrumentation and support services for radio astronomical research, to a more limited program that focuses on the unique ability of the world's largest radio telescope to survey and study faint objects in the universe. Specific reductions in scope of the astronomy program include the following: We will eliminate all AST-supported NAIC program elements that are not directly related to operation of the NAIC astronomy research program. We will reduce the number of telescope observing hours for astronomy to approximately 3800 hours per year. (Now it is 4800 hours per year).*

- *Nearly all astronomy observations on the telescope will be scheduled at night, leaving the days free for maintenance activities.*
- *We will do telescope and instrument maintenance 8-hours per day, 5-days per week (Monday-Friday).*
- *Because 80% of the astronomy observations will be for survey observations, we will reduce the number of receivers available for astronomy observations from 13 to 6. This will make it easier to maintain the remaining receivers.*
- *The survey observations require less local support. Accordingly, scientific and support services in many areas will be reduced.*
- *We will encourage remote observations to reduce the number of on-site visitors requiring Observatory assistance. This will enable us to reduce the cafeteria hours, and trips to the airport, for example. Student visits for training still will be encouraged.*
- *We will continue to operate the Arecibo Planetary Radar in FY2007 as we seek additional support for it from NSF and other sources.*

4. The SR report recommends that only 20% of the astronomy observing time be allocated to research programs of individual investigators with the remaining 80% of the time being allocated to survey programs. The SR makes this recommendation based on their assessment of the greater scientific value of the surveys and on the expectation that Observatory scientific and observing support can be reduced as a result. Is this feasible?

**Answer:** *The astronomy survey programs on-going at the Arecibo Observatory are being conducted by large groups of researchers, 40 or more researchers involved with*

*each survey is typical, whose combined skills encompass all aspects of observational research. For this reason, Observatory services, in all areas, necessary to support the survey programs are less than for more traditional individual-investigator research programs.*

5. The SR report mentions that much of the survey work will be completed by 2010 and hence 2010 is a suitable year to consider making major changes to NAIC. Do you agree with the SR statement and the conclusion drawn from that statement?

**Answer:** *The report states (6.2.1, p. 62) that "much of the survey work will be completed by 2010". That statement is incorrect. When asked by the Senior Review panel, "When will the surveys be half done?" we responded that the current surveys would be \*half\* done in five years. Furthermore, this time would of course be extended if the telescope operates for fewer hours each year as a result of staff reductions. We also noted that three additional approved survey programs were still awaiting the scheduled delivery of survey-specific signal processors, spectrometers, and that these new surveys would start upon delivery of the new spectrometers (January 2007). They too would require 5-years to be half completed, or 10 years to be completed. Further, all the surveys make discoveries that demand follow-up. The most interesting discoveries are faint sources and/or time-variable/periodic phenomena: both require Arecibo's collecting area to deliver their ultimate science outcomes. Unfortunately, the SR report appears to have based its recommendation regarding the close out date for the Arecibo Observatory on the erroneous premise that the ALFA surveys would somehow come to conclusion in 2010. We encouraged AST to investigate the logic that led to this recommendation and take the appropriate steps to revise it as part of their implementation plan.*

6. What is the effect of the Senior Review recommendations on the Arecibo Planetary Radar program?

**Answer:** *NAIC has issued a separate statement on this issue. In brief, NAIC is concerned that the Senior Review report includes only a single reference to the Arecibo planetary radar. And that reference is to discoveries made several decades ago, ignoring the long list of recent achievements given, for example, in the NAIC report to the SR. Regrettably, the failure of the SR to appreciate the critical role of the Arecibo planetary radar may lead to its demise. The SR report (6.2.1, p. 62) states "The SR was advised that a minimum feasible operating cost for Arecibo is \$8M, even when it is largely working in survey mode." The \$8M budgetary number does not include any support for the planetary radar program: the \$8M operating budget applies, as the report notes, when the Observatory is doing astronomical surveys. The operating cost of the Arecibo planetary radar is \$1M per year, a figure NAIC supplied to the SR. Therefore, the SR recommendation that the funding for NAIC be decreased to \$8M, together with the SR recommendation that the NAIC astronomy program focus on survey programs, is a recommendation to terminate the Arecibo planetary radar program. The community should have been told this explicitly in the SR report if indeed that was the intended*

*conclusion of the SR panel. Cornell/NAIC has expressed its concern about the lack of clarity, and candor, in the SR report regarding the Arecibo planetary radar program.*

*It is the position of Cornell/NAIC that the Senior Review failed to understand the role of the Arecibo Planetary Radar and, in particular, it failed to appreciate that the two primary SR recommendations for NAIC had the effect of terminating this critical program. This error can be rectified by revising the SR recommendation for NAIC from “the SR recommends a decrease in AST support for Arecibo to \$8M ...”, to “the SR recommends a decrease in AST support for Arecibo to \$9M...” The additional \$1M per year in NAIC operations funding preserves the operation of the Arecibo planetary radar without violating the apparent SR objective of diminishing NAIC funding overall. The \$1M per year in incremental operations funding is one-half of one-percent of the current AST annual budget. NAIC believes this change should be a key element in the AST implementation plan for the Senior Review recommendations. We have communicated this suggestion to Wayne van Citters, the AST division director.*

*NAIC will continue operating the Arecibo Planetary Radar until the end of FY2007. Operation beyond this date depends on the availability of funds.*

7. The SR report recommends that the Arecibo Observatory be closed if external funding is not found for the NAIC astronomy program after the year 2011. What is the Cornell position on this recommendation?

**Answer:** *Cornell believes the SR was acting beyond its charge in making this recommendation. The SR was charged as follows: “The committee is asked to examine the impact and the gains that would result by redistribution ~\$30M of annual spending from Division funds. These funds would be obtained by selective reductions in the operations of existing facilities and instrumentation development programs, possibly in combination with opportunities to deliver scientific knowledge at reduced cost to NSF or increased efficiency through new operating modes.” Thus, the charge to the SR is a budgetary question, not a programmatic question. The decision to construct new NSF facilities or close existing NSF facilities is a NSF decision; the SR was not established to address this issue.*

*In any case, the SR report properly notes that its recommendations refer to the mid-term period between decadal reviews of astronomy and astrophysics. The SR report states: “If Arecibo is kept operating beyond 2011, it is expected that this will only be a limited term extension, pending deliberations of the next decadal survey”. Cornell agrees with the statement that the continued operation of the Arecibo Observatory, and the continued operation of all NSF-supported programmatic activities, is an issue to be assessed as part of the next decadal survey. It is not an issue for review by the SR.*

8. What is the effect of the SR recommendations on the program of ionospheric research at the Arecibo Observatory?

**Answer:** *The ionospheric research program at Arecibo is supported independent of the astronomy program. Funding for the ionospheric research program comes from the Upper Atmospheres division of the NSF Geosciences directorate. It is not affected directly by the actions of astronomy division senior review process. However, there will be indirect effects. The ionosphere research program is funded as an incremental cost to the operation of the astronomy program. As support for the astronomy program declines the incremental cost required to support the ionospheric research program will increase. However, there is no reason to think that the scope of the ionospheric research program will need to change as a result of the increasing cost burden on the ionospheric program, unlike the situation with the astronomy program at the Arecibo Observatory.*