NSF Background and Goals for Arecibo Telescope Study

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Introduction

- On December 1, 2020, the platform above the 305-meter Arecibo telescope collapsed due to catastrophic failure of support cables.
- NSF desires an independent engineering assessment of contributing factors and probable cause(s) and any recommendations regarding technical or administrative actions that NSF and its awardees could take to reduce risks of similar damage to other facilities in the future. (See specific task list on subsequent slide.)

Basic Timeline-1

- 1960s: Arecibo 305-meter (1000-ft) telescope constructed in Puerto Rico by Cornell University, with funding from the Advanced Research Projects Agency (ARPA).
- 1970s: Stewardship transferred from the U.S. Air Force to the National Science Foundation.
- 1990s: Instrument platform above the 305-meter main dish was upgraded significantly, resulting in considerable increases in platform weight and corresponding modifications to the cable support structure.
- 2005 and later: Independent scientific reviews commissioned by NSF concluded that the 305-meter telescope was lower priority than a number of other major facilities and science programs funded by NSF for astronomical and geospace sciences.
  - Based on these reviews, and given a constrained budget, NSF capped and gradually reduced funding for Arecibo Observatory from ~2010 to 2013, partially ameliorated by increased NASA funding for the planetary radar system.

Basic Timeline-2

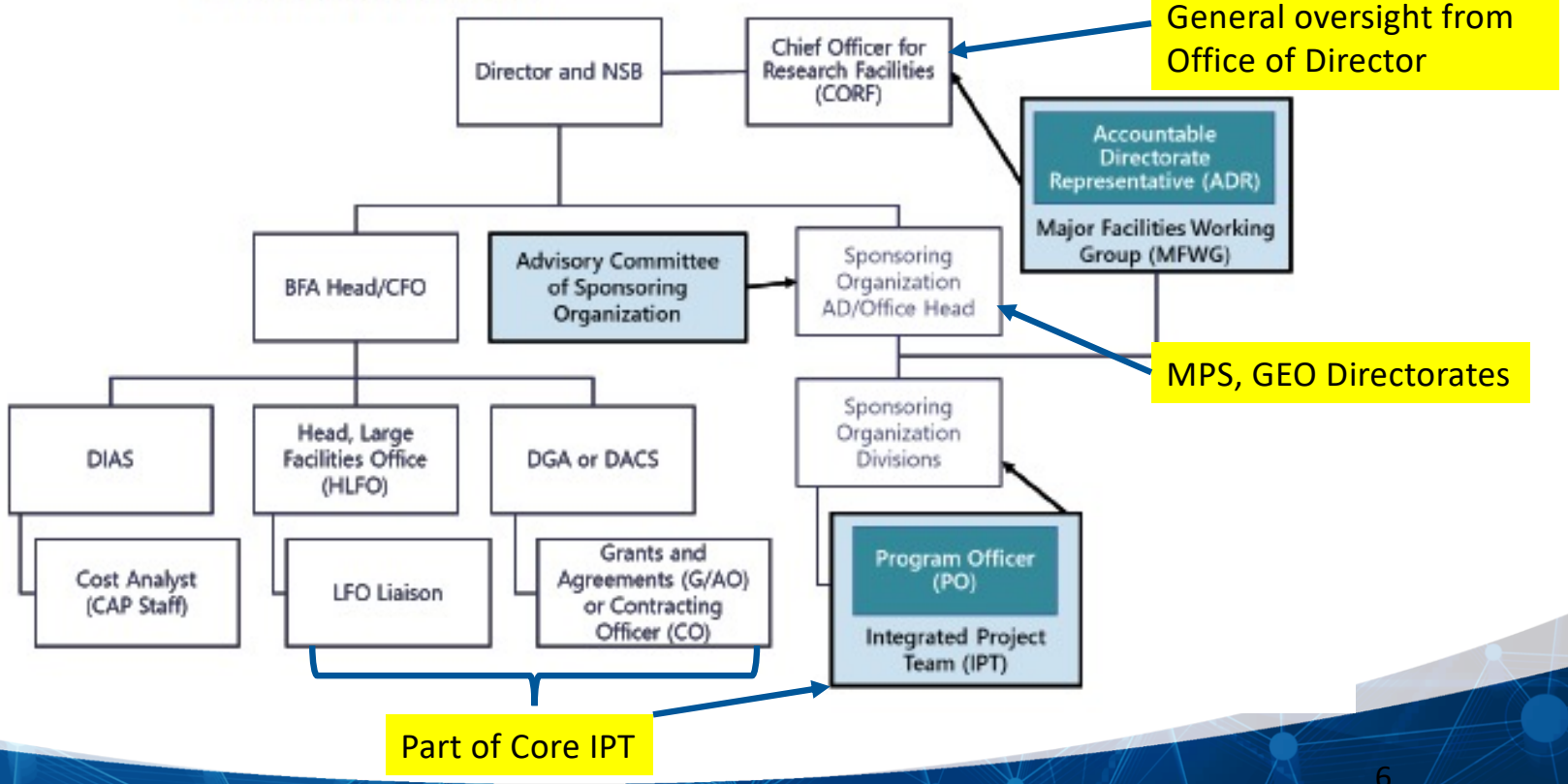
- October 2011: Management responsibility transferred from Cornell to SRI.
- January 2014: Puerto Rico suffered a magnitude 6.4 earthquake.
- September 2017: Category 5 Hurricane Maria passed directly over Arecibo (high Category 4 when it struck Puerto Rico).
- April 2018: Management responsibility transferred from SRI to University of Central Florida.
- December 2019: Beginning of a series of earthquakes as strong as magnitude 6.4 that struck Puerto Rico.
- August 10, 2020: An auxiliary platform support cable from Tower 4 (cable added as part of the 1990s upgrade) failed.
- November 6, 2020: An original platform support cable, also from Tower 4, failed.
- December 1, 2020: Further cable failure and platform collapse occurred.

Origin of this Study

- Soon after the platform collapse in late 2020, NSF leadership determined that an independent technical assessment of the root causes of the collapse was important, and contacted NASEM.
- Assessment by unbiased, reputable experts was sought.
- The 305-meter telescope was a unique structure, and specific engineering findings may not apply directly to other NSF facilities.
  - Although many major NSF facilities are "one-of-a-kind," there still could be many useful lessons for NSF regarding approaches to construction, maintenance, usage, and safety of such unique facilities.
  - Lessons also may be applicable to other large structures.
  - Independent assessment is important for the historical record.
  - Comments on administrative and management processes are also extremely valuable to NSF.

Functional NSF Oversight of Arecibo

Figure 2.1.6-2 NSF organization chart showing coordinating and advisory bodies for major facilities and mid-scale research infrastructure.



Study tasks (with minor re-phrasing)

1. Examine performance of structures related to
   a. Engineering design and material specification (original + upgrades);
   b. Documented construction procedures and contractor performance;
   c. Environmental conditions & loading events;
   d. Maintenance, repair, and recapitalization.
2. Assess oversight and management policies and practices that may have been contributing factors, including:
   a. Contractor selection and procurement during construction and repair;
   b. Maintenance planning and oversight;
   c. Routine inspection and structural review.
3. Identify lessons learned for NSF in general for other large facilities.
4. Identify and recommend actions or general best practices to prevent engineering failure or damage at other NSF large facilities.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