



AURA's Response to the NSF Portfolio Review

Dan Clemens¹, Timothy Heckman², Heidi B. Hammel³

¹ Boston University and Chair of the AURA Board of Directors

² Johns Hopkins University and Vice Chair of the AURA Board of Directors

³ AURA Executive Vice President

and

the AURA Board of Directors

(see next page)

October 31, 2012

*"To promote excellence in astronomical research
by providing access to state-of-the-art facilities."*

— AURA Mission Statement

AURA Board of Directors, October 2012

Dr. Jonathan Bagger

*Dept. of Physics & Astronomy
Johns Hopkins University*

Dr. Harvey Butcher

*Mt. Stromlo and Siding Spring Observatories
Australian National University*

Dr. Dan Clemens (Chair)

Boston University

Dr. Alan Dressler

*Carnegie Observatories
Carnegie Institution*

Dr. Frederick Gilman

*Department of Physics
Carnegie Mellon University*

Dr. Richard Green

*Large Binocular Telescope Observatory
University of Arizona*

Dr. Guenther Hasinger

*Institute for Astronomy
University of Hawaii*

Dr. Timothy Heckman (Vice Chair)

*Dept. of Physics & Astronomy
Johns Hopkins University*

Dr. Lynne Hillenbrand

*Astronomy and Astrophysics
California Institute of Technology*

Dr. J. Todd Hoeksema

*W.W. Hansen Experimental Physics
Laboratory, Stanford University*

Dr. Elizabeth Hoffman

Iowa State University

Dr. Charles Lada

Smithsonian Astrophysical Observatory

Dr. Mark Phillips

*Las Campanas Observatory
Carnegie Observatories*

Dr. Philip Pinto

*Department of Astronomy
University of Arizona*

Dr. Maria Teresa Ruiz

*Departamento de Astronomia
Universidad de Chile*

Dr. Michael Shull

*Dept. of Astrophysical & Planetary Sciences
University of Colorado*

Dr. William Smith (ex officio)

AURA President

Dr. Oskar von der Lühe

Kiepenheuer-Institut für Sonnenphysik

Summary

AURA commends the Portfolio Review (PR) Committee for an admirable job of producing a detailed, ambitious report and comprehensive set of recommendations responsive to the constrained charter under which it operated. The PR Committee worked to find ways to achieve an overall budgetary ‘soft landing,’ given the ramp up in operating costs for new facilities recently commissioned and for those coming in the near future, while at the same time recognizing the needs of existing productive facilities and the grants programs.

Exercises like the PR can bring value to difficult, complex enterprises and can help realign community thinking. This realignment is particularly necessary when rising facility costs combine with decreasing Federal investment. Potentially, such exercises can also over-correct with premature actions that lead to future regrets for opportunities and capabilities lost.

It is worth noting that the President’s Budget Request for NSF/AST for FY2013 places AST funding at levels well above both PR Scenarios for that year. Thus radical changes to the AST portfolio, particularly irrevocable changes to existing astronomical facilities, may be unwarranted. Today’s budget climate is bleak, yet it may not be an accurate gauge of the future. Extreme actions now will certainly lead to the loss of world-class, scientifically-productive astronomical facilities in an unrecoverable manner. In implementing the recommendations of the PR, the NSF should adopt a forward-looking plan that both promotes growth and conserves vital capabilities needed by the astronomical community.

AURA supports many of the findings of the PR. We concur with PR support for the Large Synoptic Survey Telescope, the National Solar Observatory’s Advanced Technology Solar Telescope, and the Gemini Observatory. All of these facilities are (or will be) world-class, and all offer (or will offer) merit-based access for forefront science.

We are, however, extremely concerned about the negative impacts of removing instrumentation funding from facility budgets, consigning them to a general “MSIP” pool that competes with many other pressing concerns. If not properly managed, such action weakens U.S. national interests in strategic instrumentation development. At a minimum, if this approach is adopted, then a strategic instrumentation line within MSIP should be established to maintain an effective program for U.S. facilities. National observatories should retain a high degree of responsibility and authority for the development of the instruments for the telescopes they manage, whether such instruments are built in-house, or by external groups. A viable instrumentation program is also critical to the Gemini international partnership.

Although the overall thrust for divesting older facilities is well reasoned, AURA is extremely concerned about the timescale articulated in the NSF response to the Portfolio Review, which defines the decision deadlines to be the end of calendar year 2013. This timescale does not provide adequate opportunity to develop and implement alternate solutions and new partnerships for NOAO and NSO facilities. Indeed, this may arbitrarily preclude high-impact science programs now envisioned by NOAO and DOE (*e.g.*, cutting-edge community-based sky surveys). There are significant policy and legal questions that need to be resolved as well, and these also take time. AURA has begun identification of potential operators of divested facilities. AURA will continue to solicit expressions of interest and will work with partners to make full transitions.

AURA also opposes divestiture solutions that immediately reprogram operating budgets into facility closures. Under such solutions, science is poorly served: broad community access to facilities, especially for institutions without their own telescopes, is curtailed; the scientific workforce is directly harmed; and U.S. competitiveness is diminished.

The National Solar Observatory is the key provider of community access to solar telescopes and synoptic data. Synoptic data provided by the NSO Integrated Synoptic Program (NISP) is essential to the program recommended by the 2012 Solar and Space Physics Decadal Survey. We urge NSF to work with AURA to allow NSO sufficient time to responsibly divest the McMath-Pierce solar facility, and to assist NSO with involving Geosciences, operational agencies, and other national and international entities in supporting NISP.

The PR recommendations for NOAO offer challenges and opportunities. AURA asks the NSF to work with us and NOAO to redefine its role as *the* national observatory for OIR astronomy through the following actions.

1. Establish NOAO's central role in the future of US ground-based OIR astronomical facilities and instruments, including Gemini, LSST, DECam, BigBOSS, and GSMTs. In particular for LSST, a Community Science Center based at NOAO will significantly enhance the scientific return on Federal investment in this major project. AURA reiterates its endorsement of the NWNH recommendation that operational consolidation of Gemini and NOAO be considered.
2. Maintain peer-reviewed open-access telescope nights as a core component of the NOAO and NSF OIR portfolio, for example through continued use of the Mayall telescope while BigBOSS is being developed and deployed.
3. Charge NOAO to organize and facilitate well-instrumented telescopes within the U.S. System of telescopes, Federal and private, and to continue System coordination and merit-based public access through management of TSIP-type programs.
4. Support a key role for NOAO in building expertise in software and facilitating data analysis for the astronomical community of the future through development of scientific software and data products.
5. Provide adequate time (through the end of the current Cooperative Agreement, or at least a minimum of two years) to allow AURA and NOAO to pursue effective partnerships for the future of Kitt Peak as a site for ground-based tenant/partner astronomy.

Since its inception, AURA has been the advocate and agent for creating world-class facilities for all astronomers with access based on scientific merit, regardless of institution. The National Science Foundation has also historically supported the concept of merit-based public access to telescopes. As facilities and instruments evolve, natural tensions arise between existing facilities and future capabilities. AURA will strive to find a path forward through working with the NSF to develop a future where the best science is enabled by merit-based public access to world-class ground-based OIR telescopes and instruments.

Introduction

The Association of Universities for Research in Astronomy (AURA, Inc) was formed in 1957 by seven universities (University of California, University of Chicago, Harvard University, Indiana University, University of Michigan, Ohio State University, and University of Wisconsin) to provide access to state-of-the-art astronomical facilities for all American astronomers, on a scientific merit basis. The initial site for AURA facilities was Kitt Peak in Arizona; subsequently, AURA developed new facilities at Cerro Tololo in Chile. As AURA's role as the manager/operator came to include Cerro Tololo International Observatory, AURA expanded its membership.

In 1982, the AURA Board of Directors voted to "approve consolidation of all AURA-managed ground-based observatories (Kitt Peak National Observatory, Cerro Tololo Inter-American Observatory, and the National Solar Observatory with facilities at Sacramento Peak, New Mexico and Kitt Peak, Arizona) under a single Director."¹ The consolidated entity became the National Optical Astronomy Observatory (**NOAO**). Subsequently, the National Solar Observatory (**NSO**) was established as a separate AURA Center. Gemini Observatory (**Gemini**) was later added to the AURA portfolio. The construction of the Large Synoptic Survey Telescope (**LSST**) became an AURA-managed project and Center in 2011.

AURA now has 39 U.S. university members plus 7 international affiliated universities, and directly represents a major fraction of all U.S. optical/infrared (OIR) astronomers. AURA-operated facilities are the public ground-based OIR tools used by the U.S. astronomical community every night and every day. NOAO, NSO, Gemini, and LSST are all funded in large part by the National Science Foundation. Each is described in more detail below. (A fifth AURA Center, the Space Telescope Science Institute, is funded by NASA, and is not discussed in this white paper.)

AURA was founded on, and continues to support, the following principles for advancing scientific discovery in astronomy and astrophysics.

- ***Merit-based telescopic access to the sky maximizes scientific return on facility investments.***

The opportunity to conduct world-class science should be available to all, regardless of institutional affiliation. Indeed, it is through such merit-based competition for public access to the sky that NOAO and other AURA centers help ensure the best possible science. This open access to world-class tools is provided through public telescopes, as well as initiatives on private ones. Because of AURA's formation and the leadership it provides, the scientific playing field is more level now than it has ever been and the scientific return on public investment is excellent. Merit-based science by individuals using the NOAO System has led directly to several paradigm-changing breakthroughs, including the discovery of dark energy (via Type Ia supernovae) and inferred gravitational effects of dark matter.

¹"AURA and Its US National Observatories", by Frank Edmonson, 1997

• ***Forefront innovations in facilities and technology drive scientific discovery.***

World-class facilities are often the largest and newest. Innovative instrumentation also transforms older or smaller telescopes into world-class performers. World-class science answers the questions we ask today, and challenges old paradigms to discover tomorrow's key questions. It drives outward the boundaries of the known, often in quantum leaps as new telescopes and/or new instrumentation become available.

Inherent in science is a natural tension between the need to develop new facilities and instruments, and the desire to exploit the stable and reliable performance provided by existing facilities and instruments. AURA has long understood the tension between these vital paths to scientific success. We empower our Centers, via community-led oversight councils and user committees, to constantly assess the appropriate balance in this tension. AURA acknowledges that limited resources demand tough choices, and AURA has over 50 years of experience in working closely with the astronomical community in making such choices.

AURA Facilities in the Portfolio Review

In 2012, the Astronomy (AST) Division of the Math and Physical Sciences (MPS) Directorate of the National Science Foundation commissioned a "Portfolio Review" (PR).² The review was designed to examine the balance across the entire portfolio of activities supported by AST. The stated primary goal of the review, and of any resulting adjustments of the AST portfolio, was to maximize progress on the compelling science described in Chapter 2 of the Astro2010 Decadal Survey³ (NWNH). AST provided two challenging funding scenarios, Scenario A and a more severe Scenario B.

In its report, the Portfolio Review Committee articulated two key principles that drove their decision-making processes. First, "**AST should maintain substantial funding to AAG⁴, ATI⁵, and a mid-scale program as a top priority**" (PR Page 118). Justification for this principle was that maintaining the status quo for facilities at the expense of these other programs would be "disaster for the field," that these programs provide the "free energy [for] new ideas & projects," and that they serve as a "capacitor against budget fluctuations"⁶ (Pages 118-119).

² http://www.nsf.gov/mps/ast/portfolioreview/reports/ast_portfolio_review_report.pdf

³ New World, New Horizons in Astronomy and Astrophysics, http://www.nap.edu/catalog.php?record_id=12951

⁴ The Astronomy and Astrophysics Grants program – the general, competitive program of Principal Investigator grants that are not tied to any specific facility

⁵ The Advanced Technology and Instrumentation program – a separate program for supporting small to medium sized instrument development

⁶ In the sense of being able to absorb year-on-year budget fluctuations better than the facilities.

Second, “AST should plan its facility portfolio assuming the more pessimistic range of forecasts” (e.g., Scenario B).

The actual distinction between the two Scenarios was moot with respect to AURA, because the recommendations for AURA-managed facilities were identical, as shown in Table 1. Table 2 summarizes how AURA-managed facilities fared in the final PR priorities. Table 3 shows a more detailed breakout for Priority 2 facilities from a presentation by AST Director Dr. James Ulvestad to the AAAC⁷ on 25 September 2012.

Programs (All budget values in \$M)	“current”	A		B	
	FY10-12	FY17	FY22	FY17	FY22
National & International Observatories					
NOAO	27.0	14.5	16.4	14.5	16.4
Gemini	20.1	17.0	19.2	17.0	19.2
NRAO	43.1	25.0	28.3	25.0	28.3
EVLA construction	2.5	0.0	0.0	0.0	0.0
ALMA Ops & Development	23.4	40.8	46.2	40.0	40.0
Arecibo	6.7	4.2	4.8	4.2	4.8
NSO sans ATST	9.1	4.8	2.3	4.8	2.3
ATST	1.3	16.0	19.5	16.0	19.5
LSST Ops	0.0	0.0	26.5	0.0	26.5
SIP: CCAT Construction & Ops	0.0	10.0	7.4	0.0	0.0
SIP: GSMT	0.0	0.0	20.0	0.0	0.0
Total for Observatories	133.2	132.3	190.5	121.5	156.9
Purchasing power: Observatories	100%	86%	109%	79%	90%

Table 1. Comparison of facility funding in Scenarios A and B. For AURA facilities (highlighted in red), there is no difference between the scenarios. Adapted from Table 10.1, PR Page 123.

Priority	Comments	Facilities (AURA in red; Recommended <u>underlined</u>)	PR Rec
0	“future large facilities”	<u>LSST</u>	9.1
1	“essential”	<u>ALMA</u> , <u>VLA</u> , <u>ATST</u> , <u>Gemini-South</u> ¹ , <u>Blanco</u> , <u>Dunn Solar Telescope</u>	9.15
2	“remaining facilities in priority order (highest to lowest)”	<u>Gemini-North</u> ¹ , <u>Arecibo</u> ² , <u>Mayall</u> , VLBA, <u>NISP</u> ³ , GBT, <u>SOAR</u> ² , <u>WIYN</u> , and <u>McMath-Pierce</u>	9.16

¹ Cost capped at \$17M (FY17) excluding major instrumentation

² Reevaluate later in decade

³ Cost capped at \$2M (FY17) annually; divest if no partner found

Table 2. AURA Facilities in the PR Priorities. Adapted from Table 10.1, PR Page 123.

⁷ Astronomy and Astrophysics Advisory Committee (AAAC); link to Dr. Ulvestad’s presentation at <http://www.nsf.gov/attachments/125454/public/AST-PR-AAAC-25Sept.pdf>

Priority	Comments	Facilities
2	“partnerships, ‘keep for now,’ re-evaluate in 4-5 years”	<u>Gemini-North</u> ¹ , <u>Arecibo</u> ² , <u>NISP</u> ³ , <u>SOAR</u> ²
3	“divest expeditiously; i.e., move forward on relatively short time scale in order to realize savings by 2017”	Mayall, VLBA, GBT, WIYN, and McMath-Pierce

¹ Cost capped at \$17M (FY17) excluding major instrumentation

² Reevaluate later in decade

³ Cost capped at \$2M (FY17) annually; divest if no partner found

Table 3. AST Interpretation of PR Priority 2. AURA facilities are highlighted in red; “recommended” programs are underlined. From a presentation to the AAAC by Dr. James Ulvestad.⁸

In reviewing the PR recommendations, and these AURA responses, AST should remain open to less pessimistic realities, should they arise, so that properly measured responses are able to prevent irrevocable damage to vital Federal assets. This may include, for example, not adopting the Scenario B facilities reduction plans if budgets are found to be near or beyond Scenario A values. In the following sections, we review the PR recommendations for each AURA-managed Center, followed by our assessment of impacts. We finish with a vision for the future.

Large Synoptic Survey Telescope (LSST)

LSST will be a wide-field OIR imaging facility, and is expected to complete construction near the end of the decade. It will have a clear aperture equivalent to that of a 6.5-m mirror, and a field of view of 10 square degrees. LSST will operate primarily in a full-time survey mode; its open data model will include rapid dissemination of transient alerts.

LSST was highest priority for new large ground-based astronomy projects in the NWNH report, and the Portfolio Review concurred. The PR recommended that the LSST begin construction with an MREFC⁸ start in FY14, or as soon as possible thereafter, so as to maintain an expected start of operations in late 2021 or early 2022. They further recommended that the Federal government (NSF and DOE), as the majority LSST partner, avoid any contractual structure that prevents it from unilaterally reviewing and setting the Federal operations support level. The PR indicated that synergies among LSST and other southern facilities played a key role in its prioritization process.

AURA Assessment of LSST Recommendation

We concur with the PR recommendations regarding LSST and look forward to working with the NSF and the LSST Corporation to make LSST a success.

⁸ Major Research Equipment and Facilities Construction, a special program within NSF for funding large projects.

National Solar Observatory (NSO)

NSO is the national center for ground-based observations of the Sun. The solar community uses instruments at its current major telescope facilities, the Dunn Solar Telescope (DST) and the McMath-Pierce Solar Telescope (McM-P). NSO also built and operates two synoptic facilities—the *Global Oscillation Network Group* (GONG) and the *Synoptic Optical Long-term Investigation of the Sun* (SOLIS). Together these facilities form the instrumental and observational core of the *NSO Integrated Synoptic Program* (NISP). NSO is also initiating construction in Maui, Hawaii, of the Advanced Technology Solar Telescope (ATST), a 4m-class ground-based telescopic facility that complements synoptic programs by providing unprecedented high angular resolution and high sensitivity measurements.

The PR Committee classified the DST as essential and world-class. They recommend that NSO should operate DST to within two years of ATST first light, as well as utilize it as a test bed for development of critical ATST instrumentation. McM-P, in contrast, was the lowest ranked facility in the PR, and divestment was recommended.

The PR recommended that NSO develop a NISP plan that includes GONG and SOLIS but limits AST funding to no more than \$2M (FY17) annually. Expanded partnerships for operations should be sought, and the plan should be implemented in time for the FY16 budget. If a partner cannot be found, the PR recommends that NISP should be divested entirely.

The PR Committee expressed concern regarding the open skies policy⁹, and suggested that NSF should “*look to leverage its assets to maximize the ability of U.S. astronomers to access non-U.S. capabilities or to obtain contributions toward operations and maintenance costs for U.S. facilities with high fractions of foreign users.*” The PR specifically addressed ATST, suggesting that NSF might: “*seek collaboration on ATST operations funding from foreign partners; negotiate for increased access to European solar facilities as the Dunn and McMath-Pierce telescopes ramp down in advance of ATST; or find foreign collaborators to contribute to ATST through supplying instrumentation that would be available to the broader community in return for some guaranteed access and for continued competed open access.*”

AURA Assessment of NSO Recommendation

AURA concurs with continued support of DST, particularly as a test-bed for ATST instrumentation and technology development. McM-P was already slated for divestiture as part of the NSO long-range plan, though not as quickly as the NSF indicates in its response to the PR.¹⁰ We urge AST to allow NSO sufficient time to responsibly divest McM-P.

⁹ Under open skies, scientists from any country may apply for merit-based access to U.S. national facilities. Open skies has been the operating policy of the NSF for decades.

¹⁰ NSF MPS/AST Response to Portfolio Review Report, <http://www.nsf.gov/mps/ast/portfolioreview/reports/ast-response-v1-final-0830-rev-final.pdf>

AURA strongly supports NISP, noting that the 2012 Solar and Space Physics Decadal Survey recommended NISP highly, saying “*Full-Sun measurements by existing synoptic facilities (e.g. GONG, SOLIS...) ... have the potential to balance the narrow field of view captured by [the future Advanced Technology Solar Telescope], and are essential for the study of transient phenomena...*”¹¹ AURA will pursue potential partnerships for NISP, including the NSF Geoscience division. Divestment of NISP would not be consistent with the needs of the solar community or the recommendations of the decadal survey.

AURA shares the concern of the Portfolio Review Committee regarding open access to the Sun (and night sky). Establishing additional foreign collaborations, as recommended in the Portfolio Review for ATST, is certainly an avenue to pursue, though it must be balanced against the difficulties involved with complex contractual structures. The NSO already has operating instruments at the DST supplied by international partners, and one ATST facility instrument will be contributed by an international partner under conditions recommended by the PR.

Gemini

The Gemini Observatory is a U.S. and international partnership that operates two 8-m telescopes, and is a vital part of the U.S. System. With one telescope in Chile (Gemini-South) and the other in Hawaii (Gemini-North), Gemini provides the U.S. community access to 8-m class facilities over the entire sky. Gemini was supported in the PR recommendations, with the caveat that instrumentation funding be separated into the MSIP program.

AURA Assessment of Gemini Recommendation

AURA supports the PR recommendations to retain and operate the Gemini telescopes. Although the two Gemini telescopes were evaluated independently by the PR, they were designed, built, and are operated as a single observatory and AURA cautions against separating the management of the two telescopes. Doing so would have a profound negative impact on Gemini’s ability to deliver the same services at a given cost. AURA is concerned in general by the trend to chop the OIR portfolio into many smaller pieces. This runs counter to the goals of high efficiency, smooth operations, and cost control.

A significant concern for Gemini is the proposal to move future instrumentation funding into a generic MSIP pool. This could lead to the loss of strategic future instrumentation for Gemini, and will weaken the U.S. vis-a-vis the international partners; indeed it may violate the current partnership agreement.

A core AURA principle for its facility management (all AURA facilities, not just Gemini) aligns responsibility with authority to deliver world-class science tools to

¹¹ Page C-2, *Solar and Space Physics: A Science for a Technological Society*, http://www.nap.edu/catalog.php?record_id=13060. We note that the decadal survey was released after the PR process had been completed.

its community. Because forefront instrumentation plays such a crucial role in an observatory's competitiveness, AURA advocates for retaining significant responsibility and authority at each Center to manage the instruments developed for their telescopes, whether that development is performed at a Center or done by external teams. By divorcing instrumentation from facilities, the MSIP proposal breaks with this crucial principle. If other forces drive this decision to move instrumentation out of facilities and into an MSIP pool, then a strategic instrumentation line within MSIP should be established to maintain an effective instrumentation program for U.S. facilities, including Gemini. In any case, AURA advocates that AST retain the flexibility to enter into the renewal of an effective international agreement, even if retention of a Gemini-controlled instrumentation development fund is a condition for international participation.

National Optical Astronomy Observatory (NOAO)

NOAO operates two main facilities, the telescopes on Cerro Tololo and Cerro Pachón in Chile, anchored by the Blanco 4-m, and the telescopes on Kitt Peak in Arizona, anchored by the Mayall 4-m. Another major role envisioned by the NSF, imbedded in NOAO's cooperative agreement, is to "represent NSF in community-based planning, design, and development efforts for potential new Federally-funded initiatives in astronomy."¹²

Continued operation of the Blanco was supported in the Portfolio Review. The Mayall Telescope and other facilities on Kitt Peak were recommended for divestment, even though the Mayall was ranked at higher priority than two facilities that were not recommended for divestment (NISP and SOAR). The reasons were diverse, but focused mainly on location (the perceived synergies with facilities in the South), cost, and other commitments (to other nations and/or other national U.S. programs).

AURA Assessment of NOAO Recommendation

The PR recommendations mandate fundamental changes in the U.S. national optical and infrared ground-based observatory model. These recommendations, which include NSF divestment of all NOAO facilities on Kitt Peak, will require a new model, if NOAO is to continue to facilitate the best public-access merit-based science by the astronomical community.

AURA is aware that the *status quo* is untenable in the current fiscal climate, yet we urge caution in determining future directions for NOAO. Several points should be considered when implementing the PR Report.

NOAO manages a coherent U.S. System. NOAO's leadership of the OIR System has been crucial for coordination among many OIR facilities, both Federal and private. NOAO management of TSIP provides crucial public access to premier private

¹² NSF's Cooperative Agreement CA 409 AST 0809409 for NOAO.

facilities. This role was strongly endorsed in the ALTAIR¹³ survey and will be vital for the future, especially if public access to Federal facilities is greatly decreased. AURA facilities (e.g., Mayall, Blanco, Gemini North and South) are key nodes in the U.S. OIR system, as shown in the System Roadmap survey in late 2011¹⁴. Breaking up our national facilities into increasingly separate administrative entities (e.g., NOAO North and South, Gemini North and South) makes little economic sense, reduces the System effectiveness, and fragments and dilutes U.S. leadership in ground-based OIR astronomy. We urge the NSF to be sensitive to the critical role played by NOAO in organizing the diverse components of the U.S. system (more on LSST below). NWNH specifically supported continued (indeed, increased) access to Gemini, as well as better coordination among the U.S. OIR facilities including NOAO and Gemini. AURA reiterates its endorsement of the NWNH Recommendation (p. 179) to consider consolidation of Gemini and NOAO under a single operational structure¹⁵. In the meantime, AURA commends the NSF for placing the NOAO Director on the Gemini Board. This will help ensure better coordination between the two major observatories on which the U.S. community depends.

Individual scientists produce world-class science using NOAO facilities. NOAO's open-access model for individual scientists has been highly successful, leading directly to several paradigm-changing breakthroughs including the 2011 Nobel-prize winning work on dark energy. It is essential that AST maintain, within its Portfolio, merit-based competitive access to ground-based OIR telescope and instrument facilities for smaller-scale, individual peer-reviewed projects, as recommended by the 2006 NSF Senior Review¹⁶ and NWNH.

NOAO works to ensure its facilities are world class. NOAO is constantly working to ensure its facilities stay at the cutting edge of astrophysics research via new instrumentation. The recent interest on the part of the Department of Energy (DOE) in projects such as DECam on the Blanco, and BigBOSS on the Mayall, are a testament to this. DOE is investing time, personnel, and significant funding in these projects.

We appreciate the overall goal of the NSF to maximize scientific return within the budget. Actions on Kitt Peak, however, should be flexible enough to “minimize collateral damage” to other tenants while enabling transformative projects such as BigBOSS on the Mayall. AURA will engage the community to identify potential operator consortia, and asks that NSF help us ease the path to viable partnerships

¹³ “Final Report of the Committee on Access to Large Telescopes for Astronomical Instruction and Research (ALTAIR),” http://www.noao.edu/system/altair/files/ALTAIR_Report_Final.pdf

¹⁴ “Ground-based O/IR System Roadmap Committee Community Survey,” <http://ast.noao.edu/sites/default/files/SummaryDocumentSystemRoadmapCommunitySurveyV1.5.pdf>

¹⁵ “Report of the AURA Consolidation Working Group,” http://www.aura-astronomy.org/news/2011/ACWG_Report_Rev_Nov29_2011.pdf

¹⁶ “From the Ground Up: Balancing the NSF Astronomy Program,” http://www.nsf.gov/mps/ast/seniorreview/sr_report_mpsac_updated_12-1-06.pdf

that maintain top-quality astronomy. Such consortia might arise before, during, or after, other dedicated programs such as BigBOSS, for example. AURA is particularly concerned about the very short time scale articulated by the NSF for identifying future partners for the telescopes identified for divestment; the end of calendar year 2013 is simply too soon to identify partners and negotiate transitions.

We reiterate concern about instrument funding leaving facilities for a general MSIP pool.

NOAO's evolving role presents an opportunity to represent NSF and the U.S. community in the newest Federally-funded initiative in astronomy, LSST. When construction of LSST is complete, the US community must be prepared to fully utilize this new facility. Between now and operations start, NOAO should -- in collaboration with the LSST Corporation and Project Office -- be a nexus for community engagement with LSST via a Community Science Center (CSC). It should provide user support for installing data management products, including LSST-released image processing software and image simulations; enable community pathfinder efforts to characterize and follow-up time-domain phenomena; provide a feedback/input interface between the community and the LSST Project; work with astronomers to develop spectroscopic follow-up capabilities; host topical workshops; and provide documentation and training in the use of LSST databases and querying tools.

In summary, AURA seeks to work with NOAO and the NSF to redefine NOAO as the U.S. national observatory for ground-based OIR astronomy through the following actions.

1. Establish NOAO's central role in the future of US ground-based OIR astronomical facilities and instruments, including Gemini, LSST, DECam, BigBOSS, and GSMTs. In particular for LSST, a Community Science Center based at NOAO will significantly enhance the scientific return on Federal investment in this major project. AURA reiterates its endorsement of the NWNH recommendation that operational consolidation of Gemini and NOAO be considered.
2. Maintain peer-reviewed open-access telescope nights as a core component of the NOAO and NSF OIR portfolio, for example through continued use of the Mayall telescope while BigBOSS is being developed and deployed.
3. Charge NOAO to organize and facilitate well-instrumented telescopes within the U.S. System of telescopes, Federal and private, and to continue System coordination and merit-based public access through management of TSIP-type programs.
4. Support a key role for NOAO in building expertise in software and facilitating data analysis for the astronomical community of the future through development of scientific software and data products.
5. Provide adequate time (through the end of the current Cooperative Agreement, or at least a minimum of two years) to allow AURA and NOAO to pursue effective partnerships for the future of Kitt Peak as a site for ground-based tenant/partner astronomy and for our National OIR Observatory.

AURA Vision for the Future

AURA is an association of universities pursuing research in astronomy. The fundamental mission of AURA is to develop and operate world-class facilities on behalf of the NSF, NASA, and U.S. astronomical community. Researchers at AURA member institutions and in the U.S. community benefit from the state-of-the-art instruments and telescope facilities AURA operates, but they also depend on the individual PI grants awarded by the NSF. This makes AURA highly cognizant of the importance of portfolio balance for both today and the future.

Newer facilities and instruments have larger operating budgets than the ones they replace. Bleak budget conditions, such as those assumed in the Portfolio Review, would drive a serious decline in capabilities and access. The best remedy would be to restore NSF and AST budgets so that capability and access grow, thereby allowing U.S. astronomers to maintain world-leadership in astronomy and astrophysics. AURA will work with its member institutions and U.S. political leaders to try to put NSF funding back onto a sustainable growth path.

AURA seeks to enable world-class research across a broad suite of facilities and instruments. NOAO's "System" approach embodies this spirit, and AURA stands behind that philosophy. LSST is a telescope of the future that drives new paradigms for astronomy. AURA strongly supports LSST development and operation, and is working to see it perform at the cutting edge of astronomical productivity. AURA continues to support the Gemini Observatory, offering the U.S. community 8-m telescopic access to the entire sky. AURA supports the NSO and the ATST as the future of solar research.

NOAO has central roles to play in the future of U.S. astronomy, including: deep and close engagement with LSST, including operating an LSST Community Science Center; deeper and more positive engagement with Gemini on behalf of the U.S. community including a long-term assessment of Gemini's connection with the U.S. national observatory at the appropriate time; and enabling major new wide-field survey programs on Blanco and Mayall with DOE-funded instrumentation such as DECam and BigBOSS. Evolution of these NOAO roles will yield significant benefits to the U.S. astronomical community.

For the future, when GSMTs are built and operating, AURA and NOAO aspire to deeper involvement with these facilities, because we believe the best science is enabled when telescope access is based on vigorous, competitive, scientific merit.

With good stewardship of our existing sites during this time of transition, coupled with careful planning, a future will be reached where the NSF supports world-class facilities for the U.S. community, and other entities operate world-class facilities that are accessible to the U.S. community via the NOAO System supported by NSF. Until then, as facilities and instruments evolve, as budgets ebb and flow, and as natural tensions arise between existing facilities and future capabilities, AURA will strive to best manage those tensions, and to find the path forward that enables the best science for the U.S. astronomical community.