

Giant Segmented Mirror Program Management Plan

May, 2007

The U.S. must seek any and all avenues to access to extremely large telescopes. AURA has taken on the role of National Program Manager working with the Thirty Meter Telescope (TMT) program, the Giant Magellan Telescope (GMT) program, and NSF to effect the most favorable and sustainable outcome for achieving a Giant Segmented Mirror Telescope (GSMT) sometime during the JWST era.

Top Level Goals

The top-level goals of this management plan are to establish the process, decision criteria and general schedule for achieving access to extremely large telescope facilities by the U.S. community. Appendix I summarizes the overall AURA role and mission in carrying out this plan. In fulfilling this mission, AURA has adopted the following objectives:

- Providing access to extremely large telescopes during the JWST era, at a sufficient number of nights to meet community needs
- Providing direct support for operations that will ensure the efficient and effective use by community observers
- Ensuring that supporting facilities (the ensemble of telescopes comprising the US system) make it possible for investigators at all institutions to plan and execute programs on extremely large telescopes.

Background

Within the US there are two predominantly privately funded Giant Segmented Mirror Telescope activities: Thirty Meter Telescope (30m) and the Giant Magellan Telescope (24.5m). TMT & GMT have invested substantial resources in design and development. GMT and TMT have essentially identical science cases that are consistent with GSMT Science Working Group science case. Both projects are planning overlap with JWST, as does ALMA. The scientific synergy that comes with those overlaps has been persuasive.

Each GSMT is at present designed as a stand-alone, general purpose telescope with:

- Wide-field, seeing-limited or ground-layer Adaptive Optics corrected for multiobject optical spectroscopy
- High resolution, seeing-limited optical spectroscopy
- Adaptive Optics fed instruments (Multi Conjugate Adaptive Optics imagers; Integral Field Unit spectrographs; Extreme Adaptive Optics imagers.

Beginning in April, 2007, the two projects have initiated discussions aimed at defining a combined science case. This could result in a single merged project, or a two-telescope

complementary science case. The goal for these discussions is to establish a baseline for the combined science case by October 1, 2007.

Options for Federal Support

This document is intended to provide a plan and options for Federal support for a GSMT. Federal Support for both projects has been provided thus far by a grant administered by AURA aimed at technology development. It is envisioned that this grant will continue to provide partial support for each project over the period leading up to the next decadal survey. During this period, both projects are expected to reach full design maturity along with potential convergence paths.

Following this, at least two paths can currently be envisioned—one that provides substantial construction and operations funding for a single telescope, and one that provides operations support for one or both telescopes. In addition, it is possible to define a third option, not exclusive to either of the above, which provides for a level of Federal support for instrumentation. All options are intended to establish public observing time in proportion to the Federal investment.

A final decision to proceed must be made in a contemporary context incorporating a realistic budget outlook, other astronomy priorities, and the evolution of the community over the intervening decade. This Program Plan will evolve to define different decision paths that could be followed based on the outcome of the next Decadal Survey.

In order to inform that process, a Design Reference Mission (DRM) will be developed by the second quarter of fiscal year 08. AURA will work with the GSMT Science Working Group¹ to develop the DRM to set scientific expectations for candidate designs and quantify performance vs. aperture. This will be traceable to the science goals articulated by the Decadal Survey and the science cases that have evolved since then. It will comprise not only the large survey like projects, but would address the nature and level of PI-class projects as well as archival research. This Design Reference mission will be reviewed on an annual basis thereafter and is expected to evolve as the community increases its engagement in potential GSMT science.

¹ The GSMT Science Working Group would need to be reconstituted to have broader community representation as well as balanced representation from both projects.

Steps Towards a National GSMT Program

January 23, 2007

A key result of the Senior Review is the observation that coordinating the design and technology development for major projects like the GSMT, expediting passage through the various phases of the NSF MFREC process and ultimately preparing for the operations and science phases requires leadership and planning at a level unprecedented in NSF. In view of this, in October 2006 NSF's Division of Astronomical Sciences (AST) approached AURA/NOAO, the Thirty Meter Telescope (TMT), and Giant Magellan Telescope (GMT) to begin discussing the most productive approach to developing a GSMT program in a manner that best serves U.S. astronomy, capitalizes on the basic purpose of the national observatory, preserves the strength of the non-federal investment in the development of the next generation of optical/infrared telescopes in the U.S, and assures a fair and balanced approach to both projects

As a result of those discussions, and with the full agreement of all of the parties, NSF has asked that AURA/NOAO act as NSF's "Program Manager" for the GSMT Technology development effort at a national level in a manner similar to the role played by NASA's major Centers for the development and operations of various space missions. In this role NSF expects that AURA/NOAO will, *inter alia*:

- As recommended by the Senior Review, promote the development of both TMT and GMT at a pace that recognizes the timescales of the MREFC and federal budget processes
- Understand and champion the national needs for a GSMT in any public/private partnership. This implies:
 - Establishing and running a national community Science Working Group
 - Establishing and maintaining the national Design Reference Mission (DRM) to set scientific performance expectations for candidate designs
 - Providing an independent evaluation of the community operational needs, costs, and scientific sociology of a GSMT – then leading the community in understanding the implications of these for both a GSMT and the necessary underlying instrumental and human resource capability.
- Advise NSF about engineering design performance necessary to respond to the DRM and the technical progress of both projects; this should not be interpreted as AURA/NOAO holding independent reviews of either project.
- Assure a healthy scientific enterprise in the GSMT era. In this regard, AURA/NOAO should lead in defining "the system", being certain that it addresses an appropriate range of apertures, suite of instrumentation, and

utilization of existing non-federal facilities where available. AURA/NOAO must assure that this system is robust against the delays and uncertainty in the path to an eventual GSMT.

In the longer term:

- Identify areas of commonality or overlap in technology with a view towards optimizing federal and private budgetary commitments
- Carry out any appropriate independent technology efforts of importance to both programs.
- Assist NSF in defining and realizing possible alternatives to a competitive down-select,
- AURA/NOAO will advise NSF on options for international collaboration at a governmental level
- NOAO will be the NSF/national presence in any eventual partnership that operates the GSMT.

In order to respond to the new role as defined by NSF, AURA/NOAO is restructuring its existing relationships with both projects, withdrawing from any direct partnership participation, and establishing symmetric interfaces with both projects. AURA, NSF, TMT, and GMT are in active discussion about the necessary means and timescales to address any previous imbalances in support for the two projects.