1 EXECUTIVE SUMMARY

The Giant Magellan Telescope (GMT) is a collaborative effort between universities and research institutions to build a next-generation extremely large telescope for astronomical research at optical and infrared wavelengths. GMT combines proven technology in primary mirror fabrication with the latest innovations in adaptive optics to produce a telescope with unique and powerful capabilities.

The design of GMT aims to achieve outstanding performance in the following areas:

- Excellent image quality due to superior performance of its optics and an excellent site.
- Diffraction-limited adaptive optics with a minimum number of reflecting surfaces.
- Wide-field operation at visible wavelengths.
- Low thermal background due to its IR-friendly Optical Support Structure (OSS) design.
- High wind resistance due to its compact and stiff structure.
- Rapid instrument switching capability to respond to changing conditions.
- Observing mode flexibility to allow GMT to make best use of these capabilities.

These features will enable GMT to excel in several forefront areas of astrophysics as identified in the National Academy of Sciences Decadal Survey report: *Astronomy and Astrophysics in the New Millennium*.

Over the last three years the GMT Project has developed the concept for an extremely large telescope that draws on the experience of the participating scientific/engineering teams in the areas of optics, telescope structures, and instrumentation. GMT's primary mirror consists of seven 8.4 m segments cast and polished at the University of Arizona's Steward Observatory Mirror Lab. The technology has been developed on a succession of 3.5 m, 6.5 m, and 8.4 m mirrors. The GMT mirrors are mounted in a structure that has been designed for compactness and very high modal performance. The secondary mirror, with seven fast-steering segments aligned to the primary mirrors, enables excellent correction of alignment errors and wind shake.

GMT will use adaptive optics (AO) to correct wavefront errors from the atmosphere and wind-induced telescope shake. Various AO modes of operation are being planned for first-generation deployment: all-sky Laser Tomography AO, Ground-layer AO, and high-contrast, high Strehl-ratio Extreme AO. The key element in all cases is a segmented deformable secondary mirror that allows AO operation with just two mirrors for high throughput and low IR background.

A suite of instrument concepts has been developed that provide a broad range of capabilities for achieving the science objectives of the project. These cover a wavelength range from the atmospheric cut-off in the UV to 25 μm in the thermal IR. Both seeing-limited and AO diffraction-limited instruments are included.

The GMT enclosure is cylindrical in shape and stands approximately 65 meters high. The telescope rotates independently of the enclosure down to a minimum elevation angle of 25°. The vertical and horizontal shutters double as deployable wind and moon screens. The enclosure has been designed with numerous ventilation windows to promote rapid equilibration of the dome structure to the nighttime air temperature in order to prevent dome seeing. Additional buildings will provide offices, laboratory space, and facilities for maintaining and operating the telescope.

The baseline location for GMT is the Las Campanas Observatory in Chile (LCO), where there are several potential sites. LCO is well known for its superb seeing and overall excellent observing conditions. Final site selection will be made in roughly 2-1/2 years following the results of the site testing program which is currently underway.

The GMT schedule calls for design/development to take place over the next four years with major construction of the telescope and mountain facilities starting in early 2010. Commissioning of the telescope and instruments will begin in early 2015 with full science operations expected at the start of 2016.