

Office of the President

TO MEMBERS OF THE BOARD OF REGENTS:

DISCUSSION ITEM

For Meeting of July 30, 2020

THIRTY-METER TELESCOPE UPDATE

EXECUTIVE SUMMARY

The University has been a world leader in astronomy and astrophysics research for more than 125 years. The Lick (1888) and W.M. Keck (1993) observatories have created opportunities for forefront research that attract top faculty and researchers in the field of astronomy and astrophysics. The outcomes in new knowledge generated, external funding generated, and the remarkable record of national and international awards going to UC researchers are well documented. University of California researchers have also been leaders in developing sophisticated technologies required to advance astronomy facilities. There are vibrant and growing astronomy and astrophysics programs on nine of the University's campuses.

The purpose of this item is to provide the Board with an update on ongoing activities related to the Thirty Meter Telescope (TMT) since the Board approved it in March 2014. This briefing will provide an overview of prior Regents actions, status of budget and funding commitments, project challenges, alternatives, and engagement with the National Science Foundation.

BACKGROUND

On March 19, 2014 the Regents approved the University's participation in and commitment of resources to the formation and operation of a nonprofit limited liability company, the TMT International Observatory LLC (TIO), which is intended to construct, own, and operate the Thirty Meter Telescope (TMT) project (the Project). The TMT, when built and operational, will be one of the premier scientific facilities of this century. The University's membership in TIO was viewed as a strategically important investment for the next generation of the University's astronomy community and to carry out the University mission of forefront research and generation of new knowledge. The Regents approval authorized:

1. The commitment and contribution of up to \$175 million¹ of University funds and resources toward construction of the Project,
2. The commitment and contribution of additional University funds and resources toward the ongoing operation of the Project, and

¹ All amounts are in U.S. Dollars.

3. The University's entering into the TIO Limited Liability Company Agreement (LLC Agreement) and undertaking the obligations set forth therein.

To date, the financial authorities for each of the TIO members²:

1. Signed the TIO Master Agreement and LLC Agreement to become members of TIO and
2. Voted on and approved:
 - a. The initial "Decision to Proceed" with the partnership and site preparations in 2014, and
 - b. A subsequent "Decision to Proceed" with full construction in 2015 that bound each of the members to deliver certain contributions to the pre-construction, construction, operation and decommissioning of the Project.

See Attachments 1 and 2, respectively, for additional historical background information on the University's involvement in the Project and a timeline prepared by TIO that sets forth various material Project events.

FUNDING OBLIGATIONS

The University's funding for the preliminary design, preconstruction, and construction phase of the Project was to come from a \$125 million pledge from the Gordon and Betty Moore Foundation (GBMF) and \$50 million in University matching funds expected to be raised by campus leaders through philanthropic support from University donors. Given delay in construction (see below), the University has paused its fundraising efforts. In order to comply with its matching funding obligations to GBMF, the University has been meeting its funding obligations pursuant to various internal loans with repayment expected to occur from either subsequent fundraising efforts or any available surplus funding resulting from a decrease in operational funding to Keck³.

The University's remaining funding obligation to the Project is approximately \$39.11 million, of which the University is required to contribute \$19.86 million, assuming GBMF contributes

² The TIO financial members include: (i) the University, (ii) Caltech, (iii) Association of Canadian Universities for Research in Astronomy as the Scientific Authority and the Government of Canada, acting by and through the National Research Council of Canada as the Financial Authority (Canada), (iv) People's Republic of China, acting by and through the National Astronomical Observatories of Chinese Academy of Sciences as the Scientific Authority on behalf of the Chinese Academy of Sciences, and the Ministry of Science and Technology as the Financial Authority (China), (v) Republic of India, acting by and through the Department of Science and Technology in the dual capacity as the Scientific and Financial Authority (India), and (vi) Japanese astronomy institutions, acting by and through the National Astronomical Observatory of Japan as the Scientific Authority and the National Institutes of Natural Sciences as the Financial Authority (Japan). Each of the University and Caltech are all-cash members of TIO with substantially similar funding obligations. Each of Canada, China, India and Japan have obligations to provide a combination of in-kind and cash support to the Project.

³ Note that the University is responsible for its ownership share of the total operating costs of the Project estimated as of time of formation of TIO at \$39 million/year (in FY2012 Dollars). Funding for operations was expected to become available with certain scheduled reduction of the University's portion of the Keck operating costs effective as of April 1, 2018. Some of those operating cost savings are being used to make the University's portion of its cash contribution obligations to TIO.

\$19.25 million. These obligations are expected to be met on or before the end of calendar year 2021.

TIO AND MAUNAKEA IN HAWAII

The TMT project (Project) has engaged with the local community in Hawaii for more than a decade, working with the Native Hawaiian cultural practitioners to identify design choices for the TMT that minimize adverse impacts on Maunakea while creating local programs for Big Island students and teachers that provide educational and STEM workforce development benefits. The TMT project also agreed to paying substantial annual rent that provides resources for stewardship of the Science Reserve at Maunakea. Many in Hawaii, including some in the Native Hawaiian community, saw the TMT approach as setting a new higher standard for developing a project within Hawaii by integrating local and cultural interests into the fabric of the project.

Nevertheless, there is a group of peaceful opponents (primarily comprised of Native Hawaiians) who are strongly opposed to the Project. They have taken legal and other actions, including road blockades, social media and grassroots campaigns, to prevent the Project from being able to access Maunakea to begin construction. This has resulted in a significant delay in the Project that was slated to begin construction in 2015. Before Covid-19 travel restrictions were imposed, members of the Project team and TIO Board were involved in a mediation process called *ho'oponopono* with various Native Hawaiian elders. Although there is hope that *ho'oponopono* will result in some level of reconciliation with the larger Native Hawaiian community, it is not reasonable to expect the process to ever result in full support of the project. The possible contraction and concept of TMT on Maunakea has become a rallying symbol for many of the historical and current injustices that affect Native Hawaiians, even though it is unrelated to these real and serious issues.

THE OVERALL MASTER LEASE FOR THE SCIENCE RESERVE AT MAUNAKEA

The University of Hawai'i subleases the Maunakea site to the Project pursuant to a Master Lease that covers land in the astronomy zone on Maunakea. The Master Lease for the astronomy zone expires in 2033 and would need to be extended in order for our W.M. Keck telescopes as well as the Project to be able to continuously operate on the mountain, assuming construction occurs. The University of Hawai'i has started the process to seek renewal of the Master Lease, but there is a risk that the site for the TIO Project will not be available beyond 2033. We are monitoring this development closely.

PROJECT COST INCREASE

The total cost of the Project has increased as a result of the delays. At the time the Regents approved the Project in 2014, the estimated cost was \$1.49 billion (in FY2012 Dollars), based then on an assumption that scientific operations would commence in 2022. Various litigation and other actions in Hawaii delayed construction of the Project, resulting in increased Project costs, delay of "first-light" until about the same time the Master Lease for the astronomy zone in Maunakea currently is set to expire, as well as exploration of alternative sites. As of March 2020,

the estimated total cost at the primary site is \$2.4 billion in today's dollars⁴, but it is part of a major re-baselining effort that will require an international review by experts and likely a review by a National Science Foundation–appointed panel (see below). National Science Foundation funding is not certain.

DEVELOPMENT OF AN ALTERNATE SITE

Because of the uncertainties in Hawaii, the Project initiated activities to evaluate and secure a TMT backup site. The island of La Palma in the Canary Islands was selected and the necessary permits and permissions have been obtained to build the telescope there. According to astronomers, it is an excellent site for the science, although not as ideal as Maunakea. In order to make a location change for the Thirty Meter Telescope from Maunakea to La Palma, there would need to be unanimous agreement among the current TMT partners and the National Science Foundation (see below) in case they become a partner.

THE U.S. EXTREMELY LARGE TELESCOPE PROJECT AND THE NATIONAL SCIENCE FOUNDATION

A significant update for the Project is a relatively recent collaboration with the Giant Magellan Telescope (GMT), and the U.S. National Optical-Infrared Laboratory to propose a partnership with the U.S. National Science Foundation for a two-telescope project with viewing coverage in both the Northern (TMT) and Southern (GMT) Hemispheres. The initial planning proposal has been submitted to the National Science Foundation and will trigger a series of reviews of all aspects of the TMT Project. This will also trigger federal environmental impact statement and National Historic Preservation Act (NHPA) Section 106 processes in Hawaii and the equivalent at the alternative site of La Palma. This will be another opportunity to evaluate environmental and cultural impacts in detail and identify any necessary mitigations. As has been the case for past decade, the Project will respect the need for these processes to reach their conclusions.

Attachments:

1. [March 2014 Regents Item](#)
2. [TMT Timeline](#)

⁴ The project cost is subject to change based on where and when construction finally begins.