



FACT SHEET

DESCRIPTION: The Thirty Meter Telescope (TMT) International Observatory (TIO) is a powerful international scientific endeavor that has the potential to revolutionize our understanding of the universe and our place within it. More than this, at TIO, we believe in a community model of astronomy that upholds the values of inclusion, respect, and community stewardship.

Since the halt of construction in 2019, we have fundamentally changed our approach to community outreach and engagement. We apologize for contributing to the division and conflict within the community and within families. With new leadership and a new Hawai'i-based team, our focus for the past few years has been on listening to, and learning from Hawai'i communities, in particular Native Hawaiian communities whose voices were not previously sought.

Maunakea, Hawai'i is our preferred site because of the unique qualities of the sky above and around the site, in addition to its geographical location. Ultimately, the decision on the future of TMT on Maunakea rests with the Hawai'i and Native Hawaiian communities. We believe it is our *kuleana* (responsibility) to learn from our past mistakes, to do what is right for the community, to help heal divisions, and to contribute to a better future for everyone in Hawai'i, especially those in underserved communities.

OUTREACH & EDUCATION:

Our new community engagement approach starts with being in the community, respecting the indigenous culture, land and history, and proactively reaching out to the people who protested against the project.

Following the new Project Manager's move to Hilo, Hawai'i in 2021 and the formation of Hilo-based community engagement team, TIO has been meeting regularly with local communities, in particular Native Hawaiian communities who are opposed to the project.

TIO is now partnering on initiatives developed and led by the community to improve outcomes for *keiki* (children) and the environment. These community-driven programs are designed to meet the local communities' unique needs, with a specific emphasis on supporting underserved students. TIO's new programs are focused in four key areas: 1) education and workforce development opportunities for all local *keiki* (children), 2) Hawaiian culture-based learning, 3) environment protection and conservation, and 4) community-led reviews. Current and planned activities include:

- 'Ale Lau Loa Indigenous cultural exchange program with the County of Hawai'i

'Ale Lau Loa, or long large wave, is a new initiative to promote cultural learning and exchanges between high school students, with an emphasis on sharing Hawaiian culture and knowledge. Led by Hawai'i County in partnership with

cultural practitioners and wayfinding experts, this unique program provides an immersive learning experience that allows local youth to explore first-hand the history, values, and customs of traditional cultures across the globe. Each year, Hawai'i students visit indigenous or traditional communities in one of TIO's partner countries.

- In-person K–12 student tutoring with Hawai'i Department of Education (DOE) schools

The COVID-19 pandemic severely impacted students' learning in Hawai'i, disproportionately affecting underserved students. In the Fall 2021, upon a request from local teachers, TIO staff began providing weekly in person tutoring to students. This teacher-led tutoring program has successfully reduced the number of students failing multiple classes. More importantly, the program provided an opportunity for TIO staff to learn the students' needs and interests firsthand, to improve communications and teaching skills, and to deepen the sense of community.

- 'Ohana Stargazing program with 'Ohana Kilō Hōkū

'*Ohana* means family in the Hawaiian language. 'Ohana Stargazing is the collaborative stargazing program that brings together modern astronomy with '*Ike Hawai'i* (Hawaiian traditional knowledge). The program is led by a Native Hawaiian non-profit organization, '*Ohana Kilō Hōkū*, and takes place primarily in Hawaiian homelands and culturally significant locations in Hawai'i.

- Next Generation Science Standards (NGSS)/STEM curriculum development and teacher workshops with Hawai'i Department of Education

According to a 2022 NGSS/STEM survey, 60% of elementary teachers in Hawai'i are not confident teaching science, especially with the adoption of NGSS. In the summer of 2023, TIO partnered with Hawai'i DOE to develop NGSS-aligned STEM curriculum and provide teacher workshops with a special focus on teachers in underserved communities. The curriculum will be translated into the Hawaiian language to better engage with Indigenous students.

- Maunakea Reforestation

Mālama 'āina (caring for the land) is a principal tenet of Native Hawaiian life and core values. In listening to the needs of the Native Hawaiian communities on Hawai'i Island, it is apparent that all organizations with a presence on Maunakea have a duty to directly contribute to the stewardship of the land, plants, and animals on the mountain. Maunakea is home to various native species on the brink of extinction. TIO assists a biological study of the critically endangered native Hawaiian *palila* bird (*loxoides bailleui*), which are only found on Maunakea. Together with Maunakea Observatories, TIO engages in invasive weed pull volunteer programs on Maunakea to improve the sense of and protect the '*āina* (land).

In addition to above community-driven programs, all TIO Hawai'i staff spend at least 5% of their work time on community engagement activities such as tutoring at local schools and assisting astronomy outreach events as a member of

the Maunakea Observatories.

Past and ongoing community outreach efforts included pandemic relief and a focus on education. TIO launched The Hawai'i Island New Knowledge (THINK) Fund in 2014 to better prepare Hawai'i Island students for careers in STEM. To date, TIO has funded more than \$5.5 million for Hawaii Island students, their families, and teachers. Following community input, TIO expanded the scope of the THINK Fund in 2023 to support a broad range of activities (not limited to STEM) that the community truly needs, including cultural learning, environmental protection and restoration, and additional support for traditionally underserved students. TIO also initiated a workforce pipeline program, funding summer internships, STEM camps, robotics, community events, and other programs to help Hawai'i Island students become successful lifelong learners.

SCIENCE:

TIO will explore some of the most compelling and difficult questions about the universe and our place within it. It will provide many unique capabilities that astronomers around the world will use to address the most compelling, outstanding open questions in astronomy including:

- o What is the nature and composition of the universe?
- o When did the first galaxies form and how did they evolve?
- o What is the relationship between black holes and galaxies?
- o How do stars and planets form?
- o What is the nature of extrasolar planets?
- o Is there life elsewhere in the universe?

TIO builds on a rich heritage of technical innovation and scientific exploration in astronomy, and represents a huge leap forward in capability. TMT will have more light gathering power than the largest ten existing ground-based telescopes combined, and its images will be more than four times sharper than the phenomenal James Webb Space Telescope.

ENVIRONMENT:

Among the cultural and environmental considerations regarding TIO are the following:

- Located **500 feet below the true summit of Maunakea**, the site was chosen to minimize its archaeological, cultural, and environmental impact.
- The observatory will **not be visible from culturally sensitive locations**, such as the summit of Kukahau'ula, Lake Waiau, and Pu'u Lilinoe.
- The observatory will install a zero-discharge wastewater system, with all wastewater collected and transported off the mountain for proper treatment and disposal.
- Comprehensive research by expert hydrologists confirms that TMT poses no danger to the aquifer. There are no wells extracting groundwater near the summit of Maunakea; the nearest wells are located approximately 12 miles away in Waiki'i Ranch along Saddle Road.
- The observatory will not use liquid mercury anywhere within the project.
- The fuel storage area and piping within the observatory have been reduced in size and will feature double-walled construction, along with leak monitors.
- The design of the observatory dome prioritized minimizing the structure's size, ensuring a tight fit around the telescope. The footprint and the height of the observatory have been minimized.

- MILESTONES:** The project team and partners continue advancing the observatory’s design. Recent milestones include:
- In February 2024, TIO will celebrate a major milestone with the **polishing of its 100th mirror segment**. The final design will include 492 segments that will form the 30-meter-diameter primary mirror. Additionally, 82 spare segments will be produced.
 - The **Laser Guide Star Facility** has successfully completed its Preliminary Design Review and is advancing to the Final Design Phase. The facility will play a crucial role in producing artificial laser guides that are essential to the Adaptive Optics systems.
 - The Preliminary Design Phase for the **Secondary Mirror Support System and Positioner Assembly** is currently underway. This system will be responsible for safely supporting and adjusting the rigid body motion of the secondary mirror.
 - The **US Extremely Large Telescope Program (US-ELTP)**, a joint endeavor of TIO, the Giant Magellan Telescope and NSF’s NOIRLab, was ranked as the highest ground-based priority in the Decadal Survey on Astronomy and Astrophysics 2020, published by the National Academies of Sciences, Engineering, and Medicine. The US-ELTP will provide unique access to the entire sky from the Northern and Southern hemispheres with a level of precision and sensitivity never seen before.
 - In November 2023, as a member of the **US-ELTP**, TIO received \$6.5 million funding from the National Science Foundation for telescope design and development. This award does not ensure the construction of the telescope on Maunakea.

LEASE RENT: Based on its current agreement with the University of Hawai’i, TIO began making payments on its sublease rent in 2014. Beginning in 2025, TMT will pay \$1 million in annual rent; 80 percent will go to the stewardship of the mountain and 20 percent will go to the Office of Hawaiian Affairs.

PARTNERS: The TMT International Observatory LLC is a non-profit organization established in May 2014 to carry out the construction and operation phases of the TMT Project. The Members of TIO are Caltech, the University of California, the National Institutes of Natural Sciences of Japan, the Department of Science and Technology of India, and the National Research Council (Canada); the Association of Universities for Research in Astronomy is a TIO Associate. Major funding has been provided by the Gordon & Betty Moore Foundation. Work is supported as well by the U.S. National Science Foundation (NSF).

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