The GMT Site, Enclosure, and Facilities: 2026 Design and Construction Update

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ABSTRACT

The Giant Magellan Telescope (GMT), one of three extremely large telescopes (ELTs) currently in development, will be located on the summit of Cerro Las Campanas, a peak within the property of the Las Campanas Observatory (LCO) in Chile. The GMT employs seven 8.4m monolithic mirrors as segments to form a single optical surface with an equivalent diameter of 25.4 meters. Developing a new observatory for cutting-edge science operations and a 50-year lifespan poses a variety of design and construction challenges. This paper reports on design and construction progress since 2024, including the most recent work completed for the GMT Site infrastructure, telescope Enclosure, and Facilities (SEF). In late 2021, GMTO selected IDOM (Bilbao, Spain) to mature the enclosure from its preliminary reference design through to final design and documents (drawings and specifications) for construction. The designs for enclosure structures, mechanisms, pier seismic isolation system, and related control systems culminated in a successful final design review (FDR) held in May 2024. Following the 2024 FDR, IDOM was awarded additional task orders for design of the GMT Summit Support Building (SSB) and the Site Information Technology Infrastructure (SITI). Construction work at the GMTO site started in 2015, but has been paused since 2024, awaiting completion of the designs for the SSB and the SITI, final design maturity of the GMT subsystems, and arrival of construction funding.

Keywords: GMT, GMTO, observatory, facilities, enclosure, construction

1. INTRODUCTION

The Giant Magellan Telescope Organization (GMTO Corp.) was formed to build and operate the Giant Magellan Telescope. Since 2015, the GMT project has been engaged simultaneously in design, fabrication, and construction activities for the telescope, optics, science instruments, telescope enclosure, and related facilities. As of 2026, the GMT project is advancing in all major areas, including fabrication of the seventh 8.4m primary mirror, fabrication of the azimuth structure of the telescope, fabrication of the first adaptive secondary mirror, fabrication of components for the first-light instrument suite, and many other areas. See Burgett[1] (this proceedings) for a comprehensive update of all areas of the GMT project since 2024.

This paper provides an update on the design and construction of the GMT Site Infrastructure, Enclosure, and Facilities (SEF) since 2024 (See Bigelow[2]). The GMT project is organized and led by the project manager (PM), who delegates responsibility and authority to a group of project element managers (PEMs), who in turn are responsible for managing delivery of the major project subsystems (elements). The Site Infrastructure, Enclosure, and Facility elements are combined under a single PEM, and a dedicated group of engineers who are responsible for guiding work in their disciplines, including structural, mechanical, electrical, physical plant, and controls engineering. The SEF team is responsible, in coordination with GMT Systems Engineering, for developing the element and subsystem architecture (the product breakdown structure, PBS), the subsystem operational concepts, requirements, and interface control documents (ICDs) for the SEF deliverables. The SEF team works with GMT Contracts and Procurements (C&P), to develop design and construction statements of work (SoW), procurement strategies and plans, and requests for proposals (RFP), to execute the design and construction contracts which will deliver the final products. In this report, we address the most recent work in the SEF elements, including the Enclosure, Facilities, and Site Infrastructure. The GMT observatory site includes three major construction areas; the Summit, Support Site 1 (SS1), and Support Site 2 (SS2). The Summit Site includes the GMT enclosure, the Summit Utility Building (SUB), the Summit Utility Tunnel (SUT), and the (Facilities) Summit Support Building (SSB).

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Immediately below the summit, the water pad hosts summit infrastructure including the water and fire equipment buildings (WEB and FEB), the GMT water tank, and just below the water pad, the GMT dry coolers. SS1 (the technical support site) includes the (Facilities) Shop and Warehouse buildings, along with the site infrastructure associated with connections to external networking and electrical power (via the Chilean internet and power grid). SS2 (the personnel support site) includes the buildings and site infrastructure which provide lodging, food service, and recreation for GMT and site contractor personnel. As of 2026, the GMT construction offices, currently located on the summit, are planned to be relocated to SS2 prior to the start of construction. Site Infrastructure includes the roads, parking areas, utility systems, communication network systems, utility treatment, and underground distribution systems which connect and support the three major construction areas. The GMT site master plan has remained stable since 2024. See Figure 1 for the layout of the GMT observatory site plan. In La Serena, roughly 2-1/2 hours south of the observatory site, the GMT Facilities scope will include a Base Facility, which will provide spaces for the personnel, business, and operations support functions for the observatory which are most efficiently provided in an urban environment. In the following sections, we report on the latest design and construction progress, organized by the three primary construction areas, and including the telescope enclosure, the facilities buildings, and the site infrastructure.

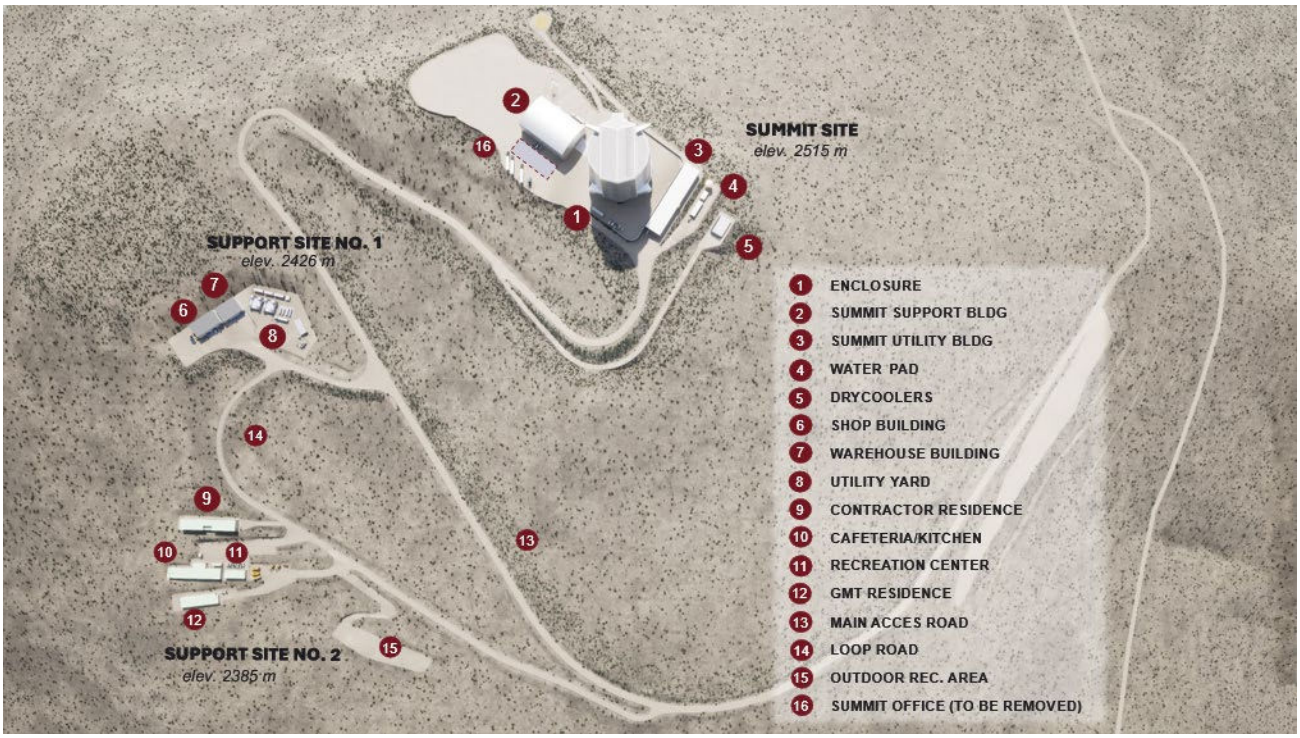

Figure 1 - The GMT Observatory Site Master Plan as of 2026

2. THE SUMMIT SITE

The Summit Site includes the buildings and support infrastructure as described in the site master plan. See Figure 2 for a rendering of the site looking from the North-West. The following sections describe the designs and status for the Summit Site improvements. The scope of the GMT enclosure final design contract includes the foundations for the telescope and enclosure, the telescope pier, the telescope pier seismic isolation systems (SIS), the fixed lower portion of the enclosure, and the rotating upper enclosure. Although they are named individually, the designs for the Enclosure, Summit Utility Tunnel (SUT), Summit Utility Building (SUB), water pad buildings, dry cooler platform, and the Utility Yard at SS1 were designed together by IDOM and successfully passed an external FDR in 2024.

2.1 The Enclosure

Starting in early 2022, the enclosure Architecture & Engineering (A&E) firm IDOM, supported and guided by the GMT project and SEF teams, matured the enclosure reference design (from 2020) through a successful series of preliminary, critical, and final design reviews (FDR in May 2024).

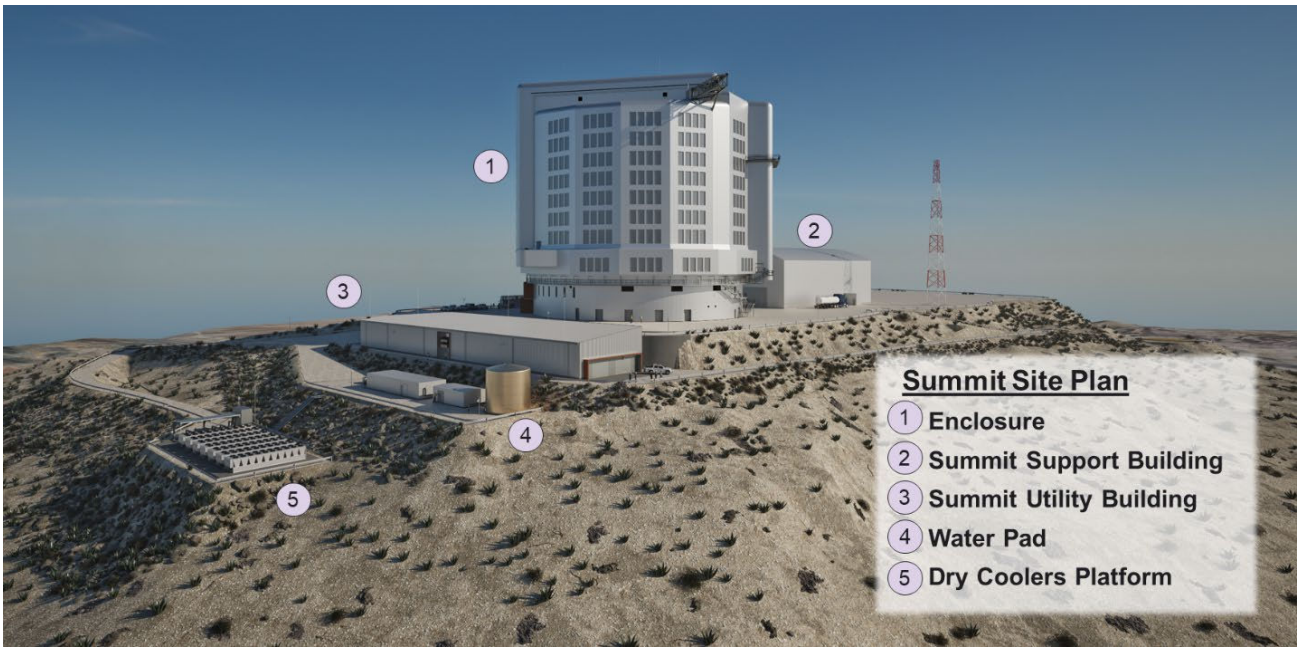

Figure 2 - View of the dry cooler platform, water pad, Summit Utility Building, Enclosure, and Summit Support Bldg.

A detailed description of the enclosure design was provided by IDOM at the 2024 SPIE meeting (see Castro[3]). Similarly, a detailed description of the design, prototype fabrication, and prototype testing for the telescope pier and seismic isolation systems is also provided in 2024 (see Fernández[4]). For a report on the manufacturing of the Giant Magellan Telescope Structure, see Park[5] in these proceedings. The enclosure was designed using a Building Information Modeling (BIM) approach and used a variety of computer-aided design and engineering tools including Autodesk Revit, Tekla, SolidWorks, Autodesk Construction Cloud (ACC), and Navisworks. For a detailed description of the BIM design process used for the enclosure and SSB, see de Echenique[6] in these proceedings. The BIM design process has delivered a comprehensive and integrated set of 3D models for the enclosure and facility buildings, and construction documents (drawings and specifications) have been developed directly from those models. But the resulting 3D models are very large, and "static", in the sense that non-specialist users cannot dynamically change the configurations in the models (e.g., shutter doors open vs. closed). To better serve the GMT project design team, especially for developing assembly, installation, and maintenance procedures, we have developed an interactive dynamic model of the observatory, called "BOB", created by importing the 3D models into a 3D gaming engine. See sample BOB graphics in Figure 3 and a description of the modeling process by Madden[7] in these proceedings.

Control of conventional building functions such as secure access, lighting, fire detection and protection, and heating, air-conditioning, and ventilation (HVAC), are controlled by a Building Automation System (BAS), which in turn is monitored by the GMT Observatory Control System (OCS). Control of the enclosure kinetic mechanisms (e.g., enclosure rotation system – ERS) and the enclosure-provided telescope utility systems (e.g., carbon dioxide (CO^2) refrigeration system) were designed by IDOM according to GMT software and controls architecture and requirements. See Cox[8] for a detailed description of the GMT observatory control system (OCS) development program. See Figure 4 for a section view of the enclosure and general arrangement of its features. Figure 5 shows the angular relative motion of the bi-parting shutter doors. The total height of the enclosure is 65m, the upper enclosure is ~61m in diameter, and the rotating mass of the upper enclosure is ~5660 metric tonnes. Key design drivers for the mass and dimensions of the upper enclosure include the following:

- Height determined by the location of the telescope elevation axis and the telescope's swept volume
- Diameter determined by the telescope aperture plus the dimensions of the floor hatch
- Shutter door dimensions based upon the telescope aperture diameter and elevation angle range
- 75 MT bridge crane reach spanning the width of the telescope and half of the enclosure diameter
- Mass determined by requirements for elastic seismic/structural performance

The shape of the GMT enclosure was heavily influenced by tight image quality allocations for “dome seeing” and wind-induced telescope jitter. The designs of the curved transitions between vertical and horizontal surfaces, the angled orientation and motion of the shutter doors, the design of the enclosure wind screen, and the number, size, and shape of the enclosure wind vents were all developed through multiple phases of computational fluid dynamics (CFD) analyses and validated with both water and wind-tunnel testing. See Figure 6 for current renderings of the enclosure and SSB. For the latest updates on CFD, “dome seeing”, and wind jitter estimation for the telescope, see Conan[9] and Vogiatzis[10].

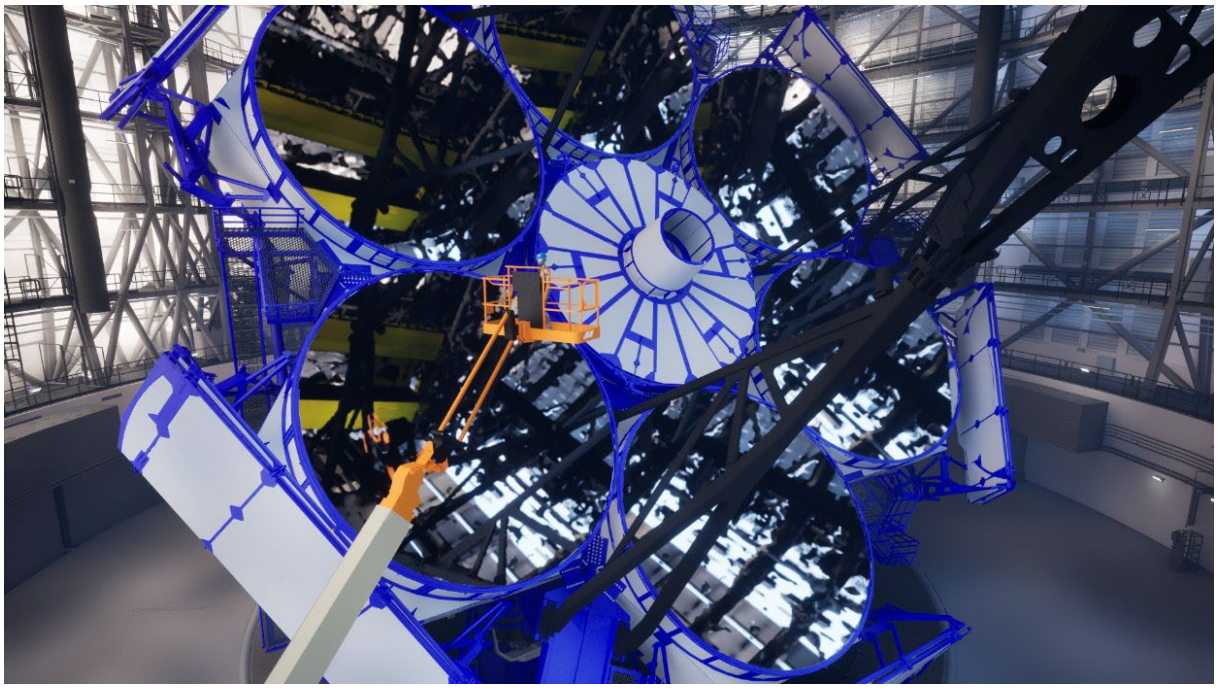

Figure 3 - Graphics from the dynamic BOB model showing the telescope, enclosure, and personnel lift.

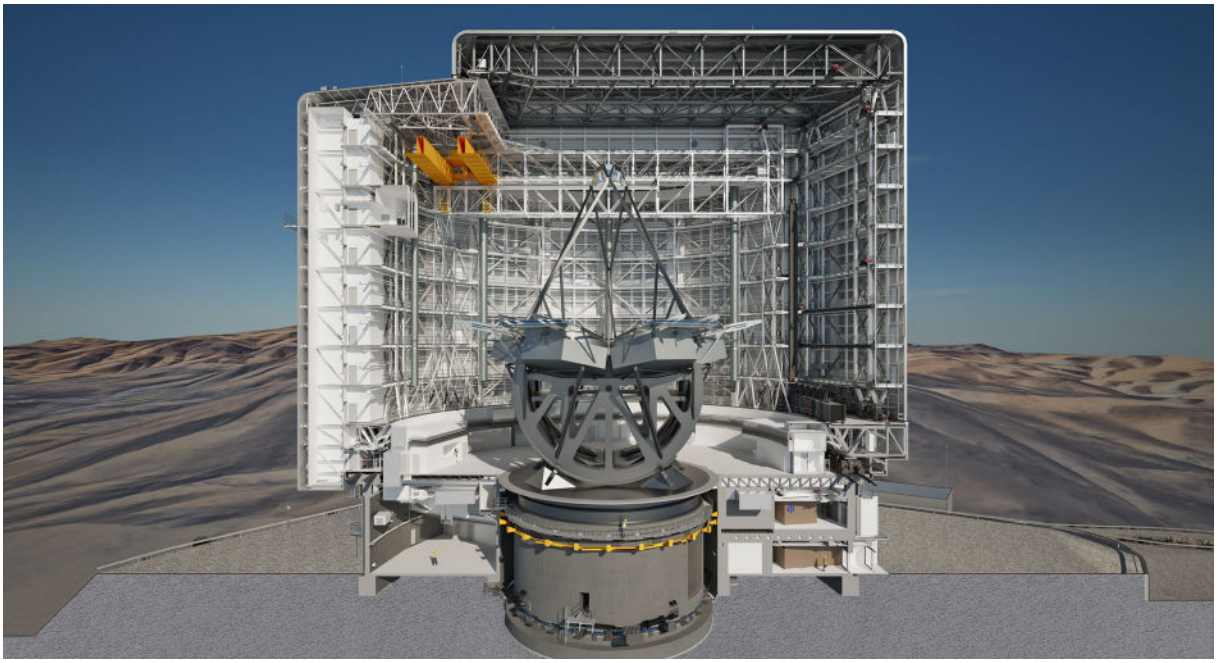

Figure 4 - Section view of the enclosure with the telescope.

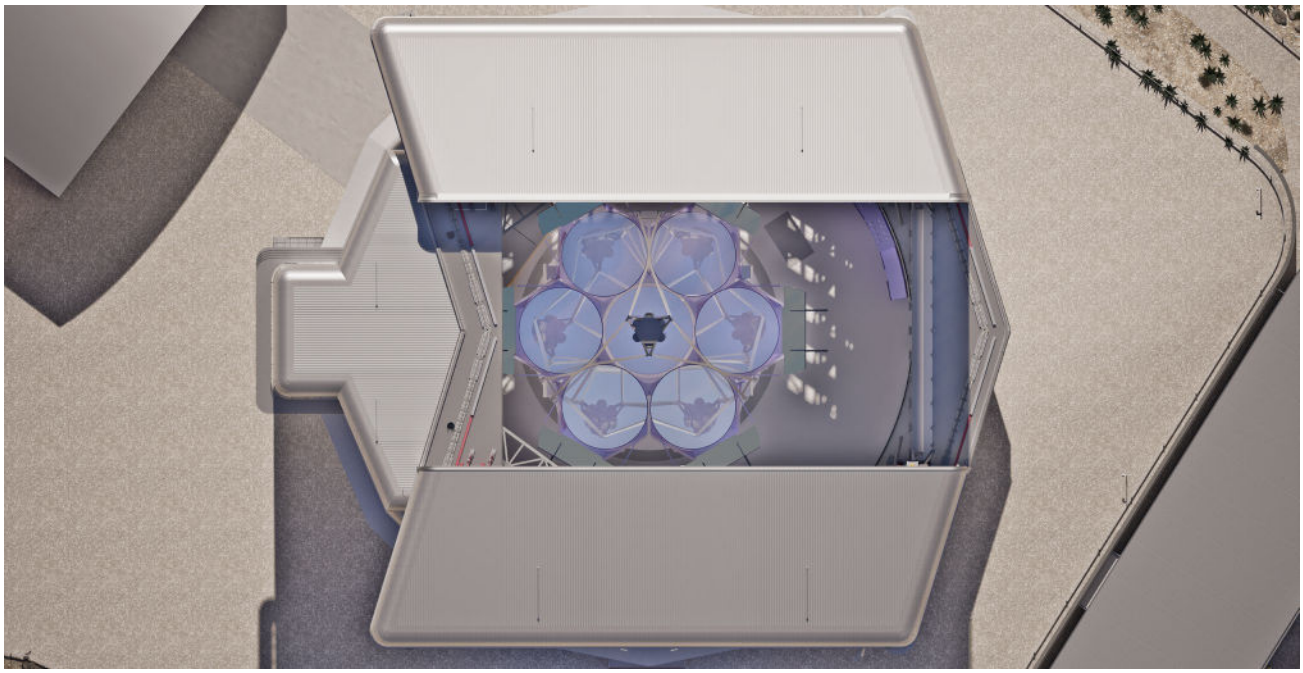

Figure 5 - Top view of the enclosure, showing the angular motion arrangement for the bi-parting shutter doors.

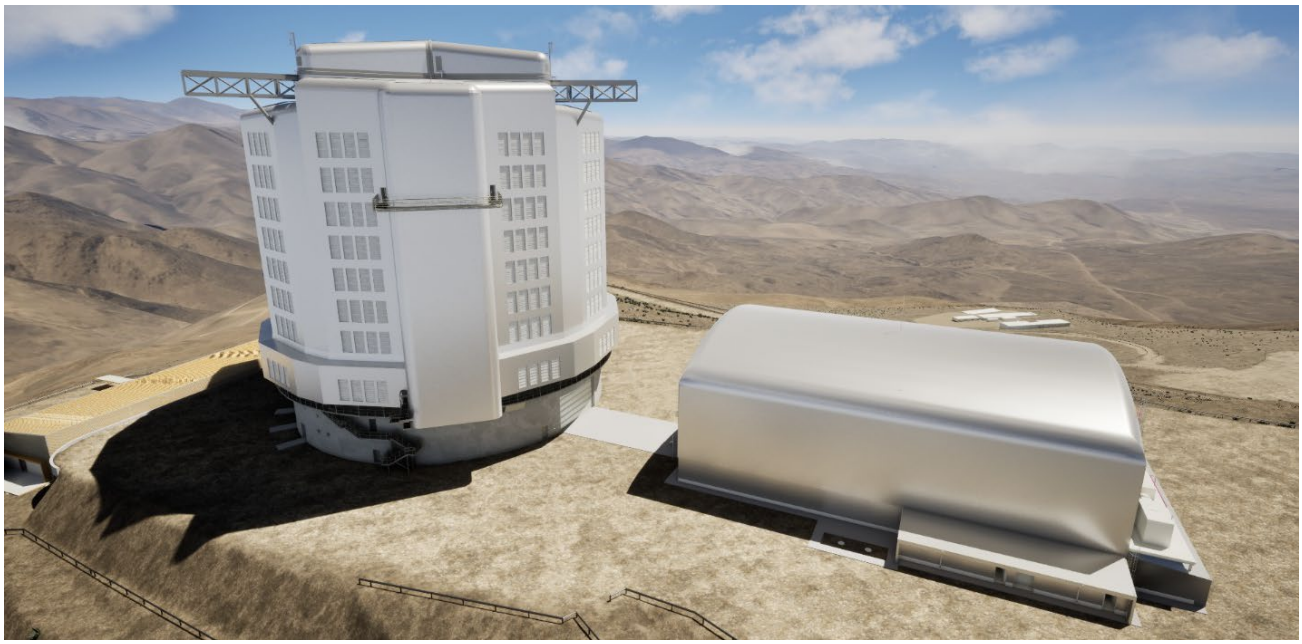

Figure 6 - Rendering of the Las Campanas summit with the enclosure and SSB.

Since the enclosure FDR in 2024, additional work on the enclosure has included final design of the shutter door latches and the pier lift platform (a vertical conveyor for installation of Direct Gregorian (DG) instruments on the back end of the telescope). A separate FDR for these mechanisms was successfully completed in February 2025. As a result of the phased development process for the GMT observatory, some enclosure stakeholders (e.g., GMT telescope structures, instrument, and OCS teams) have requested revisions (post-FDR) to the enclosure design. These revisions include minor changes to the CO^2 refrigeration system supplying the telescope payloads, updates to the upper enclosure catwalks and service

platforms to improve maintenance access, final alignment of the telescope-pier utility interfaces, and addition of special foundations for a DG instrument test stand in the lower enclosure high-bay instrument lab. These change requests are tracked in a "laundry list" and funded individually and in groups through additional design task orders to IDOM.

Following completion of the enclosure FDR, GMT and IDOM have conducted a series of technical consolidation workshops focused on refinement of the Enclosure Software and Controls (SWC) architecture. The objective of these activities was to improve alignment with GMT Observatory-wide SWC standards while reducing overall system complexity, lifecycle cost, and long-term operational risk. The ongoing review effort has identified opportunities to simplify the enclosure Low-Level Control System (LLCS) architecture through consolidation of subsystem control functions, standardization of PLC deployment strategies, reduction of inter-controller dependencies, and clarification of supervisory responsibilities between the Observatory Control System (OCS) and subsystem-level controls. Emphasis has been placed on improving maintainability, operational robustness, and consistency across the Enclosure subsystems. Planned updates include consolidation of motion-related enclosure subsystems under a more unified control architecture, revisions to utilities and HVAC control strategies, updates to the Enclosure Interlock and Safety System (ISS) and Global Interlock and Safety System (GISS), and refinement of the communication and network infrastructure supporting the Enclosure control systems. The planned architecture updates also include increased use of standardized communication protocols, improved time synchronization strategies, and clearer separation of operational, information technology, and safety-related communication paths. The LLCS update effort is expected to continue through 2026 and into 2027, including evaluation of opportunities for reduction of implementation complexity and lifecycle cost while maintaining compliance with functional and safety requirements. We anticipate that all design changes impacting the enclosure construction documents (drawings and specifications) will be completed prior to start of the enclosure construction procurement process, and at the latest, prior to the planned start of construction.

2.2 The Summit Support Building

The Summit Support Building (SSB) will be located near the center of the Summit Site and adjacent to the Enclosure Building. A concrete apron will extend between the SSB and the Enclosure to enable safe movement of telescope components (mainly primary mirror assemblies) and personnel between the two buildings. A rendering of the 60% design of the SSB is shown in Figure 7. The primary functions of the SSB are to provide the workspaces to support operations and maintenance of the observatory, starting with assembly, integration, and verification (AIV) of the GMT primary mirrors and adaptive optics systems, and leading into commissioning and operation of the telescope, washing, stripping, and coating (and re-coating), and maintenance of the GMT primary mirror segments. On the fourth floor, the SSB also provides office spaces, a conference room, and an open (configurable) space for office and lab work.

IDOM was awarded a task order in early 2025 to design the SSB. The conceptual design review for the SSB (including the requirements review) was completed in July 2025, the PDR was completed in November 2025, and the 60% maturity (critical) design review was completed in May 2026. Final design of the SSB will start in June 2026, with FDR currently planned for November 2026.

The size of the SSB has grown since the concept shown in 2024, primarily due to the provision of additional working areas based on inputs and lessons learned from the M1/M3 washing and coating systems for the Rubin Observatory (see Colleoni[11]). The SSB 60% design floors, spaces, and functions include:

- First floor: M1 coating, M1 stripping and washing, M1/M2 integration and testing, Magnetron maintenance room, Electrical room, Coating lab and control, Process Gas/Air Plant, Chemical and Watering, Vestibule, Elevator shaft, IT room and Gowning room. Floor area ~2,452m^2. See Figure 8.
- Second floor: Mechanical Room. Floor area ~145m^2
- Third floor: Storage Room. Floor area ~145m^2
- Fourth floor: Offices, Conference room, Computer room, Electronics lab, IT room, Kitchenette, Bathrooms, Elevator shaft, Vestibule and Terrace. Floor area ~563m^2. See Figure 9.

Computational fluid dynamics (CFD) modeling of the summit terrain, enclosure, and SSB has been used extensively to reduce the impact of the buildings and their geometry on telescope image quality. Rounding of vertical/horizontal transitions has been used to minimize vortex shedding and uplift of near-ground level air. The result of these efforts is to eliminate the predicted impact on telescope image quality for 99% of nighttime wind conditions.



Figure 7 - A rendering of the 60% maturity design of the Summit Support Building.

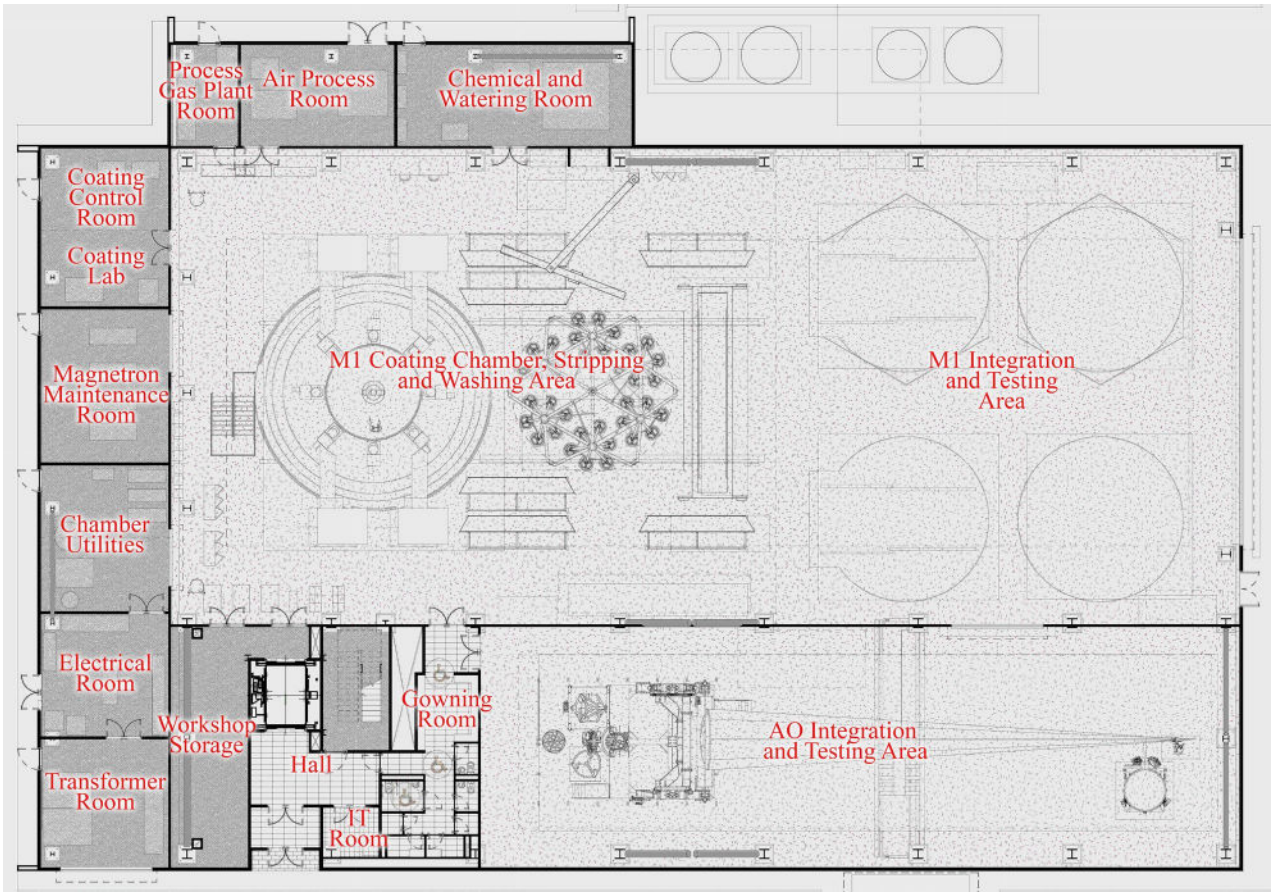

Figure 8 - The 60% maturity grade level plan and functional areas for the Summit Support Building.

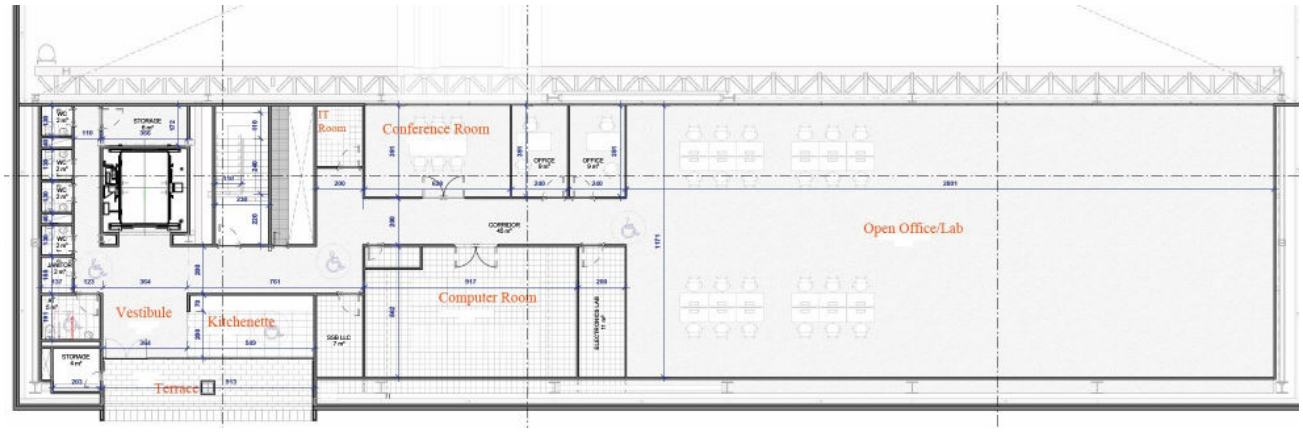

Figure 9 – The 60% maturity 4th floor plan and functional areas in the Summit Support Building.

3. SUPPORT SITE 1

Support Site 1 (SS1) is the technical support area for the observatory site. SS1 includes the observatory facilities Shop and Warehouse building and the utility yard. The utility yard includes the local entrance point for the connection to the Chilean power grid via the planned GMT powerline, and the entry point for the GMT connection to the Chilean internet. The general arrangement of SS1 is shown in Figure 10. The planned construction improvements for SS1 are described in the following sections.

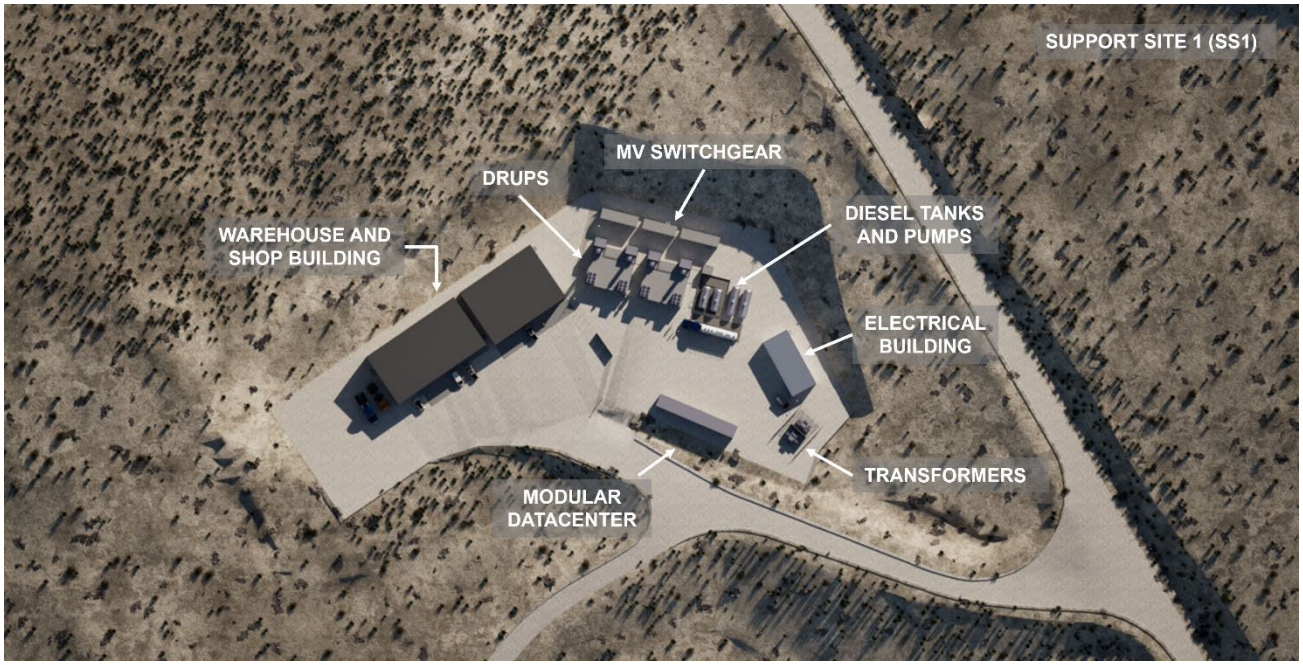

Figure 10 - Planned configuration of SS1.

3.1 The Shop and Warehouse Building

The facilities Shop and Warehouse are the primary technical facilities for off-summit local support of the observatory site. The Shop building will provide space, tools, and equipment for maintenance and repair functions for the observatory. The Warehouse Building will mainly provide storage space during operations, but also potential extra space for assembly, integration, verification, and commissioning (AIVC) during the final site integration phase. The project delivery method planned for the shop and warehouse is via a design-build procurement of a pre-engineered and prefabricated building. One possible realization of a single building, to provide both the shop and warehouse areas, is shown in Figure 11. The footprint

of the building is ~55m long and ~15.5m deep, for a total floor area of ~850m^2. The shop portion of the building is ~15m x ~20m, or ~310m^2. The warehouse portion of the building is ~15m x ~35m, or ~540m^2.

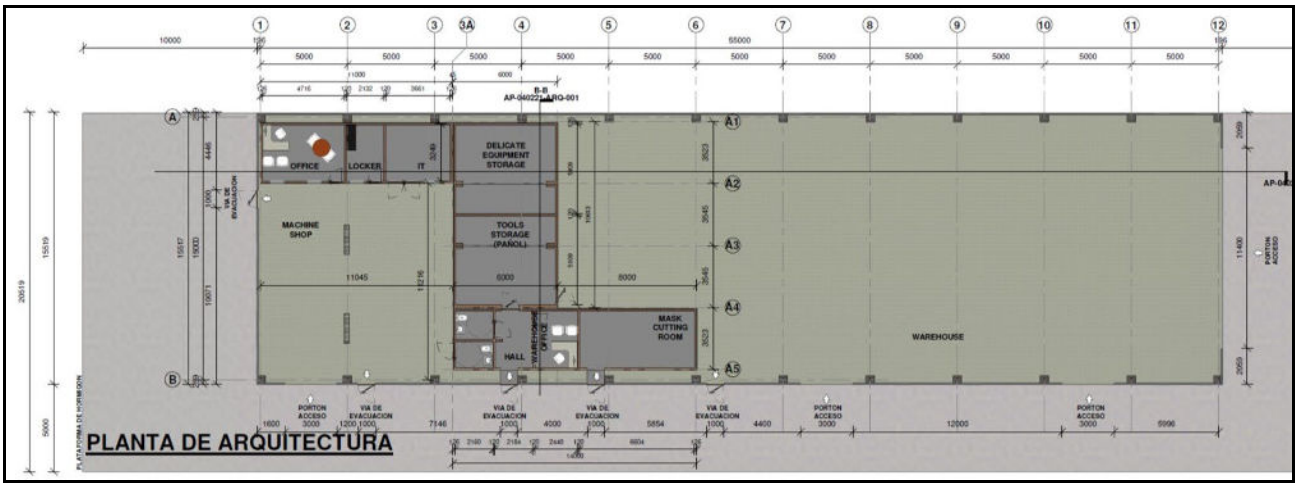

Figure 11 – Planned layout for the Shop-Warehouse building at SS1.

3.2 The Utility Yard

The Utility Yard, adjacent to the Shop-Warehouse, will provide spaces for reception of the incoming commercial power and associated transformers and switch gear, along with the power conditioning and back-up systems. Due to the remote location of the GMT, and vulnerability of commercial electrical power delivery to the site, GMT will use Diesel Rotary Uninterruptible Power Systems (DRUPS) generators. The modular DRUPS system for GMT, which will include multiple independent DRUPS units, will provide continuous high-quality (stable frequency and voltage) electric power to the summit buildings (Enclosure, SSB, and SS1). The DRUPS installation includes the electrical switch gear, and diesel fuel tanks with a 7-day supply of fuel. Support Site 2 has a separate and independent back-up power system. See Figure 12 for the general arrangement of the utility yard.

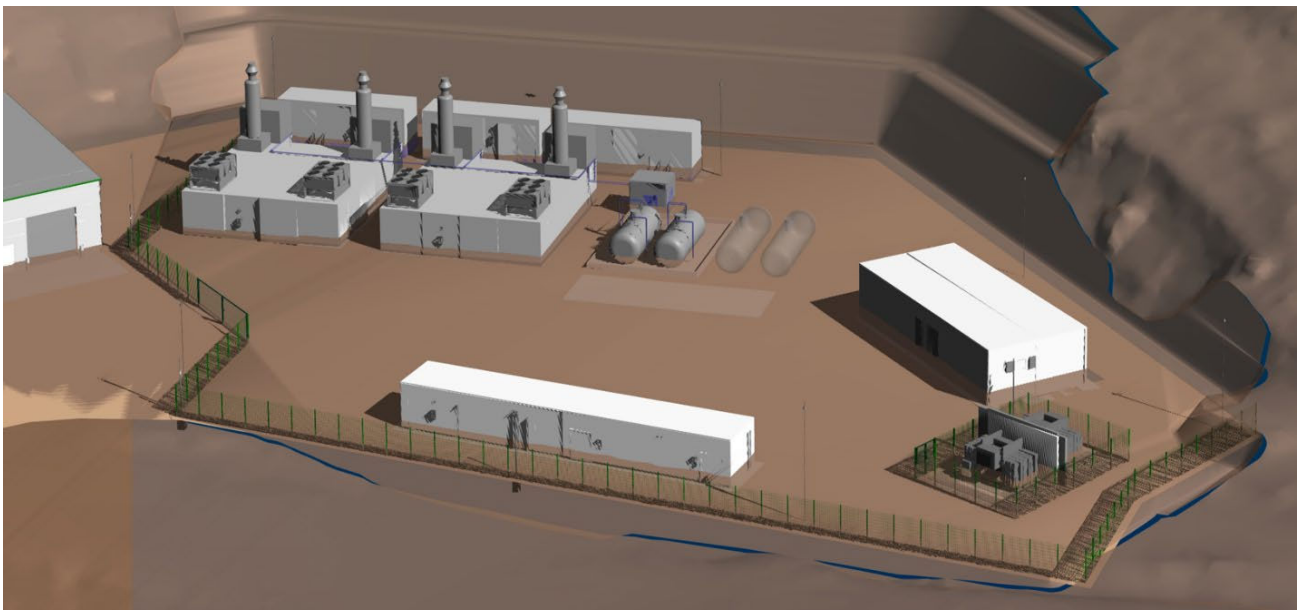

Figure 12 - General arrangement of the electrical power systems (upper left), IT network equipment building (center), and electrical power control and monitoring building (right) in the utility yard at SS1.

4. SUPPORT SITE 2

Support Site 2 (SS2) is the personnel support area for the observatory site. All buildings at SS2 make use of pre-engineered, prefabricated modules which were installed at the site in 2016. Construction at SS2 was completed in 2017 and the buildings have been in continuous use since that time. The SS2 buildings are constructed on three levels; see Figure 13. The lowest level hosts the GMT residence building, which has 24 units with separate bedrooms and bathrooms, furnished for single or double occupancy. The GMT residence area also includes a "star-gazing terrace", which is used to support VIP and fund-raising activities at the site. The middle level includes the kitchen, dining, recreation, and office buildings which support both the GMT and contractor residences. The upper level provides the contractor residence building, which has 68 rooms. The contractor's residence was originally furnished for triple occupancy, with a maximum capacity of 204 people. Following the global pandemic of 2020-2023, future use will most likely include single and double occupancy, for a maximum capacity of ~136 people.

SS2 is connected to the GMT site power, internet, and domestic/fire water systems, but also has an independent electrical generator and diesel fuel supply, and back-up domestic/fire water storage systems using inflatable bladders. SS2 has its own wastewater treatment plant which treats domestic wastewater to Chilean water quality standards acceptable for surface discharge. The independent water and power systems at SS2 provide extra safety and security for the personnel site in the event of extreme weather or other disruptions.



Figure 13 - View of Support Site 2, showing (left to right) the GMT Residence, the dining and recreation buildings, and the Contractor's Residence.

5. LA SERENA BASE FACILITY

The GMT Base Facility (BF) is planned as a purpose-built, multi-story institutional building to be located in the city of La Serena, approximately 2.5 hours by road from the observatory summit. La Serena serves as the primary urban hub for GMT operations, offering ready access to the La Serena-La Florida Regional Airport, international connectivity, and a concentration of partner astronomical institutions including the Carnegie Institution of Washington's Colina el Pino property and the NOIRLab Recinto. The GMT BF will provide continuous operational support 24 hours a day, seven days a week, with a planned occupancy of approximately 100 staff. Functions hosted at the BF span the full range of observatory support activities, including science operations, engineering, software development, information technology, administration, public outreach, and community engagement. The facility will also include a small on-site hotel to accommodate visiting observers conducting remote observations from La Serena, and personnel in transit to or from the

summit. Operational concepts and functional requirements for the BF were developed by the SEF team in coordination with GMT Systems Engineering and the relevant organizational stakeholders, including the Operations, Business Office, and Software groups. An initial conceptual architectural design was produced under contract with Andes Arquitectura of Santiago, Chile.

Since 2024, the plans for the BF have changed substantially. GMTO is in negotiations with the Coquimbo region Governor's office, to develop a "Gateway to Astronomy" campus in central La Serena. Planning for the campus will include the GMT BF, a public visitor's center and a planetarium. GMTO and the Governor's office are in discussions with the San Francisco Exploratorium (https://www.exploratorium.edu/global/projects) to develop exhibits and concepts for the visitor's center and planetarium. GMTO is working with the Governor's office to identify properties in central La Serena to host the campus, with two potential sites located near the Carnegie Observatories El Pino site and the NSF NOIRLab Recinto. Final design and construction of the BF are currently planned to follow completion of the observatory construction at the GMT summit site.

6. SITE INFRASTRUCTURE

The observatory construction-phase site infrastructure currently includes the ~750 kW electrical power system and the IT network connection, both of which are operational and fed from the neighboring Las Campanas Observatory (LCO). The summit also hosts a pair of ~50m environmental monitoring towers and a MASS/DIMM seeing monitor. Distribution of construction power and networking on the Summit, SS1, and SS2 are mainly via underground conduit. Routing of the main underground conduits, with construction completed in 2020, is shown in Figure 14. Future power and network connections will enter the GMT site above SS1. The following sections provide the latest updates (since 2024) for the connections to the Chilean electrical power grid and internet.

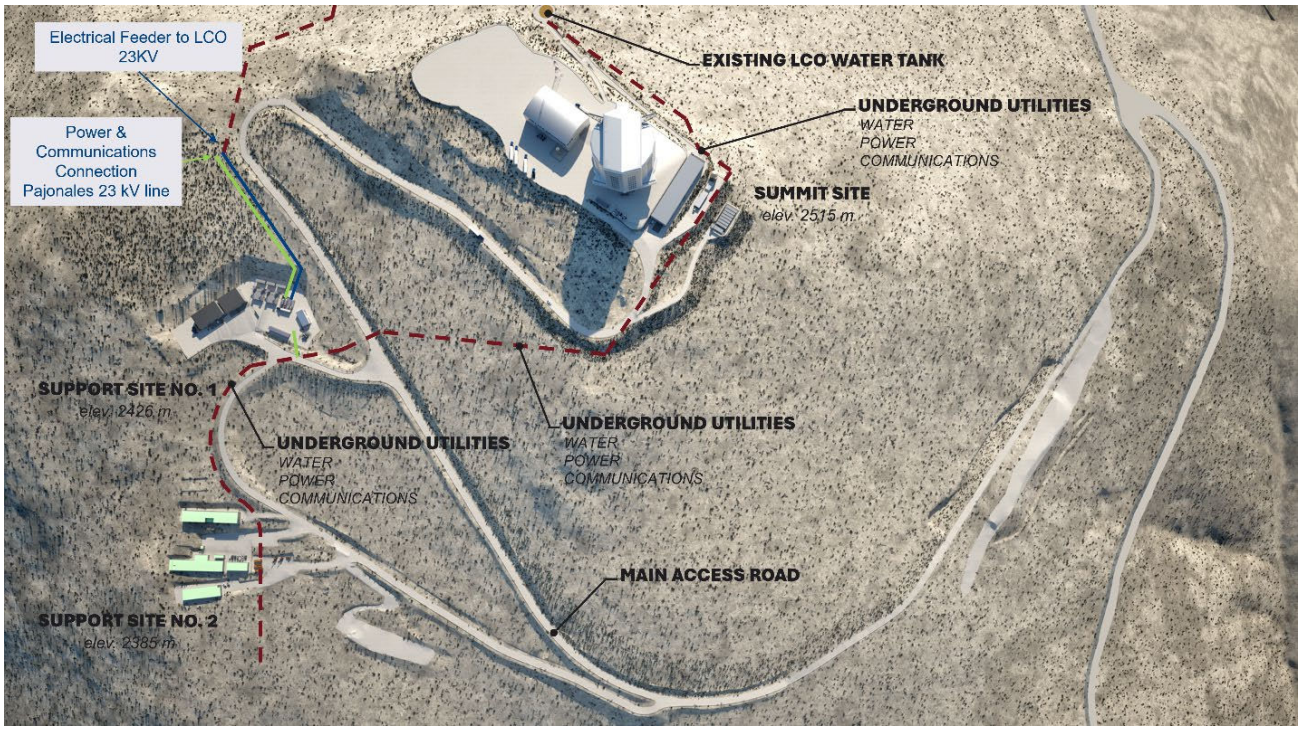

Figure 14 - Power and network connections to the GMT site and routing of the underground utility distribution systems.

6.1 Connection to the Chilean Power Grid

GMT electrical demand, including a back-feed to LCO, is currently estimated to require a maximum of 5.0 MVA at 23 kV to support observatory operations. At present, electrical power for the construction phase is supplied through the neighboring LCO infrastructure, providing approximately 750 kVA at 23 kV. To support future construction activities and

long-term observatory operations, GMTO has been evaluating new independent grid connection alternatives within the Chilean electrical system. A 2024 conceptual engineering study evaluated multiple connection alternatives based on proximity to the GMT site, availability of 23 kV infrastructure, constructability, and expected impacts on cost and schedule. The alternatives considered included connections through the El Pelícano, La Huella, and Central Pajonales substations, all located within the Coquimbo region and near the GMT site.

The study concluded that connection through the El Pelícano substation currently represents the most favorable option. The proposed solution would connect GMT directly to an existing 23 kV switchgear system, avoiding the need for major high-voltage infrastructure additions such as new 110/23 kV transformers and associated high-voltage equipment. The alternative also reduces the required medium-voltage transmission line length to approximately 24 km, resulting in lower construction costs, reduced right-of-way impacts, and shorter implementation schedules relative to the earlier Pajonales-based solution. Additional engineering activities will be required to confirm connection availability, finalize substation modifications, complete medium-voltage line engineering updates, and support the formal grid interconnection application process.

6.2 Photovoltaic Power System

In 2025, GMTO initiated a feasibility study to evaluate renewable energy-based alternatives for supplying electrical power to the observatory. The study assessed multiple configurations combining grid connection, solar photovoltaic (PV) generation, and battery energy storage systems (BESS), considering technical feasibility, operational reliability, lifecycle cost, and environmental impact. The study identified the GMT site as highly favorable for solar energy generation due to the excellent solar resource conditions in the region. Solar resource assessments based on Global Solar Atlas data and historical generation from nearby utility scale PV plants showed strong annual solar potential, particularly during summer months.

Several nearby solar facilities, including El Pelícano, El Romero, and La Huella, were analyzed as reference cases for expected PV performance near the GMT site. The study also evaluated candidate locations within the Carnegie property for installation of a future solar PV plant, considering terrain slope, accessibility, and avoidance of interference with observatory infrastructure. The evaluated configurations included grid-connected PV generation and hybrid solutions combining PV generation with BESS to store daytime solar production for nighttime observatory operations. The analysis concluded that renewable generation could provide reduced greenhouse gas emissions and long-term energy costs, while maintaining the Chilean electrical grid as the primary source of operational reliability and backup power. The study noted that increasing renewable generation penetration in the Chilean electrical system has resulted in growing solar curtailment during daytime periods in northern Chile, indicating that future renewable integration strategies for GMT will need to carefully consider the evolving grid market conditions. There were two final conclusions to the feasibility study. The first was to continue development of the new powerline to the GMT site, which will be required in any case, and to plan to procure renewable power via a power purchasing agreement (PPA). The second was to delay consideration of construction of a GMT PV and/or PV+BESS until the early operations phase, when day and night power demand will be better understood, the ongoing development of commercial PV plants will have increased availability of commercial renewable power, and the downward cost trends for construction of PV and BESS systems will further reduce the cost for a potential GMT installation.

6.3 Site Power Distribution System

The GMT site power distribution system design follows Chilean electrical regulations together with applicable NFPA standards. The nominal system voltages selected for the project are 23 kV (transmission to the site), 4.16 kV for medium-voltage (MV) distribution across the site, and 380/220 V for low-voltage systems, all operating at the Chilean grid frequency of 50 Hz with TN-S grounding configuration.

The GMT site MV power distribution system was designed to provide high availability, operational reliability, and electrical power quality for observatory operations under demanding environmental conditions. The system architecture is based on a 23 kV incoming utility service at SS1, stepped down to a 4.16 kV distribution network that supplies the GMT site (summit, SS1, and SS2) through an open-ring topology. The incoming utility connection consists of a 23 kV overhead transmission line that will transition to underground cable duct banks above SS1 before reaching the main MV switchgear.

The 23 kV switchgear distributes power to the summit distribution transformers, the SS2 feeder, and a future feeder reserved for Las Campanas Observatory expansion.

The primary substation at SS1 includes two identical 5000 kVA, 23/4.16 kV power transformers operating in an N+1 configuration. Either transformer is capable of supplying the complete observatory electrical demand independently. The MV system integrates Dynamic Rotary Uninterruptible Power Supply (DRUPS) units located at SS1 to provide backup power and power conditioning for the observatory. The DRUPS installation consists of four 1.5 MVA, 4.16 kV units operating continuously to provide voltage regulation, transient mitigation, and ride-through capability during utility disturbances. From SS1, the 4.16 kV distribution system feeds the summit facilities through an open MV ring interconnecting the Summit Utility Building (SUB), the Enclosure, and the Summit Support Building (SSB). This ring topology improves system resiliency by allowing sections of the network to be isolated during faults while maintaining power delivery through the unaffected side of the ring.

6.4 Site Information Technology Infrastructure

Since the 2023 conceptual design study and the January 2024 conceptual design review, the GMT Site Information Technology (IT) Infrastructure has advanced into preliminary design. The current Site IT Infrastructure design defines the physical network infrastructure and connectivity architecture required to provide reliable communications across the observatory site, including the main site areas, Summit, SS1, and SS2. The design is centered on SS1, where a modular datacenter is planned to serve as the main hub for site communications, hosting the Main Distribution Frame (MDF), internet service provider (ISP) interface, and core equipment spaces for IT and security network infrastructure. The site architecture combines a fiber-optic backbone for primary site interconnection, using underground conduits where practical, radio links for remote or difficult-to-reach locations, and support for WiFi coverage within buildings and selected outdoor areas.

External connectivity has also been further developed, including primary and secondary fiber-optic transport paths, a microwave backup path, and an emergency satellite communications path. This architecture is intended to support communications between the GMT site and the Base Facility in La Serena. As part of the preliminary design phase, requests for quotation (RFQ) and trade-study activities were carried out for both the external connectivity architecture and the SS1 modular datacenter solution, providing technical, cost, schedule, interface, and implementation inputs. A Site IT Infrastructure Preliminary Design Review was successfully completed in April 2026, and the final design review is scheduled for late 2026.

6.5 Water Distribution and Treatment Systems

The Water and Utility Infrastructure Distribution (WUID) construction package was completed in 2024 and formally turned over to Site Operations in 2026 (see Figure 15). The WUID construction package included underground piping and conduits for fiber optic communications, domestic and fire water, and electricity, as well as the connection to the LCO water system, and construction of the GMT water tank and water equipment building (WEB). Since 2024, GMT has completed the design of a potable water chlorination system for the 270 m^3 summit storage tank. The system recirculates the stored water, monitors free residual chlorine, and adjusts chlorine dosing to maintain compliance with NCh 409/1. A recirculation rate of approximately 67 m^3/h provides one full tank turnover in four hours, ensuring uniform hypochlorite mixing and representative chlorine readings. Chlorination is performed via on-site generation of a low-concentration sodium hypochlorite solution (approximately 0.9%) from salt, water, and electricity. By eliminating the routine handling, transport, and storage of higher-concentration chlorine products, this salt-based approach provides a safer, more controlled, and more operationally practical solution that is particularly well suited to the constraints of a remote, high-altitude observatory site. The potabilization design also incorporates an ion-accelerator scale-control device to mitigate scale formation caused by the mineral content of the local water supply, thereby protecting downstream domestic and fire water equipment and reducing maintenance demands over the long term. The potability systems will be integrated with the GMT water plant PLC, enabling fully automated operation with minimal operator intervention. Construction of the potability systems is currently planned for 2028.



Figure 15 - Construction of the GMT water system and underground utility distribution systems in 2019.

7. PREPARING FOR MAJOR CONSTRUCTION

On-site construction for the GMT observatory began in 2012, with blasting and then leveling of the Las Campanas summit. Grading of the GMT site roads and the three construction areas (summit, SS1, and SS2) was completed in 2016 and 2017. Hard rock excavation of the foundations for the telescope and enclosure, and excavations for the summit utility tunnel and summit utility building, were started in 2018 and finished in 2019. Construction of the underground utility distribution systems, along with the Water Equipment Building (WEB) and the GMT water tank, was completed in 2021. The current state of the GMT site is shown in Figure 16. The fully operational water and utility systems were turned over to GMT Site Operations in 2026. As of June 2026, plans are in process to relocate the summit office complex to SS2, and to remove the east metrology tower from the summit, prior to start of construction for the enclosure. With the Enclosure FDR completed in 2024, and the design of the SSB ending with an FDR planned for late 2026, the GMT project is now preparing for a project-level FDR in 2027, and readiness to resume construction at the site in 2028.



Figure 16 - The GMT site as of March 2026.

The current (June 2026) timeline for the enclosure and SSB construction procurement process anticipates the following:

1. Invitations to an international industry briefing (IB) to construction contractors and sub-contractors in 2026
2. Drafting of construction contract documents (specimen contract, statements of work, etc.) in 2026-2027
3. Release of an international request for proposals (RFP) in 2027
4. Award of the construction contract in 2028

8. SUMMARY

Since the 2024 SPIE Astronomy meeting, the GMTO-SEF project team has made significant progress in the design of the site, enclosure, and facilities, including a successful series of design reviews for the SSB and Site IT Infrastructure. With essentially all the necessary construction support facilities and underground site infrastructure complete, the stage is set for the GMT project to move towards the construction phase for the enclosure.

9. ACKNOWLEDGMENTS

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REFERENCES

[1] Burgett, W., et al., “The Giant Magellan Telescope project in 2026: status and look ahead” SPIE Proc. 14147-47 (2026)
[2] Bigelow, B., et al., “The GMT Site, Enclosure, and Facilities: 2024 Design and Construction Update”, SPIE Proc. 13094-1 (2024)
[3] Castro, N., et al., “GMT enclosure detail engineering design: facing the construction phase”, SPIE Proc. 13094-04, (2024)
[4] Fernández, A., et al., “GMT telescope seismic isolation system design and validation”, SPIE Proc. 13094-58 (2024)
[5] Park, S., et al., “The Giant Magellan Telescope Mount: Manufacturing progress of the azimuth systems”, SPIE Proc. 14147-52 (2026)
[6] de Echenique, A., et al., “Integrating Building Information Modeling (BIM) in the design and construction of the Giant Magellan Telescope Enclosure”, SPIE Proc. 14152-40 (2026)
[7] Madden, C., “Builder of Observatory Behaviors (BOB): an interactive platform for modeling observatory operations”, SPIE Proc. 14152-25 (2026)
[8] Cox, M., et al., “Observatory software management in the era of AI-assisted software engineering”, SPIE Proc. 14155-27 (2026)
[9] Conan, R., et al., “Dome seeing and wind jitter estimation for the GMT final design”, Proc. SPIE 14152-21 (2026)
[10] Vogiatzis, K., et al., “Aerothermal modeling for ground-based observatories; present and future,” SPIE Proc. 11450-25 (2020)
[11] Colleoni, F., Vucina, T., “Vera C. Rubin Observatory final coating plant integration, commissioning, and coating results over the main telescope mirrors”, SPIE Proc. 14147-10 (2026)