

AGREEMENT RELATING TO

HOSTING THE

THIRTY METER TELESCOPE ("TMT")

AT THE OBSERVATORIO DEL ROQUE DE LOS

MUCHACHOS ("ORM")

between the

INSTITUTO DE ASTROFÍSICA DE CANARIAS

OF THE KINGDOM OF SPAIN

and the

TMT INTERNATIONAL OBSERVATORY LLC

Agreement relating to hosting the THIRTY METER TELESCOPE

BETWEEN

The legal Parties of this Agreement:

1. The Instituto de Astrofísica de Canarias of the Kingdom of Spain, consortium that is incorporated as a public research organization of the Ministry of Economy, Industry and Competitiveness and the Government of the Canary Islands, represented by its Director, Professor Rafael REBOLO LOPEZ with its headquarters at C/ Vía Láctea, s/n E38205, La Laguna, Tenerife, Spain, and is the operator of the Roque de los Muchachos Observatory;

(hereinafter referred to as "**IAC**")

2. TMT International Observatory, LLC which is a Limited Liability Company registered in Delaware, USA under number 5412629 with its principal place of business at Pasadena, California USA;

(hereinafter referred to as "**TIO**")

(hereinafter collectively referred to as the "**PARTIES**" or each a "**PARTY**")

IAC and TIO recognize the capacity of each other to enter into this Agreement and carry out all that is specified in its Articles and Annexes.

AGREE UPON THE FOLLOWING:

Preamble

A. The members of TIO at the time when this Agreement is executed are the Regents of the University of California; the California Institute of Technology; the National Institutes of Natural Sciences of Japan; the National Astronomical Observatories of the Chinese Academy of Sciences; the National Research Council of Canada and the Department of Science and Technology of the Government of India.

B. The Parties recognize

(1) the high potential of cooperation in the field of astrophysics,

- (2) the outstanding new scientific opportunities that will be created by the Thirty Meter Telescope (hereinafter "**TMT**") for the astronomical community,
- (3) that the IAC's Roque de los Muchachos Observatory (hereinafter "**ORM**"), La Palma, Canary Islands, is an ideal site for the proposed ground-based telescope, not only because of its excellent and internationally recognized astronomical properties, but also due to its geographical location,
- (4) that the first class infrastructure and the opportunity of high level scientific contacts make the ORM an excellent place for the installation of the proposed telescope.

INTRODUCTION

In view of the fact that the Kingdom of Spain has opened the IAC Observatories to the international scientific community since the International Treaty "Agreement on Co-operation in Astrophysics and its Protocol", was signed on 26 May 1979, and the Addendum to the Protocol, signed on 9 April 1983 (hereinafter altogether referred to as "International Treaty"), the TIO is welcome to install its Telescope at the ORM. In accordance with the International Treaty, an International Scientific Committee (hereafter "CCI") has been established to provide the Telescope Operators a forum where they can express their needs and preferences in regard to the Observatory Management and its Common Services.

In view of the fact that none of the countries of origin of the TIO Members have adhered or presently intend to adhere to the aforementioned International Treaty in relation to TIO's activities, a bilateral Agreement is hereby established between the IAC and TIO. In view of the above, the IAC wishes to cooperate with the TIO and is prepared to allow the installation of the TMT on land which will become part of ORM. Subject to this Agreement, all installations and equipment of TIO will have the same consideration as an IAC telescope installation within the framework of the International Treaty and with regard to the relations with the scientific community represented in the CCI and vis-à-vis the relevant public authorities.

TIO presently intends to construct TMT on Hawaii. However, if TIO determines that it will no longer pursue that intention and instead will proceed to construct and operate TMT at ORM, then TIO will give notice to bring this Agreement into force.

Definitions

"This Agreement" means the following Articles and all the Annexes.

"Building General Services" means general services such as security and reception services provided by IAC in respect of buildings at which IAC will share occupancy with TIO Personnel under this Agreement.

"CCI" refers to the International Scientific Committee which manages the participation in the Observatorios de Canarias.

"Construction" means the planning, design, construction, erection and commissioning of the Telescope, substantially in accordance with Annex 1.

"Decommissioning Funding Statement of Intent" means a statement of intent signed by a TIO Member substantially in the form contained in Annex 7.

"Digital Communications" means the 10 Gigabits per second communications link referred to in Annex 2, Part 1.

"Digital Communications Interconnection Point" means the interconnection point for Digital Communications to be provided by IAC at a location in the Residencia to be agreed between the Parties (acting reasonably).

"Electrical Power" means the 400kw and the 3.2MW electrical power supplies referred to in Annex 2, Part 1.

"Electrical Power Interconnection Point" means the electrical power interconnection point to be provided by IAC at a location in the auxiliary building for the Gran Telescopio Canarias to be agreed between the Parties (acting reasonably).

"Governmental Consent" means any approval, permit, license or other governmental or regulatory clearance or process (including decisions concerning the zoning of land) involving any governmental or other public authority within Spain that is required (directly or indirectly) for the Construction and Operation of the TMT but the term "Governmental Consent" does not include any approval, permit, license or other governmental or regulatory clearance or process relating to the import into Spain of TMT Components, or the export of such Components after they have been decommissioned or are no longer used.

"IAC Auxiliary Building" means the building presently used by IAC located at its H.Q. in La Laguna, via Lactea s/n, including the car parking facilities associated with that building.

"IAC TMT Observing Time" has the meaning given in Article 14.1.

"IPC" means the Indice de Precios de Consumo for the Canary Islands published by the Instituto Nacional de Estadística or any index which replaces that index which is compiled on a substantially similar basis.

"Laydown Area" means the area substantially as described in paragraph I and Figure A7 in Annex 1.

"Observing Time" means the time when the TMT is scheduled for the observing of astronomical objects for scientific purposes, excluding the time required for engineering, instrument commissioning and maintenance activities. To avoid doubt, "Observing Time" for the purpose of this Agreement shall be calculated on the same basis as Observing Time is calculated for allocating Observing Time among TIO's Members.

"Operations" or **"Operation"** refers to Science Operations and Technical Operations

"ORM" means the Roque de los Muchachos Observatory on La Palma, in the Canary Islands (including the TMT Site which will become part of ORM).

"ORM Access Road" means the public road running from the La Palma road network at around sea level which connects the La Palma road network to the ORM.

"ORM Road Network" means the network of roads on the ORM, apart from the TMT Access Road and, after completion of Construction, will include the TMT Access Road up to the boundary of the TMT Site.

"Party" or **"Parties"** shall mean TIO and IAC, but shall not mean TIO Members or the Government of Spain.

"Residencia" means ORM's existing Residencia building at ORM or any building replacing it or used for the same function.

"Science Operations" means the astronomical use of the telescope and its instrumentation.

"Start of Construction" means the rough grading of the TMT Site in preparation for the commencement of civil engineering work.

“Technical Operations” refers to engineering, instrument commissioning (when carried out after completion of Construction) and maintenance activities.

“TIO’s Company Agreement” means the TMT International Observatory LLC limited liability company agreement dated May 6, 2014 as amended, supplemented or modified from time to time.

“TIO Default” means any situation when the circumstances exist which permit IAC to terminate this Agreement under Article 22.4.

“TIO Members” means the members of TIO from time to time, who are those persons referred to in Preamble A. as at the date of this Agreement.

“TMT” means the Thirty Meter Telescope, as described in Annex 1, and as modified by the addition of new instruments or similar equipment as may occur during the term of this Agreement.

“TMT Access Road” means the access road substantially as described in paragraph H and Figure A6 in Annex 1 running from the existing road network at ORM to the TMT Site (including a tunnel and/or other conduits within it or alongside it to carry power, data and telecommunications, water, waste water or any other similar utilities).

“TMT Components” means all the components, accessories, spare parts and instruments, goods or materials of any sort, whatever their origin or from whatever country they originate from, which are intended for use as part of, or in relation to the construction or operation of, the TMT.

“TMT Science Operations Period” means the period of 65 years after the first day when TMT is used for Science Operations as that period may be extended in accordance with Article 22.

“TMT Site” is defined as the area shown on the map at Figure A6 in Annex 1 marked as “Proposed ORM Annexation” which, to avoid doubt, shall include the TMT Access Road up to completion of Construction. The final location can be slightly changed associated to the detailed ground evaluation and the need to ensure the most stable base is balanced with the minimum possible change of the existing geography at the site.

Article 1 Scope

1.1 This Agreement governs the conditions for hosting the TMT at ORM, its future Operation and when agreed by mutual consent its demolition, removal and the restoration of the site in accordance with Articles 6.2, 6.3 and 6.4.

1.2 This Article 1 and Article 5 shall come into force immediately on signature of this Agreement by IAC and TIO. The remainder of this Agreement shall come into force when TIO

(a) gives notice to IAC that it has decided to proceed with construction of TMT at ORM instead of Hawaii; and

(b) provides IAC with signed Decommissioning Funding Statements of Intent from each of the TIO Members, or such other assurance that TIO will be funded to perform its obligations under Article 6.2 if there should be a termination of this Agreement before the start of the Science Operations Period as may be mutually agreed between TIO and IAC;

as long as this notification is received by April 30, 2018, otherwise the terms and conditions set out herewith could be subject to renegotiation.

1.3 IAC and TIO agree that in order for IAC to be able to perform certain obligations in Article 12.2 in relation to the supply of Electrical Power IAC must perform certain topographical and environmental studies which have an estimated cost of €50,000. IAC agrees that it will carry out those topographical and environmental studies and TIO undertakes to reimburse to IAC the reasonable documented cost of those studies.

1.4 Where a Party to this Agreement has a duty or obligation which it must perform under this Agreement, then it shall perform that duty or obligation at its own cost and expense unless and to the extent that such Party has an express right to recover compensation (or any other payment) from the other Party under the express terms of this Agreement.

Article 2 TMT Site at ORM

2.1 IAC shall grant the right to TIO:

- (a) to use the TMT Site to construct the installation, and therefore to install the telescope and its required infrastructure and auxiliary systems as described in Annex 1;
- (b) to construct the TMT Access Road;
- (c) to use the Laydown Area during Construction.

TIO may fence in individual areas, or the whole or part of the TMT Site, the TMT Access Road and/or the Laydown Area, as it considers to be appropriate for access control and safety as agreed with IAC and after obtaining any necessary Governmental Consents.

2.2 IAC agrees that the TMT equipment and all necessary infrastructure substantially as defined in Annex 1 can be constructed on the TMT Site, and can be operated by TIO for the TMT Science Operations Period.

Article 3 Telescope Construction

- 3.1 The Construction of the TMT will be carried out by TIO in accordance with the construction plan prepared by TIO. During this period TIO will take those precautions which a skilled and experienced construction contractor would take with the objective of ensuring that its work does not produce any measureable negative impacts on the existing telescopes at the ORM, nor on the operation of the site.
- 3.2 During the Construction phase IAC will appoint a contact person for TIO, who will provide support and assistance in all matters regarding the Construction on the TMT Site.

Article 4 Telescope Operation

- 4.1 Subject to the express terms of this Agreement, the responsibility for the Operation of the TMT rests exclusively with TIO, or its subsidiary

or other agency charged by TIO with this task. TIO may delegate or subcontract aspects of Operations to 3rd parties and, by mutual agreement, to IAC.

- 4.2 TIO is represented during Construction by its Executive Director and TMT Project Manager, and during Operations by the TIO Director. During the Construction phase of the project the TMT Project Manager has authority over all personnel working on the TMT Site, or entering the TMT Site. The TMT Project Manager may delegate these powers and responsibilities to an on-site Manager. In all matters of TIO Operations at La Palma, the TMT Project Manager or, during the Science Operations phase, the TIO Director serves as contact and will interface vis-à-vis IAC in accordance with a protocol to be agreed in writing between TIO and IAC, each acting reasonably.

Article 5 Governmental Consents

- 5.1 The parties agree that they intend that TIO should obtain all Governmental Consents required for the Construction and Operation of the TMT, and that where the Governmental Consents are given in favor of, or grant rights to, a person, then, wherever legally possible and reasonably practicable, the relevant person shall be TIO.
- 5.2 TIO shall keep IAC informed in relation to the application for and pursuit of all Governmental Consents.
- 5.3 IAC shall provide such advice and assistance as TIO may reasonably require in relation to the preparation of documents and evidence, and the application for and pursuit of all Governmental Consents.
- 5.4 If it is not legally possible or reasonably practicable for a Governmental Consent to be issued in favour of, or in the name of TIO, then TIO shall prepare the necessary applications and other documents for IAC to apply for and obtain the relevant Governmental Consent. As part of its duty to provide advice and assistance under Article 5.3, IAC shall promptly submit such applications and other documents as TIO may reasonably require it to submit to pursue any such Governmental Consents in the name of IAC. If such Governmental Consent cannot be transferred to TIO then IAC shall

permit TIO to act in IAC's name to exercise the rights granted by the Governmental Consent.

Article 6 Environmental impact

6.1 TIO agrees to protect the local environment by taking every reasonable measure to avoid contaminating the ground during the Construction period and leaving the TMT Site, the Laydown Area and the affected neighboring areas in a clean and orderly state upon completion of the Construction work so as to fulfil the stipulations of the Environmental Impact Report.

6.2 Within:

(a) 10 years after the TMT Science Operations Period (subject to Article 22.3 (b)); or

(b) 5 years after termination of this Agreement as a consequence of TIO Default;

TIO shall undertake at its own cost to remove from the TMT Site all TIO equipment and restore the TMT Site and, in the case of a termination of this Agreement as a consequence of TIO Default during the Construction Period, the Laydown Area, in each case according to the conditions defined in the Environmental Impact Report.

6.3 TIO will provide to the IAC the Decommissioning Funding Statements of Intent or other assurance referred to in Article 1.2(b) in relation to funding the reasonably expected costs of complying with Article 6.2 if there should be a termination of this Agreement in accordance with Article 22.4 before the start of the TMT Science Operations Period.

6.4 TIO agrees that from the start of the TMT Science Operations Period it will establish a designated bank account, and will make regular deposits into that account so that by the end of the TMT Science Operations Period the balance in that bank account will be sufficient to fund the reasonably expected costs of complying with Article 6.2. After receiving a request for this information from IAC, TIO will provide to IAC:

- (a) its current estimate of such costs;
- (b) a calculation of deposits which TIO plans to make into the bank account; and
- (c) copy bank statements to confirm that the planned deposits into such account have been made in accordance with the calculation referred to in Article 6.2(b).

Article 7 Safety

- 7.1 TIO will apply the ORM Health and Safety standards on the TMT Site.
- 7.2 TIO shall ensure that the persons authorized to construct, operate and maintain the TMT are familiar with and respect the applicable ORM Health and Safety requirements.
- 7.3 IAC will always provide the latest version of the ORM Health and Safety standards to TIO. The list of regulations currently in force concerning Health and Safety can be found in Annex 3.
- 7.4 Variances to ORM Health and Safety Standards:
 - (a) TIO may apply to IAC for variances to any ORM Health and Safety Standards which has been prepared and/or issued by IAC itself. IAC will act reasonably in considering whether to accept any such variance and will permit such variances where it is reasonable to do so; and
 - (b) in respect of any standards, such as those in Annex 3, issued by other entities, TIO may apply for or (where lawfully permissible) adopt variances to these standards as appropriate. If TIO takes any such variance actions it shall provide a copy of the variance documentation to IAC and shall conduct such consultation with IAC in respect of the variance as may be reasonable in all the circumstances. If a relevant entity or authority agrees to the variance then TIO shall provide a copy of the correspondence or other documentation permitting such variances to IAC.

TIO's obligations under Article 7.1 and 7.2 will thereafter apply to ORM Health and Safety Standards subject to such permitted variances.

Article 8 Consent of the CCI and subsequent proceedings of the CCI

8.1 So as to guarantee the preservation of the astronomical conditions at the Canarian Observatories the CCI has established a Sub-Committee on Site Properties (SUCOSIP). This Committee reviews all new developments at each Observatory to evaluate their possible impact on the prevailing astronomical conditions enjoyed by the existing telescopes. The consent of the CCI to the Construction and Operation of TMT is recorded in Annex 4.

8.2 IAC shall ensure that TIO shall be invited to have an observer in attendance at each meeting of the CCI. IAC shall provide TIO with a copy of all information and documents which are provided to members of the CCI at the same time as such information and documents are provided to the CCI members.

8.3 In relation to any matter to be discussed by the CCI which only affects:

(a) One or more telescopes that are operated by an institution from one of the parties to the International Treaty other than the IAC; and

(b) the TMT,

IAC shall reach a consensus with TIO as to the position it will defend in the CCI and IAC will not vote on that matter on the CCI until such consensus has been reached.

8.4 In relation to any matter to be discussed by the CCI which affects the TMT and one or more telescopes which are operated by an institution which is not from one of the parties to the International Treaty IAC will conduct itself as follows.

(a) IAC will consult with TIO and with the other institutions operating such affected telescopes, with the objective of

reaching a consensus as to how IAC should cast its vote on the CCI.

- (b) If such consensus is achieved then IAC will proceed in accordance with that consensus.
- (c) If such consensus cannot be achieved among IAC, TIO and all of the relevant parties then, IAC agrees to reach a consensus with TIO as to the position it will defend in the CCI and IAC will not vote on that matter on the CCI until such consensus has been reached.

Article 9 Autonomy

Subject to:

- (a) compliance with the ORM Health and Safety requirements;
- (b) the coordination with other telescopes at ORM regarding potential interference by laser guide stars or any future technological development which may have the potential to cause interference to the observations carried out by other telescopes and
- (c) the provisions of Article 14 regarding the rights of Spain in relation to TMT Observing Time,

TIO shall have sole autonomy regarding the Operations of the TMT.

Article 10 Site Access

- 10.1 IAC shall ensure that persons authorized by TIO shall have the right to access and use the TMT Site and its facilities via the ORM Access Road and the ORM Road Network. During the Construction period, access to the Laydown Area and additional neighboring areas may be required and will be granted by IAC.
- 10.2 TIO is given exclusive authority to control access to the TMT Site. IAC personnel or 3rd parties may enter the TMT Site only in the context of tasks agreed between the TMT Project Manager or TIO Director and

IAC, in case of emergencies, and in the context of monitoring and supervising the applicable ORM Health and Safety requirements.

- 10.3 So as to avoid hazards posed by accidental bush fires, TIO shall have access to clear and maintain a strip around the TMT Site as defined in the construction project.

Article 11 Ownership, Acquisition, Import and Export

- 11.1 TIO will remain as either the owner, or as the lessee from a TIO Member, of TMT Components installed at ORM. The same applies to TMT Components stored by TIO at ORM.

- 11.2 In order

- (a) to ensure that the tax and duty exemption rules applicable to goods and materials imported for the use in astronomical, scientific and research activities apply to TMT Components, and
- (b) to facilitate obtaining any governmental consent, permission or license (including obtaining any exemption from the need for a governmental consent, permission or license) which may be necessary or expedient for the import of TMT Components

IAC agrees to act as the importer of record for all TMT Components to be imported by TIO into the Canary Islands. IAC shall provide all reasonable support and assistance in connection with such importation including promptly signing such documentation as may be reasonably necessary to confirm that IAC is the importer of TMT Components. Such support and assistance shall include setting up an office with dedicated staff to deal with these matters during the Construction phase. The associated direct costs will be reimbursed by TIO to IAC.

- 11.3 Where necessary or expedient:

- (a) to facilitate the re-export of TMT Components which are no longer needed;
- (b) to permit such re-export to be on a tax and duty free basis;

IAC agrees to act as the exporter of record of such TMT Components. IAC shall provide all reasonable support and assistance in connection with such export processes including promptly signing such documentation as may be reasonably necessary to confirm that IAC is the exporter of TMT Components. The associated direct costs will be reimbursed by TIO to IAC.

Article 12 Infrastructure and Services

12.1 The IAC will provide the Dedicated Infrastructure described in Part 1 of Annex 2 and the Common Infrastructure and Common Services described in Part 2 of Annex 2 and will permit their use in accordance with this Agreement throughout the term of this Agreement.

12.2 The following provisions shall apply in relation to the Dedicated Infrastructure:

- (a) IAC shall provide the source for Electrical Power supply to the TMT Site at the Electrical Power Interconnection Point by the dates stated in Row 1a. of Annex 2. IAC shall provide the source for Electrical Power supply to the Laydown Area at the existing ORM Utility Building by the date stated in Row 1b. of Annex 2. IAC shall permit TIO to lay cables for transmission of Electrical Power to the Laydown Area (during the Construction Period) and the TMT Site on routes outlined in Annex 1, with the detail to be agreed between the Parties (acting reasonably). Subject to TIO paying for the cost of the power consumed by TIO to IAC, IAC shall ensure that the infrastructure required to transmit the Electrical Power from the main grid for La Palma to the Electrical Power Interconnection Point shall be maintained in accordance with good industry practice throughout the term of this Agreement. TIO's payment for power shall be the percentage of the cost of the power charged by the power provider to IAC (with no mark-up or additions) which is equal to the percentage of the power consumed by TIO as a proportion of the total power consumed at ORM.
- (b) IAC shall provide the Digital Communications at the Digital Communications Interconnection Point, and shall permit TIO to connect a 128-fiber optical cable from the TMT Site at that point by the date stated in Annex 2. IAC shall permit TIO to lay

cables for Digital Communications as outlined in Annex 2, with any necessary details to be agreed between the Parties (acting reasonably). IAC shall ensure that the infrastructure required to transmit the Digital Communications from the main communications grid of La Palma to the Digital Communications Interconnection Point shall be maintained in accordance with good industry practice throughout the term of this Agreement. TIO shall pay its share of the cost of the Digital Communications as part of its share of the Undifferentiated Common Services in accordance with Annex 5.

- (c) If IAC establishes a water main supply for freshwater at ORM then IAC shall provide access to such systems so that TIO may run pipes and provide such pumps or other equipment as may be necessary to connect TMT to such systems using utility connections which run on a route to be agreed between the Parties (acting reasonably) which, where reasonably practicable, will run in the ducts under or adjacent to the TMT Access Road. If TIO chooses to connect to such systems, then TIO shall pay the costs of the utility connections and shall pay a reasonable rate for the consumed freshwater.
- (d) IAC shall provide access to the IAC Auxiliary Building for the numbers of people specified, and by the dates stated in Annex 2.
 - (i) From the first date for the IAC Auxiliary Building referred to in Annex 2, IAC shall provide reasonable facilities for up to 5 TIO staff, and shall maintain the structure, the electrical and mechanical services, the interior fixtures and fittings (including non-structural partitions) and the interior decoration of that building all in accordance with good industry practice throughout the period when TIO's staff are using such facilities. TIO shall pay for its proportionate share of the cost of the utilities, and digital and voice communications used at the IAC Auxiliary Building. TIO shall pay for its proportionate share of the cost of the Building General Services provided by IAC at the IAC Auxiliary Building.

- (ii) From the second date for the IAC Auxiliary Building referred to in Annex 2 IAC shall give TIO the exclusive use of the IAC Auxiliary Building throughout the term of this Agreement. IAC shall maintain the structure and the electrical and mechanical services within the IAC Auxiliary Building in accordance with good industry practice throughout the term of this Agreement. TIO shall maintain the interior fixtures and fittings of the IAC Auxiliary Building (including non-structural partitions) and the interior decoration of the IAC Auxiliary Building in accordance with good industry practice throughout the term of this Agreement. TIO shall pay for the utilities used at the IAC Auxiliary Building during the time that it is entitled to occupy the IAC Auxiliary Building. TIO shall pay for its proportionate share of the cost of the Building General Services provided by IAC at the IAC Auxiliary Building.
- (e) IAC shall provide access to its present building at La Palma (CALP) by the date stated in Annex 2, and shall thereafter provide reasonable facilities for
 - (i) up to 5 TIO staff at its La Palma (CALP) office space from the first date for the La Palma office space referred to in Annex 2 and shall permit TIO to erect temporary prefabricated offices at that location for an additional 5 staff; and
 - (ii) up to 80 TIO staff at its its future sea-level facility building (CATELP), from the second date for the La Palma office space referred to in Annex 2, and thereafter throughout the term of this Agreement.

IAC shall maintain the structure, the electrical and mechanical services, the interior fixtures and fittings (including non-structural partitions) and the interior decoration of the relevant buildings all in accordance with good industry practice throughout the term of this Agreement. TIO shall pay for its proportionate share of the cost of the utilities, the Building General Services, and digital and voice communications used at

the building in La Palma during the time that it is entitled to occupy that building.

12.3 All persons using the Common Infrastructure and Common Services shall observe the rules established by IAC and approved by CCI, under the supervision of the IAC Director or his Delegate.

12.4 IAC shall ensure that:

- (a) the ORM Access Road;
- (b) the ORM Road Network;
- (c) the Residencia, its annex and the canteen facilities at ORM;

and any replacement, renewal or extension of any of them are operated and maintained in accordance with good industry practice to at least the current standard of maintenance throughout the term of this Agreement.

12.5 In relation to Common Infrastructure and Common Services

- (a) TIO shall pay for the costs of Differentiated Common Services in accordance with Annex 5;
- (b) TIO shall bear its proportion of the cost of all current expenditure on Undifferentiated Common Services in accordance with Annex 5. TIO shall pay its share of this expenditure annually. The contribution will be calculated on the basis laid out in Annex 5 at December 31st in each year for the following year's Budget, whether these are in full operation or not.

12.6 TIO will pay IAC for access to the ORM Residencia and canteen for personnel authorized by TIO at the same rates as all other persons who have access to those facilities. Current rates for these services are detailed in Annex 5.

Article 13 IAC Operations Support

At the request of TIO and by mutual agreement, TIO may contract the IAC to carry out on its behalf specific activities of the Technical Operations of the TMT. In such cases, IAC will charge TIO its direct costs plus an appropriate overhead.

Article 14 IAC TMT Observing Time

14.1 10% of the total Observing Time produced by the TMT will be reserved for IAC on behalf of the Spanish Astronomical community for hosting the TMT at the ORM site and in return for additional IAC contributions to the TMT project. The 10% of Observing Time is the "**IAC TMT Observing Time**". The IAC TMT Observing Time shall be distributed equally throughout the year and lunar phases. The IAC TMT Observing Time will be free of charge to IAC and will be used with any of the instruments deployed at the telescope, including guest instruments. Subject to Article 14.2, IAC may allocate the IAC TMT Observing Time among Spanish Astronomers or Astronomers from signatories of the International Treaty as IAC sees fit.

14.2 In order to foster collaboration between TIO's and IAC's community of astronomers, it is the goal that a minimum of one quarter of the IAC TMT Observing Time will be used collaboratively in IAC led proposals. TIO and IAC will discuss and seek to agree on processes to encourage this collaboration.

14.3 The creation of "Key Projects" in relation to the TMT Project by TIO's Members is at this time being considered by the Science Advisory Committee, but has not been recommended to the TIO Board. Should such projects be approved by the TIO Board, then IAC will have the same rights and obligations in relation to participation in such projects as the TIO Members.

14.4 To enable an efficient long-term planning of observations and scheduling of observation targets, the IAC TMT Observing Time shall be made available on the basis of calls for proposals issued by IAC to those persons or institutions who it considers to be eligible for use of IAC TMT Observing Time, which shall be issued simultaneously with the regular calls for proposals for use of Observing Time issued by TIO or its Members. Proposals for use of IAC TMT Observing Time will be

evaluated by IAC in its absolute discretion, subject to Articles 14.2 and 14.3.

- 14.5. IAC TMT Observing Time allocated but not taken up during a calendar year may not be transferred for use to the year immediately following or to subsequent years.
- 14.6 IAC recognizes that it will be impractical to allocate IAC TMT Observing Time in any year so that the amount of IAC TMT Observing time precisely corresponds to 10% of Observing Time. The intent of the Parties is that in any year the amount of IAC TMT Observing Time should be as close as is reasonably practicable to 10% and that over several years the process of allocating IAC TMT Observing Time should be operated so that the aggregate amount of IAC TMT Observing Time should more precisely match 10%.

Article 15 Contribution by IAC to the TMT Project

- 15.1 IAC will provide an aggregate in-kind contribution of €10 million to first light instrumentation for the TMT. This contribution shall begin when TIO gives notice to bring this Agreement into force under Article 1.2. In return for such contribution IAC, and through IAC, Spanish astronomers, shall be integrated with the relevant TIO instrument teams for those instruments to which they have made contributions, and in particular shall have the right to contribute to decisions in relation to the commissioning plans for such instruments, and shall have a reasonably proportionate share of the commissioning time. If, in the future, any Observatory guaranteed time is allowed for such instruments then IAC will also have a reasonably proportionate share of any such time.
- 15.2 As a commitment to the collaborative enterprise of the TIO, IAC shall make aggregate in-kind contributions to the TIO instrumentation program to the value of 2.5% of the aggregate annual operations costs per decade for each of the four subsequent decades after the first light instruments are commissioned. From time to time TIO, acting reasonably, shall make proposals to IAC in relation to the nature of such in-kind contributions, and thereafter TIO and IAC (each acting reasonably) shall agree what such contributions shall be.

15.3 If:

- (a) IAC or the government of Spain provides cash contributions or in-kind contributions to the Construction of TMT of at least a further aggregate amount of €10 million; and
- (b) IAC commits to funding the share of the operations cost that would correspond to the share of additional Observing Time referred to below,

then TIO will permit IAC to have additional Observing Time for Spanish Astronomers, calculating a share of Observing Time on the basis of such aggregate contribution on the same basis as observing time is calculated for TIO's members under TIO's Company Agreement. For the purpose of comparing the value of any IAC contribution under this Article 15.3 to the value of contributions made by TIO's Members, IAC's contribution will be valued on the same basis as contributions made by TIO's members under TIO's Company Agreement and the Members' respective Contribution Agreements.

15.4 TIO and IAC, each acting reasonably, shall reach agreement in relation to the valuation of in-kind contributions in accordance with generally accepted international accounting standards.

15.5 Operations costs will be calculated for the purposes of this Agreement, and in particular Articles 15.2 and 15.3, on the same basis as operations costs are calculated to assess TIO's Members obligations to contribute operating costs under its Company Agreement.

Article 16 Scientific Exploitation and Representatives

16.1 The Parties will strive to ensure that mutual benefits for science, specialist education and technological collaboration are derived from the implementation of this Agreement.

16.2 So as to promote the development of collaborations between the TIO and the IAC in Astrophysics and related technologies as well as the exploitation of the Telescope and its instrumentation, starting on the date when TIO commences installation of the segments of the TMT

main mirror, TIO will contribute annually towards the IAC Post-Doctoral Research ("PDR") program 200,000€ adjusted in accordance with the IPC on each anniversary of the date of this Agreement. At 2016 prices this amount is equivalent to the total cost of four (4) PDR positions.

- 16.3 To facilitate the communication between the Parties and secure the greatest possible scientific, technical and outreach production each Party shall appoint a high level Scientific Representative. The aforementioned Representatives shall jointly produce each year a report to the Parties of not more than 3 A4 pages by the end of February of the following calendar year, parts of which may be reproduced in the CCI Annual Report. The Parties shall inform each other of any Scientific Representative appointment or the termination of such appointment in writing without delay. The IAC Director, or the IAC Scientific Representative, could be invited as Observers to TIO Board meetings. IAC may also appoint a person to act as an Observer on TIO's Science Advisory Committee.
- 16.4 All publications arising from the Construction and Operation of TMT shall acknowledge TIO as the funding body and the IAC as the ORM hosting organisation using the following, or equivalent, wording, "This article is based on/includes observations made at the ORM on the island of La Palma with the Thirty Meter Telescope that is operated by the TIO at the IAC's Observatorios de Canarias. This research has been supported by the [type of funding]."
- 16.5 The IAC will grant the status of "Scientific Research Affiliate" to those TIO staff who have their regular workplace at the IAC headquarters. These researchers may participate in those IAC projects that can apply for IAC internal funds as well as participating in projects with competitive funding under a national or European research system. They will also have the right to apply for use of the "open time" at the Observatorios de Canarias through the normal time application channels. To avoid doubt, this includes a right to apply for open time at the Gran Telescopio Canarias.
- 16.6 TIO's technical staff will be given access to the IAC workshops and laboratories in accordance with the performance and safety standards of the IAC which are relevant to such access. The costs associated with

this access will be paid by TIO to IAC in accordance with IAC's official published tariffs.

Article 17 Use of Laser Guide Stars (LGS)

- 17.1 LGS usage is core to the science exploitation of TMT. Therefore IAC agrees that it shall ensure that the policy regarding the usage of LGS at ORM will provide the maximum priority for the TMT observations. The LGS protocol will also assure access to celestial targets for other telescopes, in particular for target of opportunity observations. Without changing the generality of TIO's rights under Article 8, IAC shall ensure that TIO will be able to participate fully in the development and adoption of the Canarian Observatories' LGS policy.
- 17.2 The current law of Canary Island Sky Protection restricts the passage of aviation routes above the Canarian Observatories. The IAC shall use its best endeavors to establish an agreement with the authorities of Civil Flight Navigation (AENA), whereby it will not be necessary to communicate in advance the date, duration, coordinates, length and power of all non-horizontal laser launches.

Article 18 Scientific Data

- 18.1 All data acquired by use of TMT shall be managed in accordance with TIO's data rights policies as managed and implemented by TIO in its absolute discretion.
- 18.2 IAC (and persons authorized by IAC) shall have the same rights in respect of data produced during a TIO Member's Observing Time as the rights of those TIO Members who were not using the Observing Time when the data was produced.
- 18.3 All data acquired by use of TMT during IAC TMT Observing Time (IAC OT Data) shall be managed by TIO so that:
- (a) the rights of IAC in respect of IAC OT Data shall be equivalent to the rights of a TIO Member in respect of data produced during that Member's Observing Time; and

- (b) the rights of each of TIO's Members in respect of IAC OT Data shall be equivalent to their rights in respect of data produced during another Member's Observing Time.

Article 19 Outreach

- 19.1 The Parties agree to coordinate outreach activities. This will include cooperating with the programs of public and academic visits operated either by Observatory staff or through third parties. These programs shall be reviewed on an annual basis in preparation of the autumn meeting of the CCI and TIO shall be invited to nominate a representative who will participate in this process.
- 19.2 In view of the project to construct a Science Outreach Centre near the ORM the Parties agree to work together to provide and maintain suitable exhibits, which may be permanent or available for temporary exhibitions in other suitable venues. The parties intend that TIO's contributions will be approximately proportionate to the proportion in which it bears the cost of Undifferentiated Common Services according to the formula in paragraph 6 of Annex 5.

Article 20 Intellectual Property

- 20.1 This Article 20 applies to information ("Protected Information") in relation to the equipment and routines that TIO uses for the Construction and Operation of the TMT, which information is the subject of intellectual property rights owned by or licensed to TIO or its members or its or their contractors and suppliers. For this purpose, "intellectual property rights" means rights in relation to inventions, technology, improvements, discoveries, software, designs or other work or data which is protected, or is capable of being protected, by copyright or patent law.
- 20.2 IAC agrees that if and to the extent that any Protected Information needs to be disclosed by TIO to IAC or, through IAC to any third party (including the CCI), in order for either TIO or IAC to perform their rights or duties under this Agreement, then TIO will only be required to disclose such Protected Information on the basis of such terms and conditions as it may require which terms and conditions shall be

contained in a Non-Disclosure Agreement to be executed by IAC or any such third party (including the members of the CCI).

- 20.3 The provisions applicable to TIO's Members under their Contribution Agreements relating to the rights granted by the Members to TIO in relation to IP included in those Contributions shall apply to the contributions made by IAC to the TMT Project under this Agreement. Those provisions are included for ease of reference in Annex 6.
- 20.4 The provisions agreed between TIO and its Members in TIO's Company Agreement in relation to the rights to exploit intellectual property developed for the TIO Project shall apply as between IAC and TIO and its Members. Those provisions are included for ease of reference in Annex 6.

Article 21 Liability and Warranty

Spanish law shall apply.

Article 22 Duration and Termination

- 22.1 This Agreement shall expire 10 years after the end of the TMT Science Operations Period (as that period may be amended in accordance with this Article 22 and Article 24.1), unless it is agreed that the TMT will be taken over by IAC or its nominee at the end of the TMT Science Operations Period (as envisaged by Article 22.2(c)), in which case this Agreement shall expire at the end of the TMT Science Operations Period.
- 22.2 At least six years before the expiration of the TMT Science Operations Period, the Parties shall aim to review the performance of TIO as a basis for negotiation:
- (a) with regard to possible extensions of the TMT Science Operations Period;
 - (b) in relation to any other amendments to this Agreement which the Parties may mutually agree;

- (c) in relation to whether TMT will be taken over by IAC or its nominee at the end of the TMT Science Operations Period.

Any such agreement shall be documented as an amendment in accordance with Article 24.1.

22.3 End of the TMT Science Operations Period

- (a) During the period of 10 years after the expiration of the TMT Science Operations Period (or any extension of that period pursuant to Article 22.2) TIO shall decommission the TMT and restore of the TMT Site as may be required in accordance with Article 6.2.
- (b) If TIO and IAC have agreed that TMT shall be taken over by IAC or its nominee at the end of the TMT Science Operations Period then TIO shall be released from its obligations to decommission TMT and from its obligations to restore the TMT Site.
- (c) To avoid doubt, TIO may continue to use the TMT for Science Operations (and IAC's rights to a share of Observing Time shall continue to apply in accordance with Article 14) during the initial part of the 10-year period referred to in Article 22.3(a) so long as that does not prevent completion of the decommissioning of the TMT and restoration of the TMT Site by the end of that 10-year period.

22.4 Termination of the Agreement before the end of the TMT Science Operations Period

- (a) A Party (the "non-defaulting Party") may terminate this Agreement by giving notice to the other Party (the "defaulting Party") if
 - (i) there has been manifest non-performance by the defaulting Party of the material objectives, terms and conditions of this Agreement; and
 - (ii) that non-performance has not been cured within 30 days after the non-defaulting Party has given notice to the defaulting Party specifying the objectives, terms or

conditions of this Agreement which have not been performed.

(b) IAC may terminate this Agreement if TIO's activity on the TMT Site has been suspended for a period in excess of 3 years and TIO's activity on the TMT Site does not resume within 90 days after IAC gives notice that it will terminate this Agreement if such activity does not resume; however, any period when TIO's activity on the TMT Site has been suspended as a consequence of:

(i) a failure by IAC to perform its obligations under this Agreement; or

(ii) any legislative, regulatory or judicial act which is outside the reasonable control of TIO;

shall not be counted when measuring the 3 year period or the period of 90 days referred to in this Article 22.4(b).

Article 23 Successors to IAC and TIO

23.1 The Parties hereto are aware that the TIO is the current legal entity responsible for the TMT. The Parties agree that any rights and obligations created by this Agreement may be transferred by TIO to any future legal entity which might be established by TIO or by its members. If called upon to do so, IAC will enter into an agreement with such legal entity to confirm that the entity has such rights and obligations.

23.2 IAC shall ensure that any legal successor to the IAC as the entity which operates and maintains ORM which may be established by any Spanish national or local government shall take over its rights and obligations under this Agreement. If called upon to do so, TIO or its transferee under Article 22.1 will enter into an agreement with such successor to confirm that the successor has such rights and obligations.

Article 24 Amendment and Annexes

- 24.1 This Agreement may be amended at any time. An amendment of this Agreement must be in writing and specifically state the intention to amend this Agreement and becomes effective when signed and dated by all Parties.
- 24.2 The Parties shall negotiate amendments to this Agreement should essential circumstances and conditions underlying this Agreement change.
- 24.3 Further organizational details and arrangements not covered in this Agreement shall be agreed upon by the Parties in writing (i.e. exchange of letters or in the form of additional Annexes signed by both Parties).

Article 25 Disputes

- 25.1 In the first instance the Parties shall endeavor to resolve any disputes over the interpretation or implementation of this Agreement in accordance with the terms and conditions set out herewith. The Parties may request that the CCI appoints an arbiter to assist them in this process. This person will not have either Spanish or the same nationality as any of the TIO partners and the Parties shall strive to come to a mutually agreeable resolution on the basis of the arbiter's recommendations.
- 25.2 In the event that the Parties do not reach an amicable solution after the process set out in Article 25.1 the matter shall be resolved in accordance with the Rules of Conciliation and Arbitration of the International Chamber of Commerce, by one or more arbitrators designated by that body. The location for the arbitration shall be London, United Kingdom. The arbitration shall be conducted in English. The arbitrators' decision shall be binding.

Article 26 Language

This Agreement is established on March 29, 2017, in four copies, 2 in English and 2 Spanish, each of which have the same meaning and value.

[The remainder of this page is intentionally blank and the signature page follows on the next page]

Signed in Pasadena, CA, 91124,
United States of America by:

Signed in La Laguna, Tenerife,
Canary Islands, Spain by:

For TIO
Dr. Edward C. Stone
Executive Director

For IAC
Prof Rafael Rebolo López
Director

ANNEX 1

The Telescope, Ancillary Facilities, and Sites

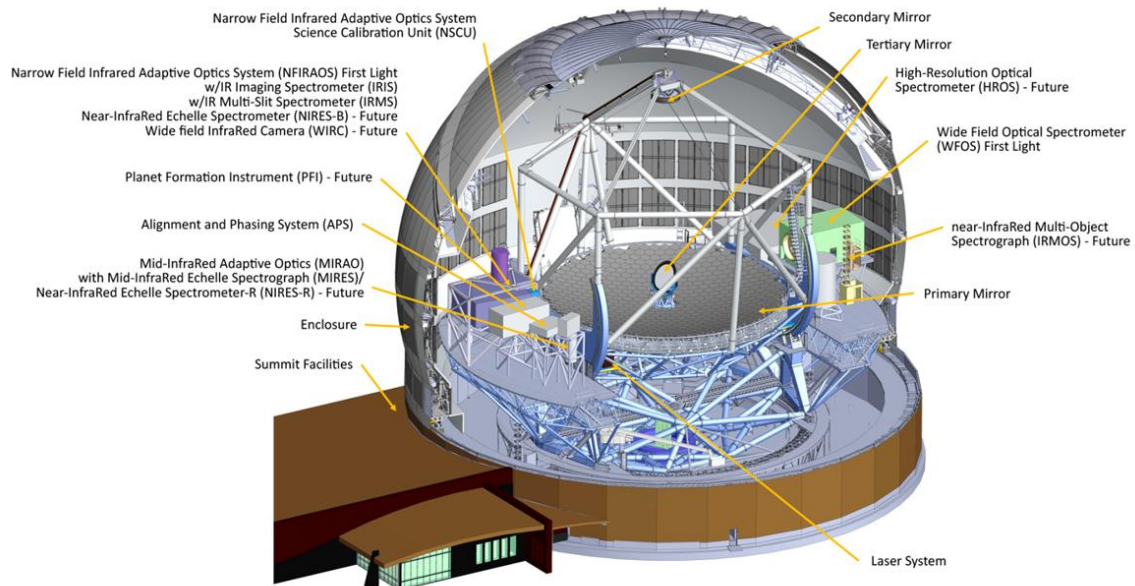


Figure A1 – TMT Observatory proposed design showing the telescope, its mirrors, the telescope's systems and its instrumentation.

A. The Thirty Meter Telescope and Enclosure

The proposed Thirty Meter Telescope is shown in Figure A1. Key observatory design features include:

- A 30 m diameter, filled-aperture, finely-segmented pupil maximizing near-diffraction-limited performance, high contrast, and uniform point spread function.
- A steerable tertiary mirror to address multiple instruments quickly, increasing observational efficiency, and enabling key science cases involving rapid follow-up of targets of opportunity and transient objects.
- An adaptive optics (AO) system - AO systems correct for the image distortion that is caused by the atmosphere - that will provide a unique first-light combination of diffraction limited correction in J, H, and K bands,

a large and astrophysically useful field, excellent image uniformity and stability, and extensive sky coverage (greater than 50 percent). The TMT will be the first large optical and infrared observatory to integrate AO into its original design. The AO system will project up to eight laser beams into the atmosphere to create an asterism, or group, of “guide stars” that are used to determine the atmospheric distortion of the visible and infrared light from distant objects and correct for it. The TMT AO system will generate each of these eight beams using a 25-watt laser; the laser light will appear yellow (0.589 microns – the sodium D2 line).

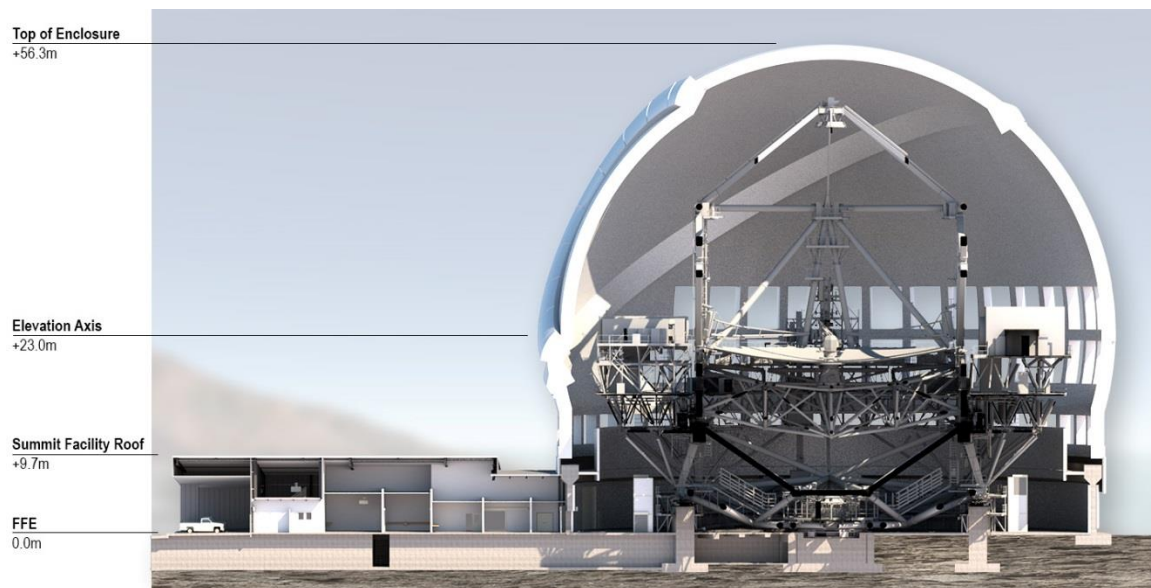


Figure A2 – Cross-section of conceptual TMT Observatory design with dimensions shown.

The dome housing the telescope will be a Calotte type enclosure with the following characteristics (as depicted in Figures A1 and A2).

- The total dome height will be 56 meters above the finished grade, with an exterior radius of 33 meters.
- The dome shutter will be 31.25 meters in diameter and it will retract inside the dome when opened.
- The dome will rotate on two planes, one horizontal at the base structure 8 meters above finish grade and the other at roughly 25 degrees as the cap structure, enabling the telescope to view from straight up into the sky down to 25 degrees above horizon.

- The calotte dome base, cap, and shutter structure will appear rounded and smooth and will have a reflective aluminum-like exterior coating.
- The fixed cylindrical structure below the rotating base will enclose approximately 3,200 square meters and will extend to 8 meters above finish grade.
- The dome will have 88 vents that will close during the day and will open at night. The vents will be used to maintain temperature equilibrium between interior and exterior air at night and manage air flow through and around the dome.
- The enclosure will be constructed primarily with structural steel and reinforced concrete. Some aluminum will be used in the enclosure shutter and in the vents.

B. Support Building

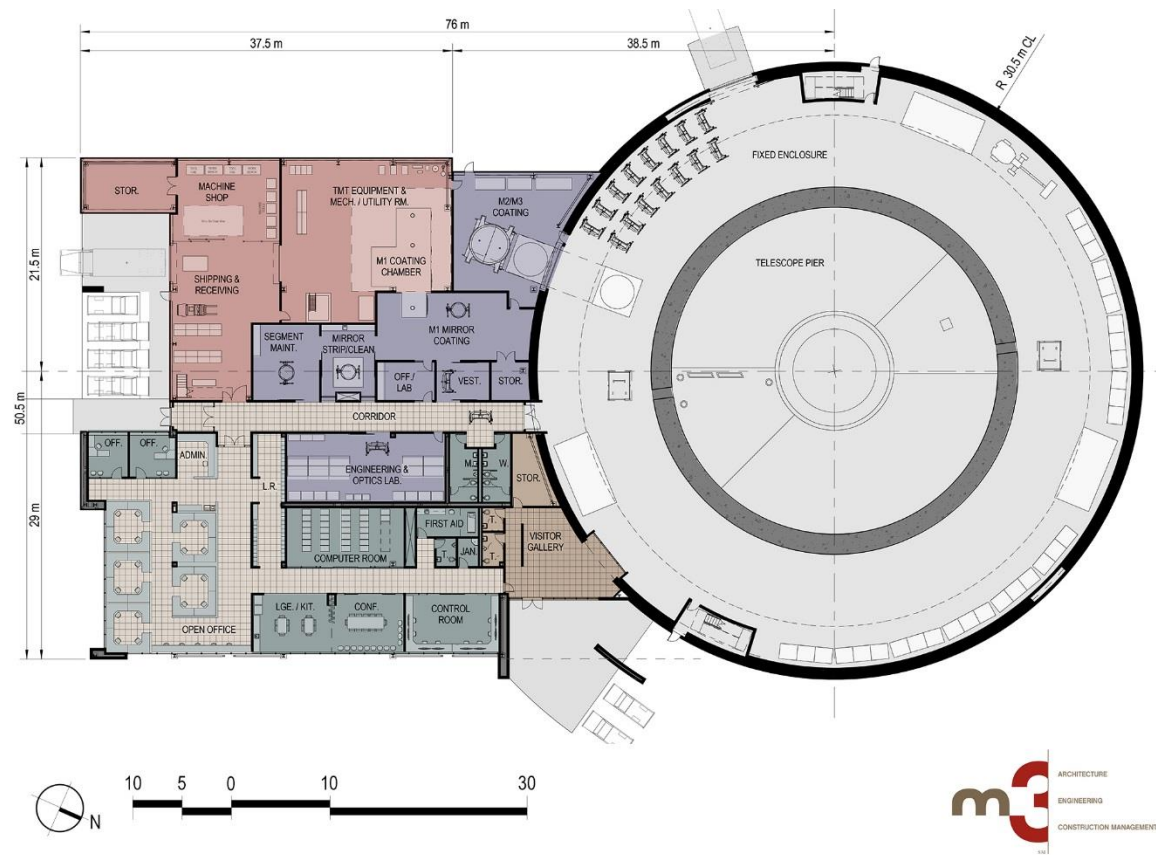


Figure A3 – TMT Support Building – conceptual floor plan

A support building will be attached to the enclosure (see Figure A3). The support building will have a floor area of approximately 1,960 square meters. The support building will include the following spaces:

- Mirror coating and staging areas
- Engineering and electronics laboratories
- Mechanical shop
- Computer room
- Control room
- First aid room
- Administrative space, including offices and a lounge with kitchenette.
- Restrooms
- Equipment and utility spaces
- Shipping and receiving
- Visitors' gallery

The support building will be constructed with reinforced concrete foundations, structural steel framing and metal panel siding and roofing.

C. Utility Building



Figure A4 – TMT Utility Building – conceptual floor plan

A utilities building (see Figure A4) will primarily house vibrating equipment and equipment that generates significant amounts of heat. The utilities building will have a floor area of approximately 650 square meters. The utilities building will include spaces for the following equipment:

- Electrical service
- Electrical equipment
- Chillers
- Generator
- Pumps for chilled water systems
- Fire suppression equipment

- Hydrostatic bearing pumps and reservoir

The utilities building will be constructed of reinforced concrete foundations and retaining walls, structural steel framing and metal panel siding and roofing.

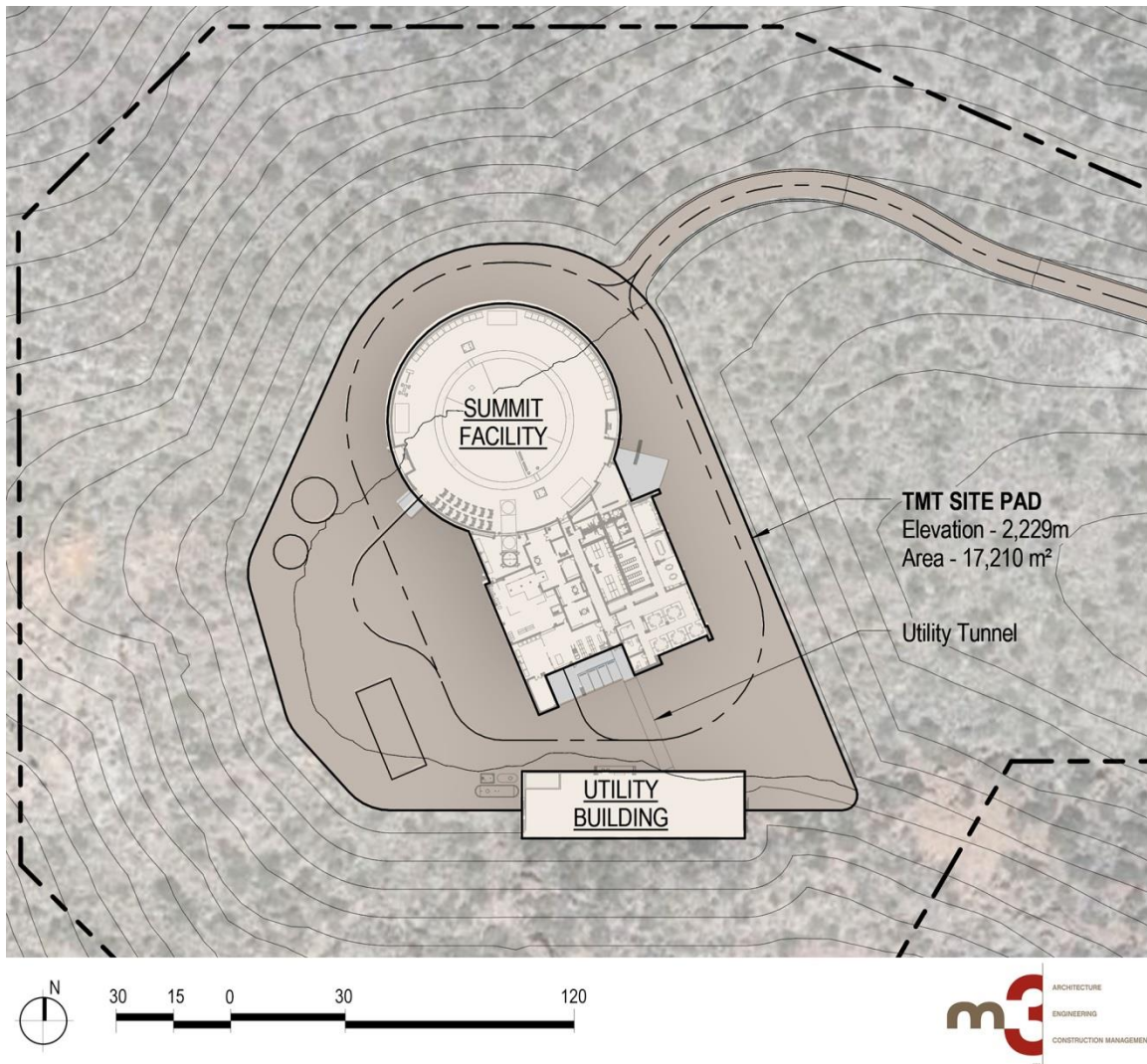


Figure A5 – Conceptual site plan

D. Utilities Tunnel

An underground tunnel will connect the Utilities Building and Support Building to the telescope pier (see Figure A5). Hydrostatic bearing oil lines, chilled water lines, coolant lines, electrical power cables, communications fibers and other utilities are routed through the tunnel to connect source to the cable wrap of the telescope.

The floor of the tunnel is at the same elevation below grade as the lower level of the Utilities Building and the lower floor of the telescope pier.

E. Utilities Exterior to the Enclosure, Support Building and Utilities Building

Some utilities will be located outside of the enclosure, support building and utilities building. These utilities include the following:

- Electrical equipment
- Wastewater holding tank (underground but with some components above ground) – TIO will take the wastewater by truck to be treated at a location remote from the TMT Site and from ORM
- Chemical wastewater double containment holding tank (underground but with some components above ground) to accept water from the mirror cleaning process. The water will be removed from ORM by TIO using an authorized waste manager.
- Domestic water tank with sufficient capacity for 1 month – approximately 140m³ (underground but with some components above ground) – the water for the tank will be supplied by IAC using trucks as part of the Differentiated Common Services.
- Diesel fuel double containment tank
- Exterior fluid cooler or chillers

F. Site Conditions Monitoring Tower

A tower will be located as shown on Figure A6 for the mounting of instruments to monitor site seeing and environmental conditions. Equipment that will be located on the tower include the following:

- A 35-cm diameter telescope equipped with a differential image motion monitor and multi-aperture scintillation sensor
- Sonic anemometers for measuring wind speed and direction
- Relative humidity measuring instrument
- Temperature measuring instruments
- Dust sensors
- All-sky camera
- Water vapor radiometer

G. Site Including Cut and Fill

The preliminary site is shown on Figure A5, with the approximate locations of the telescope and enclosure, support building, utilities building, and utility tunnel.

The site will be graded, along with the access road, to a zero-balance cut and fill to provide the platform shown in Figure A5. In addition to providing for the buildings and equipment described above, the site will provide areas required for positioning a large crane required for the construction of the enclosure and telescope.

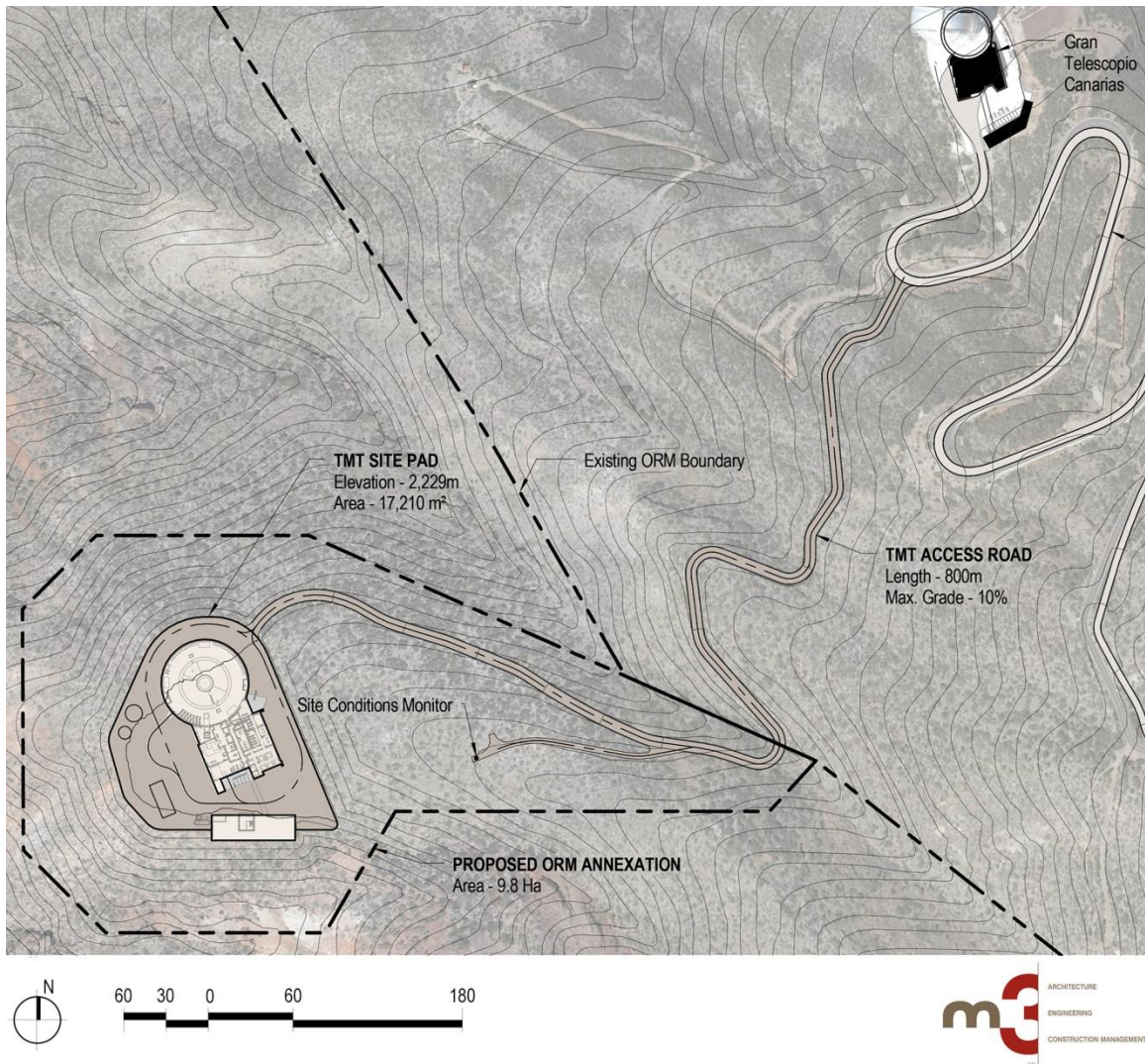


Figure A6 – Conceptual overall site plan

H. Access Road and Utility Corridor

An access road to connect the TMT site to the existing spur road to the Gran Telescopio Canarias will be constructed with the approximate alignment shown in Figure A6. In addition to the road, electrical, communications, domestic water, wastewater, and other utilities will be located underground either under the road or alongside the road.

I. Temporary Facilities

- Laydown Area

A Laydown Area for use during construction will be located as shown on Figure A7. Equipment and functions located at the Laydown Area will include the following:

- A graded area of 20,500 square meters. (Topsoil will first be removed and stockpiled at the location for site restoration after completion of construction.)
 - A warehouse with a floor area of 3,000 square meters and a ceiling height of 6.1 meters. The warehouse will be removed after the completion of construction.
 - The area will be used for storage of components to be integrated into the TMT Observatory. Components that could be damaged from storage outside will be stored within the warehouse.
 - The area will also be used for assembly of components that were sized for shipping into larger components as required for actual integration into the final construction.
 - Construction offices.
- Batch Plant
 - A concrete batch plant will be set up at the TMT site during construction. This will include the batch plant equipment, aggregate, cement and water storage.
 - Construction Camera
 - A camera and supporting equipment is to be within the TMT Site at approximately 217,285.50 m E and 3,183,975.20 m N. The camera will use solar power and connect to the internet via a wireless or a microwave system to the Gran Telescopio Canarias.

J. Connections to existing Utilities

Connections to the existing ORM utilities will be located as noted below:

- Electrical Power Interconnection Point is located at the auxiliary building for the Gran Telescopio Canarias ("GTC"). TIO is to install a new 20kV, 3.2MW capacity power feeder from the GTC to the TMT site in a new conduit from the TMT site to the existing pull box at the GTC road. From

this point, TMT will utilize the existing spare conduit to the GTC Equipment Building, electrical room. For construction purposes, TMT will install a stepdown transformer and distribution panel at the TMT site for a connected load of 400kW. For the operations TIO is to utilize the feeder from the GTC to the TMT site and install an electrical distribution system capable for a 3.2MW connected load.

- TIO is to install a new conduit and 20kV feeder from the existing ORM Utility Building electrical service to a new stepdown transformer and distribution panel at the Laydown Area for a 400kW connected load capacity.
- Digital Communications Interconnection Point is at the Residencia. TIO is to install a new 128-fiber optic cable from the TMT Site directly to the ORM patch panel at the Residencia. TIO is to utilize a spare conduit from the Residencia to the pull box near the TMT access road and new conduit from this point to the TMT site.
- TIO is to install a new fiber optics line from the patch panel at the Residencia to the TMT Laydown area. TIO is to utilize existing spare conduit from the Residencia to the ORM Utility Building conference room and new conduit from this point to the TMT laydown area.
- Domestic water will be stubbed out at the connection of the TMT Access Road to the GTC spur road as shown on Figure A7. If the ORM domestic water system has been installed at the time of TMT construction, the lines will be connected instead of being stubbed out.
- Wastewater system will be stubbed out at the connection of the TMT Access Road to the GTC spur road as shown on Figure A7 since there are no current plans for an ORM-wide piped wastewater system.

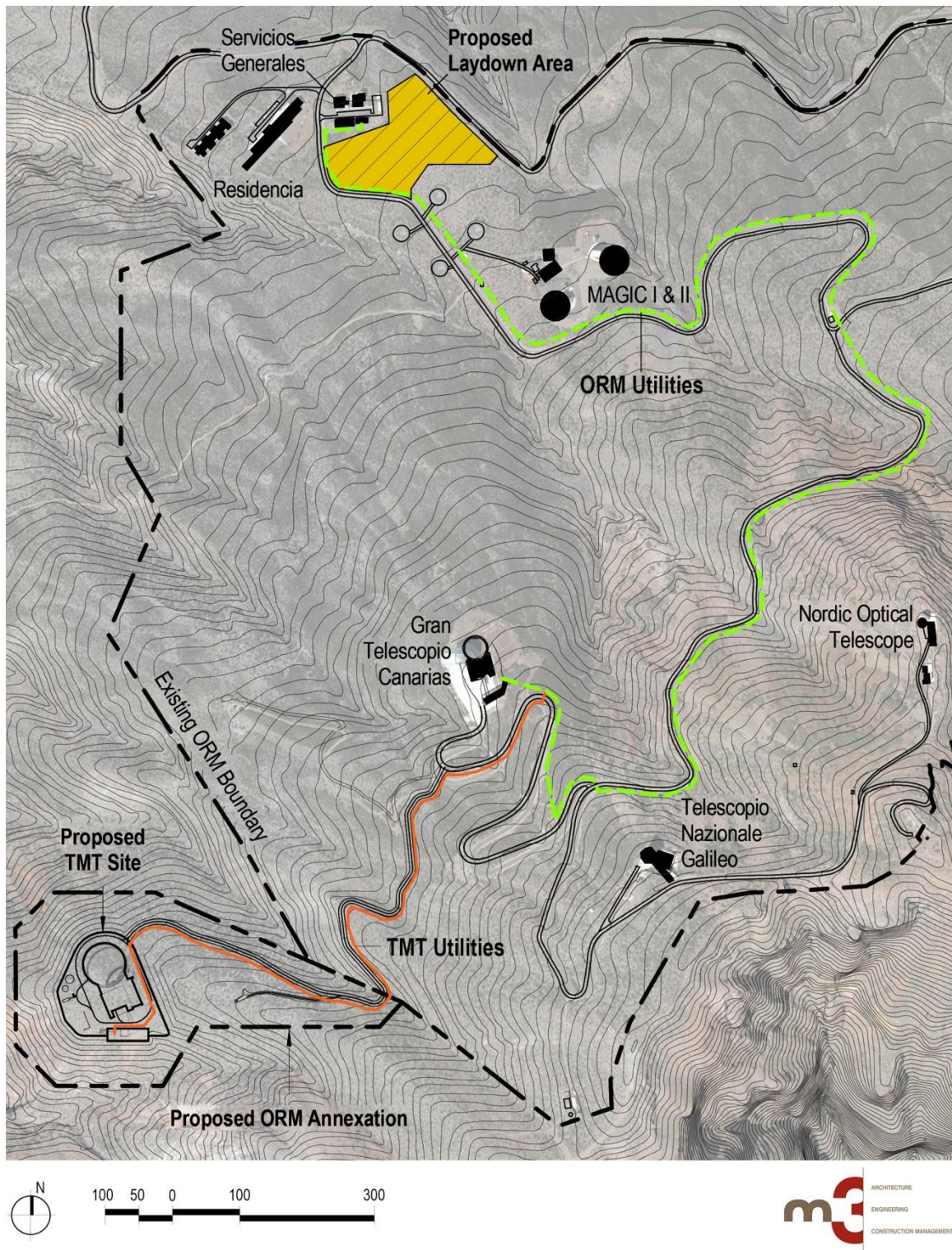


Figure A7 – Laydown Area and proposed connection locations to the existing utilities.

ANNEX 2

Part 1 – Dedicated Infrastructure and Services

		Period after Start of Construction
1a.	Electrical Power A power supply of 400kW, provided at 20 kV at the Electrical Power Interconnection Point A power supply of 3.2 MW provided at 20 kV at the Electrical Power Interconnection Point	9 months 3 years, 6 months
1b.	Electrical Power to Laydown Area A power supply of 400 KW, provided at 20kV at the existing ORM Utility Building.	6 months
2a.	Digital Communications for the TMT Site A 10 Gigabits per second internet communications connection, with facility to connect a 128-fiber cable at the Digital Communications Interconnection Point.	2 years
2b.	Digital Communications for the Laydown Area A 1 Gigabit per second internet communications connection at the Digital Communications Interconnection Point.	4 months
3.	IAC Auxiliary Building TIO to have access for up to 5 people to the IAC Auxiliary Building. TIO to have the exclusive right to use the IAC Auxiliary Building, and to fit	At Start of Construction 5 years.

	out the building for TIO's use.	
4.	<p>La Palma office space</p> <p>TIO to have the right for up to 5 people to be accommodated at IAC's La Palma office facilities. TIO shall be permitted to erect temporary prefabricated offices within the CALP grounds for an additional 5 people</p> <p>TIO to have the right for up to 80 people to be accommodated at IAC's new La Palma office facilities (CATELP).</p>	<p>At Start of Construction</p> <p>6 years</p>
5.	<p>Research Centers in Tenerife or La Palma</p> <p>Technical Lab Space – La Palma</p> <p>Remote (technical operations space – La Palma</p> <p>Remote (science) operations space - Tenerife</p>	<p>5 years 9 months</p> <p>5 years 9 months</p> <p>6 years 3 months</p>
6.	<p>Construction Camera Internet Connection</p> <p>At the Gran Telescopio Canarias IAC shall provide a wireless or microwave receiver and internet access through that receiver for the Construction Camera.</p>	At Start of Construction
7.	<p>Connection to drinking water main facilities</p> <p>If and when facilities are provided TIO shall be entitled to have a supply of water up to 4,300 litres per day, at 3.7 litres per second at 490KPa.</p>	Not applicable

Part 2 Common Infrastructure and Common Services for the TIO at the ORM.

Common Infrastructure & Common services

1 ORM Road Network

TIO and those authorized by it are entitled to use the ORM Road Network for the purpose of access to and from the TMT Site via the TMT Access Road.

2 Canteen at ORM and accommodation facilities at the Residencia

During the Construction Phase TIO may book accommodation at the Residencia or its Annex for its construction management staff and other senior staff visiting the TMT Site.

During the Operations Phase about 5 persons will be present on site at night and up to 25 during the day. These people will have the use of canteen facilities. TIO will be entitled to book accommodation for those people who stay overnight at the Residencia and its Annex.

3 Interference from stray light

The TIO will be authorized to set up warning signs on the nearby road accessing the peak at ORM requesting that cars circulate at night with only their low beam headlights.

ANNEX 3

Reference to Standards (electrical / mechanical / safety / environmental) required for components to be installed at ORM

- Reglamento Electrotécnico para Baja Tensión e Instrucciones Técnicas Complementarias, aprobado por el R.D. 842/2002 de 2 de agosto de 2002.
- Decreto 141/2009, 10 noviembre, por el que se aprueba el Reglamento por el que se regulan los procedimientos administrativos relativos a la ejecución y puesta en servicio de las instalaciones eléctricas en Canarias.
- R.D. 2267/2004, de 3 de septiembre por el que se aprueba el Reglamento de seguridad contra incendios en los establecimientos industriales.
- Ley 34/2007, de 15 de noviembre, de calidad del aire y protección de la atmósfera.
- R.D. 1627/1997, de 24 de octubre, por el que se establecen disposiciones mínimas de seguridad y salud en las obras de construcción.
- R.D. 614/2001, de 8 de junio, sobre disposiciones mínimas para la protección de la salud y seguridad de los trabajadores frente al riesgo eléctrico.
- Norma UNE-EN 60617: Símbolos gráficos para esquemas.
- Norma UNE 21144-3-2: Cables eléctricos. Cálculo de la intensidad admisible. Parte 3: Secciones sobre condiciones de funcionamiento.
- Sección 2: Optimización económica de las secciones de los cables eléctricos de potencia.
- Norma UNE 12464.I: Norma Europea sobre iluminación para interiores.

- Guía Técnica para la evaluación y prevención de los riesgos relativos a la utilización de lugares de trabajo, que adopta la norma UNE 12464 y ha sido elaborada en virtud de lo dispuesto en el artículo 5 del R.D. 39/1997, de 1 de enero y en la disposición final primera del R.D. 486/1997, de 14 de abril, que desarrollan la Ley 31/1995, de 8 de noviembre, de Prevención de Riesgos Laborales.
- Real Decreto 1215/1997 Disposiciones mínimas de seguridad y salud para la utilización por los trabajadores de los equipos de trabajo.
- Real Decreto 485/1.997, sobre Señalización de Seguridad y Salud en los centros de trabajo.
- Real Decreto 486/1.997, sobre disposiciones mínimas de Seguridad y Salud en los centros de trabajo.
- Directiva 2012/19/UE del Parlamento Europeo y del Consejo, de 4 de julio de 2012, sobre residuos de aparatos eléctricos y electrónicos (RAEE).
- Real Decreto 110/2015, de 20 de febrero, sobre residuos de aparatos eléctricos y electrónicos.
- Directiva 2011/65/UE del Parlamento Europeo y del Consejo, de 8 de junio de 2011, sobre restricciones a la utilización de determinadas sustancias peligrosas en aparatos eléctricos y electrónicos.
- R.D. 2135/1980 de 26 de Septiembre sobre liberalización industrial.
- RD 2060/2008, de 12 de diciembre por lo que se aprueba el Reglamento de equipos de presión y sus instrucciones técnicas complementarias modificado por el RD 560/2012, de 7 mayo.
- Real Decreto 187/2011, de 18 de febrero, relativo al establecimiento de requisitos de diseño ecológico aplicables a los productos relacionados con la energía.
- Real Decreto 1644/2008, de 10 de octubre, por el que se establecen las normas para la comercialización y puesta en servicio de las máquinas.

- Real Decreto 1367/2007, de 19 de octubre, por el que se desarrolla la Ley 37/2003, de 17 de noviembre, del Ruido, en lo referente a zonificación acústica, objetivos de calidad y emisiones acústicas.
- Real Decreto Legislativo 7/2015, de 30 de octubre, por el que se aprueba el texto refundido de la Ley de Suelo y Rehabilitación Urbana.
- Ley 38/1999, de 5 de noviembre, de Ordenación de la Edificación.
- D.L.1/2000, de 8 de mayo, TR Leyes de Ordenación del Territorio de Canarias y de Espacios Naturales de Canarias.
- Reglamentos de desarrollo de la Ley 1/2000, de/ 8 de mayo, por el que se aprueba el TRLOTCEC.
- Código Técnico de la Edificación (RD 314/2006, de 17 de marzo y RD 1371/2007, de 19 de Octubre).

ANNEX 4

Appointment of Scientific Representatives and Consent of the CCI to the foreseen installations.

REPRESENTATIVES

By signing this Agreement, the Representatives Designated by the Parties, acknowledge and accept the obligations contained in this Agreement and in particular Article 15.

On behalf of TMT International Observatory LLC (TIO) the Designated Representative for the collaboration is ...

Signed on the _____, 2017, in California, United States of America.

On behalf of the Instituto de Astrofísica de Canarias, the Designated Representative for the collaboration is Prof Rafael Rebolo López, IAC Director.

Signed on the _____, 201X, in _____.

INSTALLATION'S IMPACT

On the basis of the evaluation carried out by the CCI's Subcommittee on Site Properties (SUCOSIP) and its corresponding recommendation, the CCI has concluded that there is no evidence that the proposed installation will deteriorate to a measurable extent the site properties currently enjoyed by the existing installations.

The SUCOSIP CHAIR
Professor Casiana Muñoz-Tuñón

Signed on the _____, 2017, in La Laguna, Tenerife, Canary Islands, Spain.

ANNEX 5

Costs for use of the Common Infrastructure and Common Services at the ORM

General and billing

1. Costs for the use of Common Infrastructure and Common Services will be billed to TIO following the same procedure and as applied for all of the User Institutions, in accordance with the guidelines established by the CCI.

Differentiated Common Services

2. TIO will be billed for Differentiated Common Services according to use.
3. The rates at 2016 prices are:

The cost per room per night in the Residencia:

- single occupancy 68,38€
- double occupancy 119,65 €

The cost per room per night in the Annex:

- single occupancy in the Annex 53,36 €
- double occupancy in the Annex 93,37€

At both locations:

- including full board: two meals and a breakfast: 30 €

Supply of drinking water to observatory facilities (60 cents€/litre).

Undifferentiated Common Services Budget

4. TIO as a User Institution shall bear its share of the corresponding proportion of the CCI Secretariat and Annual Report Budgets (approximate total €1,000 per annum per User Institution).

5.

- (a) In addition TIO shall bear its UCSB Contribution Percentage (calculated in accordance with Annex 5, paragraph 6) of the Undifferentiated

Common Services Budget to the extent that the costs covered by the Undifferentiated Common Services Budget are not anticipated to be met by the revenue earned by ORM from the users of the Residencia.

(b) The cost categories which are permitted to be within the Undifferentiated Common Services Budget are

- Waste water disposal at ORM.
- Maintenance of Communications at ORM: The 10 Gigabit per second IACnet.
- First Aid at ORM: Staff training at ORM is included in the Common Service Budget as well as the provision of an external ambulance for emergencies.
- Common Services Staff at ORM.
- General maintenance and management at ORM.
- The vehicles used by the Observatory Administration staff at ORM (not used for the transport of astronomers or other staff travelling to and from the Observatory).*

(c) To avoid doubt, maintenance of the ORM Access Road and the ORM Road Network shall not be included in the Undifferentiated Common Services Budget for the purposes of calculating TIO's contribution to that budget.

6. TIO's UCSB Contribution Percentage shall be calculated as follows:

$$\text{UCSBC\%} = (\text{D\%} + \text{A\%} + \text{P\%})/3$$

Where:

UCSBC% means TIO's UCSB Contribution Percentage

D% means the diameter of the TMT main light collecting mirror expressed as a percentage of the sum of the diameters of the main light collecting mirrors of all telescopes in operation at ORM, provided that for this calculation:

- (a) a factor of 0.2 is applied to the diameters of the main mirrors of the telescopes comprising the Cherenkov Telescope Array); and
- (b) a factor of 3.3 is applied to the diameters of all solar telescopes.

A% means the area occupied by the buildings (including the TMT itself) on the TMT Site expressed as a percentage of the sum of the areas occupied by all telescopes and observatory buildings at ORM

P% means the average power expected to be consumed by the TMT in the year for which the UCSB Percentage Contribution is being calculated, expressed as a percentage of the sum of the average power expected to be consumed by all the observatories at ORM in that year.

7. Subject to paragraph 8, the contribution from TIO will be calculated on the above basis before December 31st of a calendar year for the following year's Budget. TIO's UCSB Percentage Contribution will be due and payable on the later of:

- (a) 30 days after receipt by TIO of an invoice from IAC accompanied by a document describing the calculation of TIO's UCSB Percentage Contribution in reasonable detail; and
- (b) December 31 of the year prior to the year to which the Undifferentiated Common Services Budget applies.

8.

- (a) TIO's obligation to pay its UCSB Percentage Contribution will commence in the year in which physical construction is commenced on the TMT Site. In that year, the amount payable by TIO will be the proportion of the UCSB Percentage Contribution which corresponds to the percentage of the calendar year remaining after the day on which TIO commences physical construction activities on the TMT Site.
- (b) The amount of TIO's UCSB Percentage Contribution for the last year of the term of this Agreement shall be the proportion which corresponds to the percentage of the last calendar year of the term of this Agreement from January 1 in that year until the day when this Agreement expires.

9. **Illustrative numerical amounts and calculations**

- (a) The approved 2017 budget is €683,874.32 is as follows:

	CONCEPTS	BUDGET 2016	BUDGET 2017	% VARIATION
11.	COST OF COMMON SERVICES B.	19,560.00	15,733.00	-19.6
12.	COST OF ORM OFFICES	23,424.20	24,599.88	5.0
13.	COMMUNICATIONS	41,752.60	41,752.60	0.0
20.	VEHICLES	18,810.00	18,931.70	0.6
30.	OTHER SERVICES	30,901.00	30,062.80	-2.7
40.	FIRST AID	6,350.00	7,050.00	11.0
60.	STAFF TRAVEL AND SUBSISTENCE	3,650.00	4,200.00	15.1
71.	GENERAL MAINTENANCE	114,162.00	113,004.55	-1.0
72.	OPERATION SUBCOMMITTEE	136,250.00	136,250.00	0.0
80.	STAFF	277,667.60	291,688.78	5.0
90.	GENERAL MANAGEMENT COSTS	601.01	601.01	0.0
	TOTAL	673,128.41	683,874.32	1.6

(b) An illustration of the calculation of TIO's UCSB Percentage Contribution is set out in the tables below:

OBSERVATORIO DEL ROQUE DE LOS MUCHACHOS								PPTO 2015	PPTO 2020
	APERTURE OF TELESOPES		AREA COVERED BY BUILDINGS		POWER CONSUMPTION		CCI		
	m	%	m ²	%	kva	%			
ING	6.70	5.22%	1,684.22	10.58%	212.25	8.00%	7.94%	370,343.17	425,894.65
IAC	8.85	6.90%	959.78	6.03%	63.61	2.40%	5.11%	29,395.28	33,804.58
TNG	3.58	2.79%	820.00	5.15%	183.50	6.92%	4.95%	18,925.11	21,763.88
LIVERPOOL	2.00	1.56%	298.00	1.87%	31.96	1.21%	1.55%	18,349.28	21,101.68
MERCATOR	1.20	0.94%	258.00	1.62%	29.23	1.10%	1.22%	5,724.63	6,583.32
GTC	10.40	8.11%	2,000.00	12.57%	273.34	10.31%	10.33%	4,517.24	5,194.82
MAGIC	6.80	5.30%	800.00	5.03%	53.71	2.03%	4.12%	38,250.07	43,987.58
CTA	57.40	44.75%	5,000.00	31.42%	800.00	30.17%	35.45%	15,251.59	17,539.32
TMT	30.00	23.39%	4,000.00	25.14%	1,000.00	37.71%	28.75%	131,277.11	150,968.67
S.WASP	1.33	1.04%	92.00	0.58%	4.34	0.16%	0.59%		122,425.54
TOTAL	128.26	100.00%	15,912.00	100.00%	2,651.94	100.00%	100.00%	2,195.88	2,525.26
								370,343.17	425,894.65
	APERTURE OF TELESOPES		AREA COVERED BY BUILDINGS		POWER CONSUMPTION		CCI		
	m	%	m ²	%	kva	%			
IAC	8.85	21.66	959.78	13.89	63.61	7.47	14.34		
JKT	1.00	2.45%	145.78	2.11%	3.15	0.37%	1.64%		
SST	3.80	9.30%	357.00	5.17%	16.60	1.95%	5.47%		
NOT	2.56	6.27%	336.00	4.86%	43.86	5.15%	5.43%		
DOT	1.49	3.65%	121.00	1.75%	0.00	0.00%	1.80%		

Notes to the Table:

- The column "CCI" lists the percentage contribution of a UI to the ORM UCSB (Undifferentiated Common Services Budget), given as the arithmetic mean of its Telescope aperture diameter(s), the area covered by its buildings and its electric power consumption; all three quantities expressed as percentages of the ORM total for each.
- Effective diameters are used for the Solar and Cherenkov telescopes, defined as 3.3 and 0.2 times respectively the physical diameter.
- Institutions not belonging to the CCI contribute using the same formula.

ANNEX 6

Intellectual Property Provisions referred to in Section 20.3 and Section 20.4

“Background IP” means IP that pre-exists, and was or is developed by a Party independently of the TMT Project.

“IP” means inventions, technology, improvements, discoveries, software, designs or other copyrightable work or data that relates to the TMT Project.

“Jointly Created TMT IP” means the TMT IP created, conceived or fixed jointly by employees of more than one of the Company, a TIO Related Party, a Member or a Member Related Party.

“Third Party IP” means IP developed by a party that is not TIO, a TIO Related Party, a Member or a Member Related Party.

“TMT IP” means IP first created, conceived, fixed or actually reduced to practice by one or more of the Company, TIO Related Parties, Members or Member Related Parties in connection with its or their work on the TMT Project.

Rights between Members and TIO in relation to Contributions (from the Contribution Agreements)

14. Intellectual Property

14.1 In order to facilitate completion of the TMT Project, each Member grants or will ensure that the owner of the relevant TMT IP grants to TIO a perpetual, non-exclusive, royalty free, fully paid up, irrevocable, sublicenseable and transferable license (or sublicense) to use any such TMT IP in any manner solely for purposes of the TMT Project.

14.2 Each Member represents and warrants that it is or will have the a sufficient right to grant or cause the owner of TMT IP to grant the license required by paragraph 14.1, subject to all government agencies or sponsors’ rights and interests therein. If a claim is raised by anyone that such Member does not have such rights in its TMT IP or such TMT IP infringes the rights of a third party, such Member shall obtain, at its sole cost and expense, the right of TIO to use such TMT IP for the TMT Project, without payment of any

license fee or royalty by TIO or any other Member, or, if a Member reasonably believes it cannot obtain such rights on commercially reasonable terms, it shall promptly notify the Executive Director and develop a plan to present to the Executive Director for proceeding without such TMT IP.

14.3 To the extent that a Member utilizes or provides Background IP as part of such Member's work on the TMT Project, including in the performance of the collaboration, the Member grants to TIO or will ensure that the owner of the Background IP grants to TIO a perpetual, non-exclusive, royalty free, fully paid up, irrevocable sublicensable license to use the Background IP, in any manner, provided that the Background IP is used solely for the purpose of the TMT Project.

14.4 To the extent that a Member acquires or utilizes Third Party IP in connection with or as part of the Work Package, such Member shall use Reasonable Efforts to obtain, at such Member's sole cost and expense, the right, if applicable, for TIO to use such Third Party IP, without payment of any license or royalty by TIO, for purposes related to or in furtherance of the TMT Project. If a Member reasonably believes it cannot obtain such rights for any Third Party IP on commercially reasonable terms, it shall promptly notify the Executive Director, and develop a plan to present to the Executive Director for proceeding without that Third Party IP.

Rights between Members and TIO in relation to ownership and exploitation of TMT IP (from TIO's Company Agreement)

5. Intellectual Property

5.1 Subject to all government agency or sponsors' rights and interests, as between the Company and the Members:

- (a) all rights to TMT IP created, conceived or fixed by employees of any one Member or a Member's Performing Institution without any assistance from any other party, shall be owned solely by such Member;
- (b) all rights to TMT IP created, conceived or fixed by employees of the Company without any assistance from any other party, shall be owned solely by the Company;

- (c) all rights to Jointly Created TMT IP created, conceived or fixed by employees of any more than one Member or that Member's Performing Institution or of one or more Members or their Performing Institution and the Company shall be owned jointly by such Members, or such Members and the Company. Such persons may enter into an inter-institutional agreement to determine which of them will take the lead in commercializing any such Jointly Created TMT IP, and distribution of income will be determined in accordance with such agreement in light of the Members' respective contractual obligations and use of resources used to develop such Jointly Created TMT IP.

For the purposes of this paragraph, an individual who is an employee and who is seconded by one Person to another Person shall be treated as the employee of the Person to whom he is seconded.

ANNEX 7

Decommissioning Statement of Intent

TIO Member Name	<i>[Member name to be added here]</i>
TIO Member Address	<i>[Member address to be added here]</i>
Estimated Closure Costs	
The conceptual cost estimate for decommissioning the observatory and restoring the site is the approximate amount [stated – add cross reference to time-based estimate of costs]	
Certification	
As an authorized representative of <i>[TIO Member]</i> , I hereby certify that <i>[TIO Member]</i> intends to provide decommissioning funds to satisfy its obligation to contribute sufficient cash in a timely manner to fund its share of Decommissioning Costs for the TMT Project as described in <i>[cross refer to document describing basis on which costs were developed]</i> .	
Signature of Authorized Representative:	
Printed Name:	
Title:	
Date of Signature:	