

Giant Magellan Telescope

(SA3CC)

Presented by

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IT Director and
GMTO CISO

Introduction

- ✿ Who is GMTO
- ✿ Network Infrastructure
- ✿ Updates

GMTO Corporation



US-ELT Program

The United States Extremely Large Telescope Program (US-ELTP) is a joint endeavor of:



Giant Magellan
Telescope



NSF's NOIRLab



Thirty Meter
Telescope

Giant Magellan Telescope (GMT)



The Giant Magellan Telescope is the work of an international consortium of **15** leading research institutions representing Australia, Brazil, Chile, Israel, South Korea, Taiwan, and the United States.

<https://giantmagellan.org/>

International

- Academia Sinica Institute of Astronomy and Astrophysics (ASIAA) (**Taiwan**)
- Astronomy **Australia** Limited
- **Australian** National University
- The São Paulo Research Foundation (FAPESP) (**Brazil**)
- **Korea** Astronomy and Space Science Institute
- The Weizmann Institute of Science (**Israel**)

United States

- Arizona State University
- Harvard University
- **Northwestern University**
- Texas A&M University
- University of Arizona
- University of Chicago
- University of Texas at Austin
- Carnegie Institution for Science
- Smithsonian Institution

GMT Founders



The Giant Magellan Telescope

<https://giantmagellan.org/explore-the-design/>

WORLD'S MOST POWERFUL TELESCOPE

The Giant Magellan Telescope is the largest Gregorian optical-infrared telescope in history. It will use seven of the world's largest mirrors to see farther into deep space than ever before. Its unique design will produce the highest possible resolution of the Universe over the widest field of view. This extraordinary image clarity will enable scientists around the globe to obtain new clues to the fundamental nature and evolution of the Universe — from searching for signs of life on distant exoplanets to investigating the cosmic origins of chemical elements.



Observatory Site (Las Campanas, Chile)

<https://giantmagellan.org/location/>



TELESCOPE TIMELINE GALLERY PARTNERS ABOUT NEWS & EVENTS

FOR SCIENTISTS



GMT Summit Site at Las Campanas

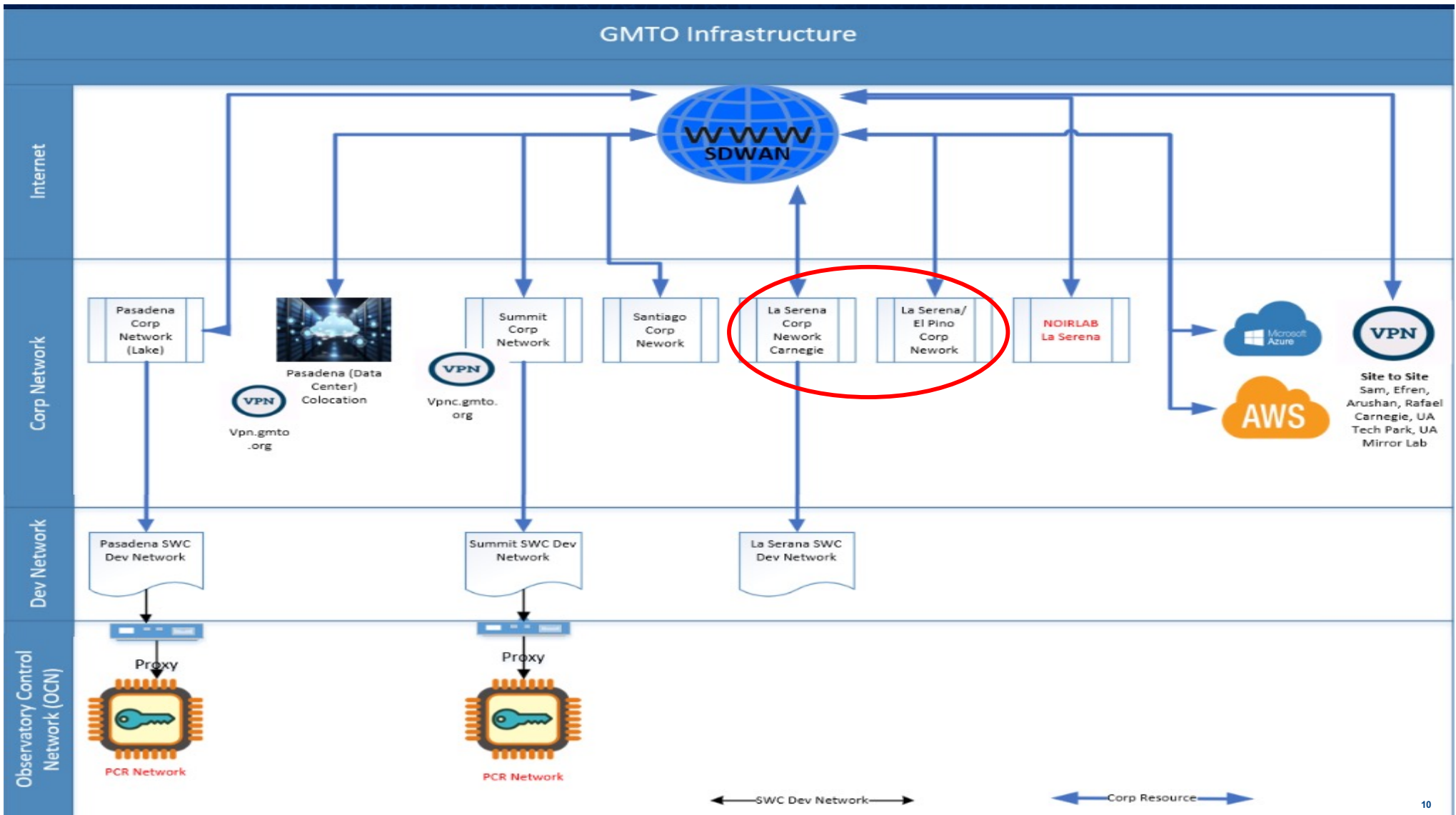
Summit Site (2514m)

- Enclosure
- Summit Support Building
- Summit Utility Building
- Summit Utility Tunnel
- Water Pad area
- Dry Coolers Platform



Network Infrastructures and Operations

- Network Infrastructure
- Internet Services
- Remote Network

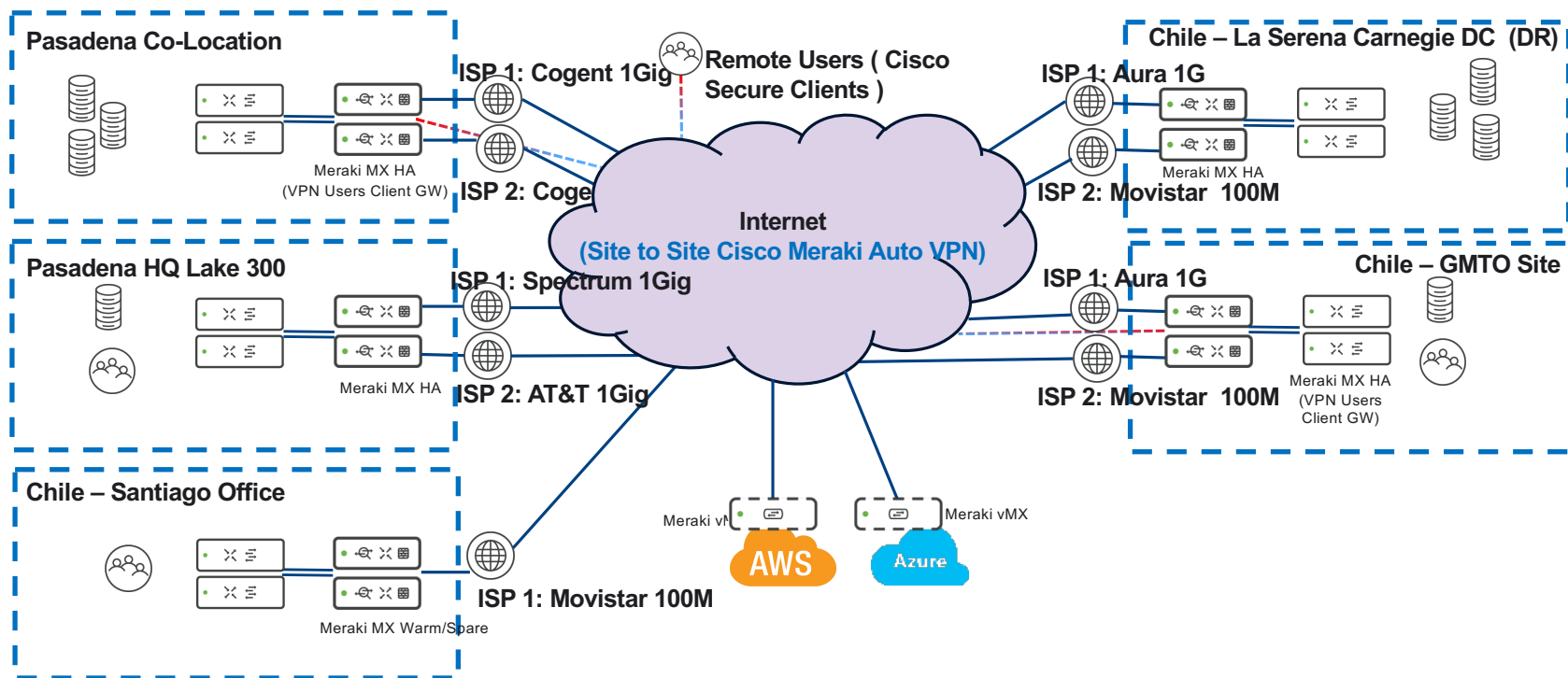


Internet Services



- **Pasadena Data Center (Colocation)**
 - Cogent (2 x 1G)
- **Pasadena Office**
 - Spectrum (1G Fiber) - Primary
 - AT&T (1G Coax) – Guest/Backup
- **Santiago Office**
 - Movistar (100M)
- **La Serena Office**
 - Movistar (100M)
- **La Serena Carnegie (Chile) – Disaster Recovery (DR)**
 - **AURA/NOIRLAB (1G)**
- **Summit (Chile)**
 - **AURA/NOIRLAB (1G through Carnegie) – Primary**
 - Movistar (100M through Carnegie) - Guest/Backup

GMTO Global Network Infrastructure (Current)

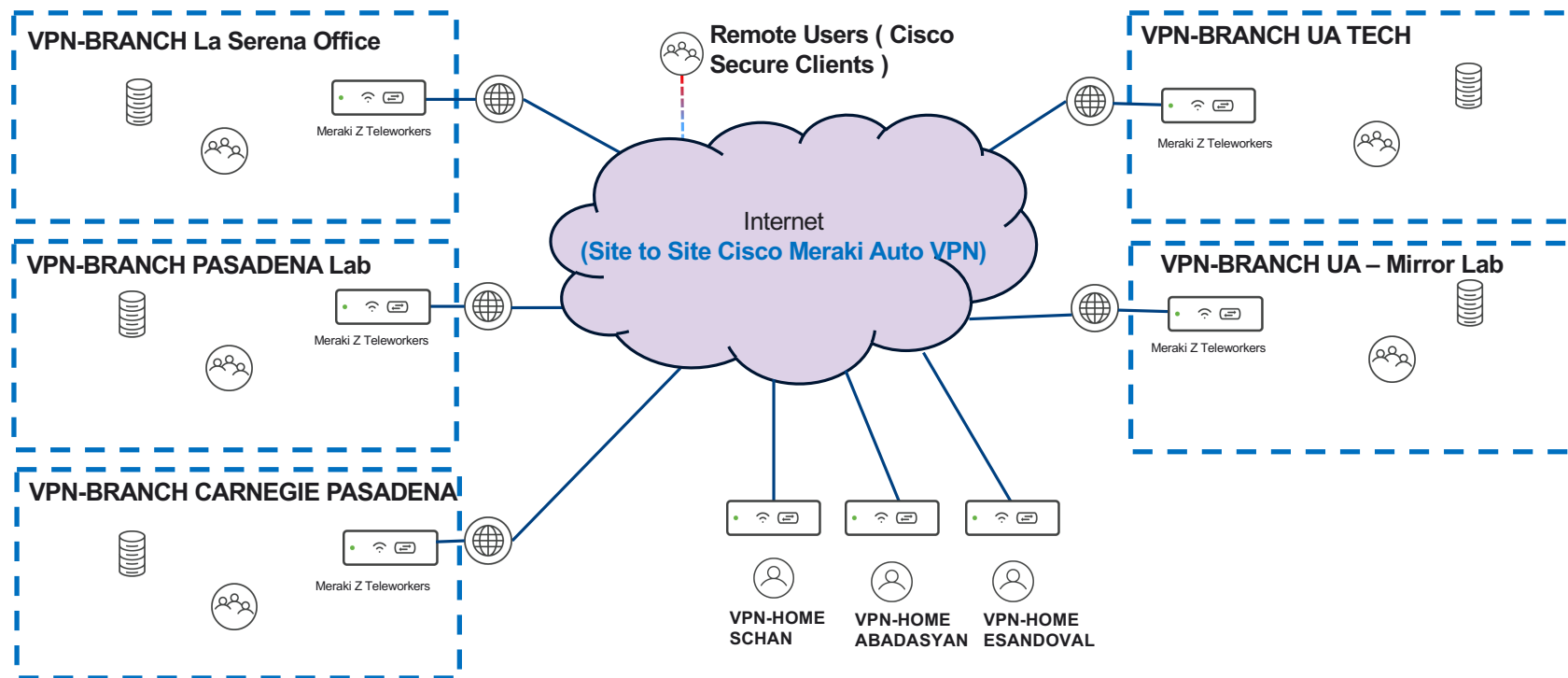


Site to Site (Remote Location)



- **IT Staff (Arushan, Efren, Rafael, Sam) – Commercial Internet**
- **Carnegie Pasadena – Carnegie Internet**
- **UA Tech Park – University of Arizona Internet**
- **UA Mirror Lab - University of Arizona Internet**
- **GMTO Lab (Pasadena) – AT&T (1G)**
- **LA Serena Office – Movistar (100M)**

GMTO Global Network Infrastructure. (Branchs / Teleworkers)



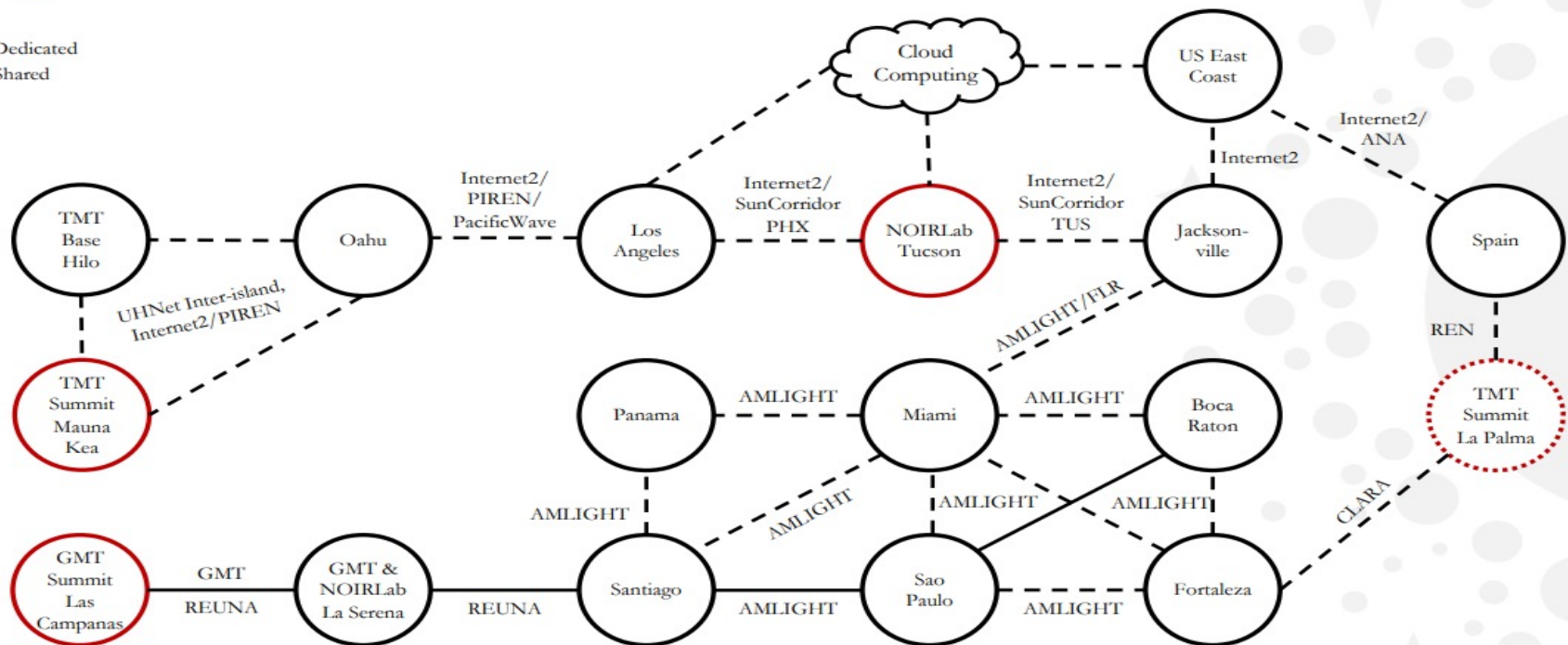
Transition to Operations – NOIRLab Presentation (Network Traffic Flow)



Possible US-ELTP Network Circuits



— Dedicated
- - - Shared



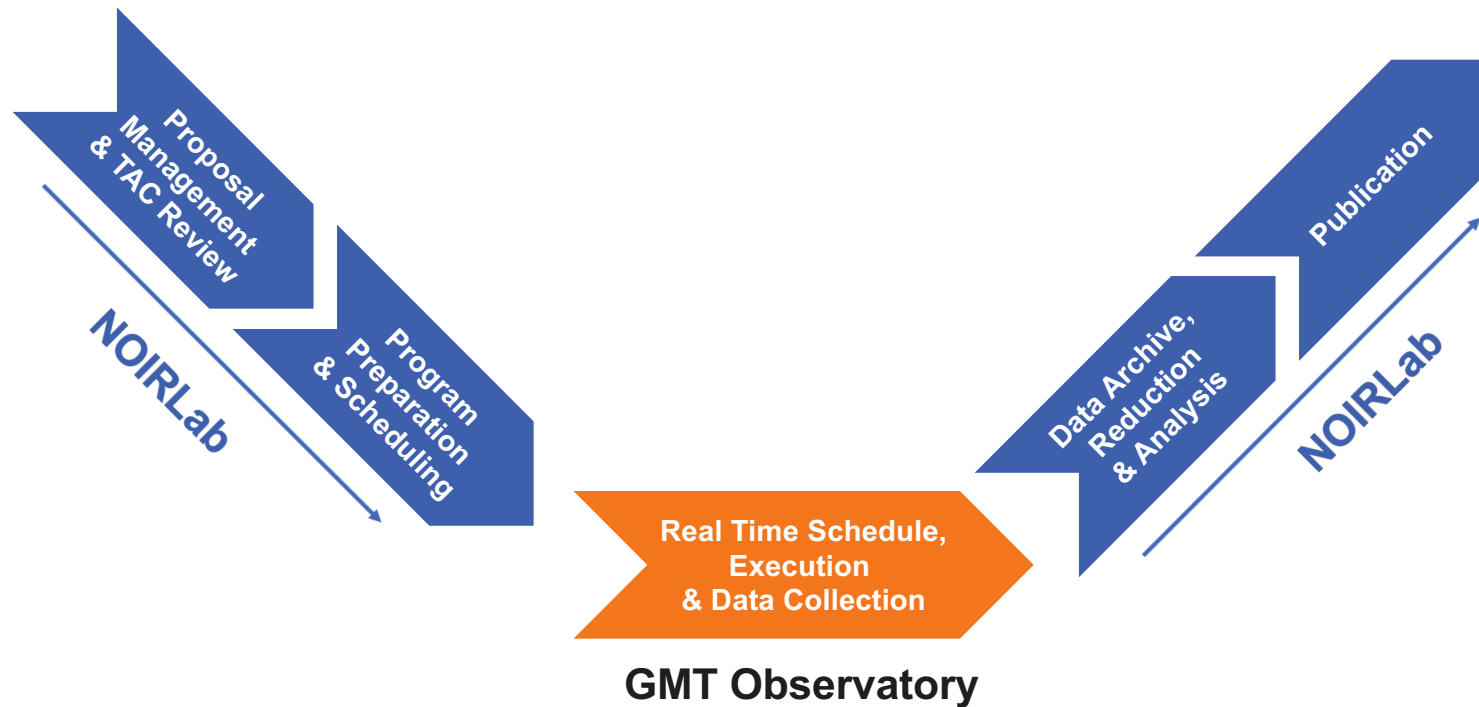
US EXTREMELY LARGE
TELESCOPE PROGRAM



GIANT MAGELLAN
TELESCOPE

GMT Operations Plan Review Summary

Science Data “Life Cycle” for Astronomy (US-ELTP model)



Data Capture

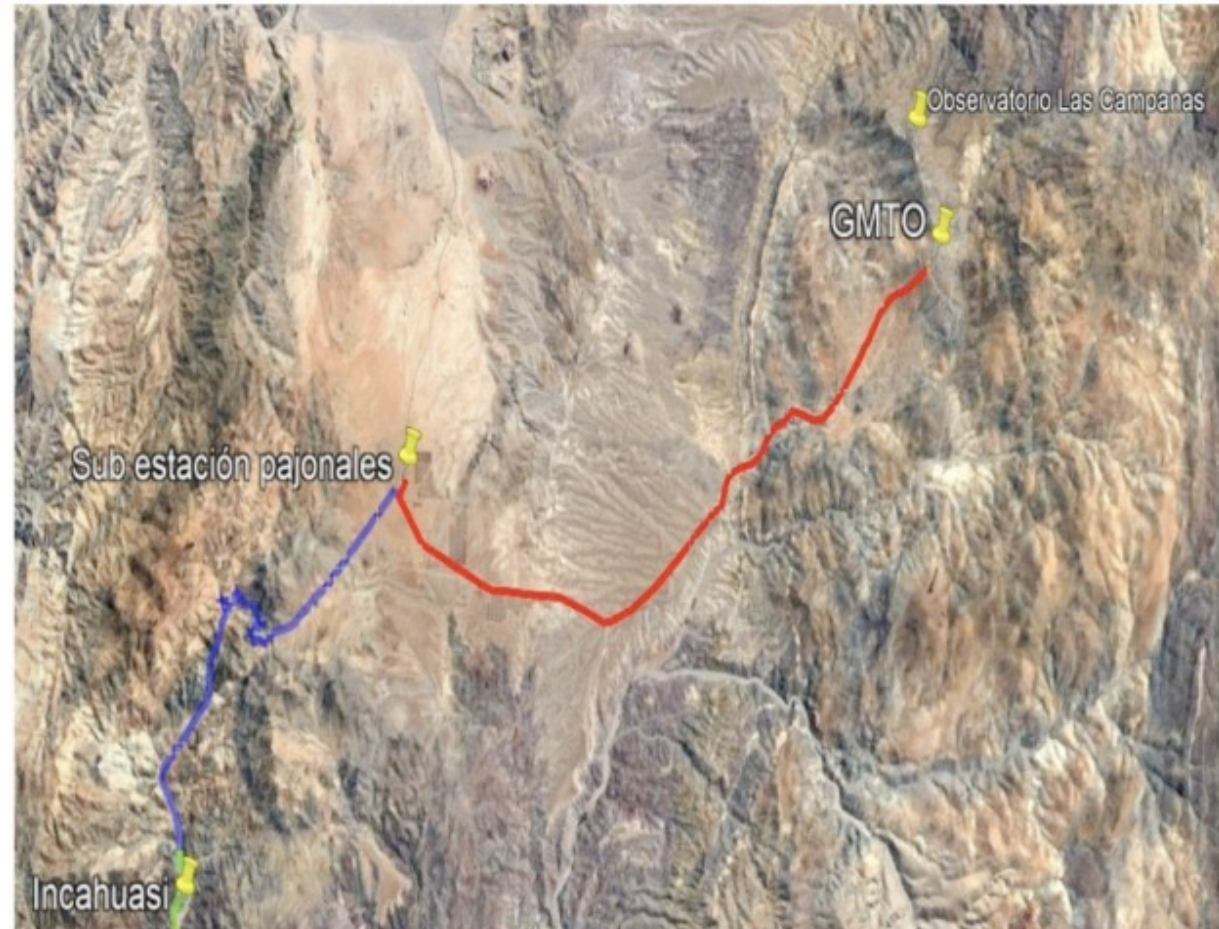
- **Projected ~ 8 TB per night ~ 2.4 PT data per year (Most of it is AO telemetry, Engineering and Environmental)**
- **Projected ~ 31 TB Per year of Science data (Transfer to NOIRLAB)**
- **Complete Early 2030s**
- **Leverage nearby data center (NSF research/education network)**

Current Fiber



New Fiber - Reuna

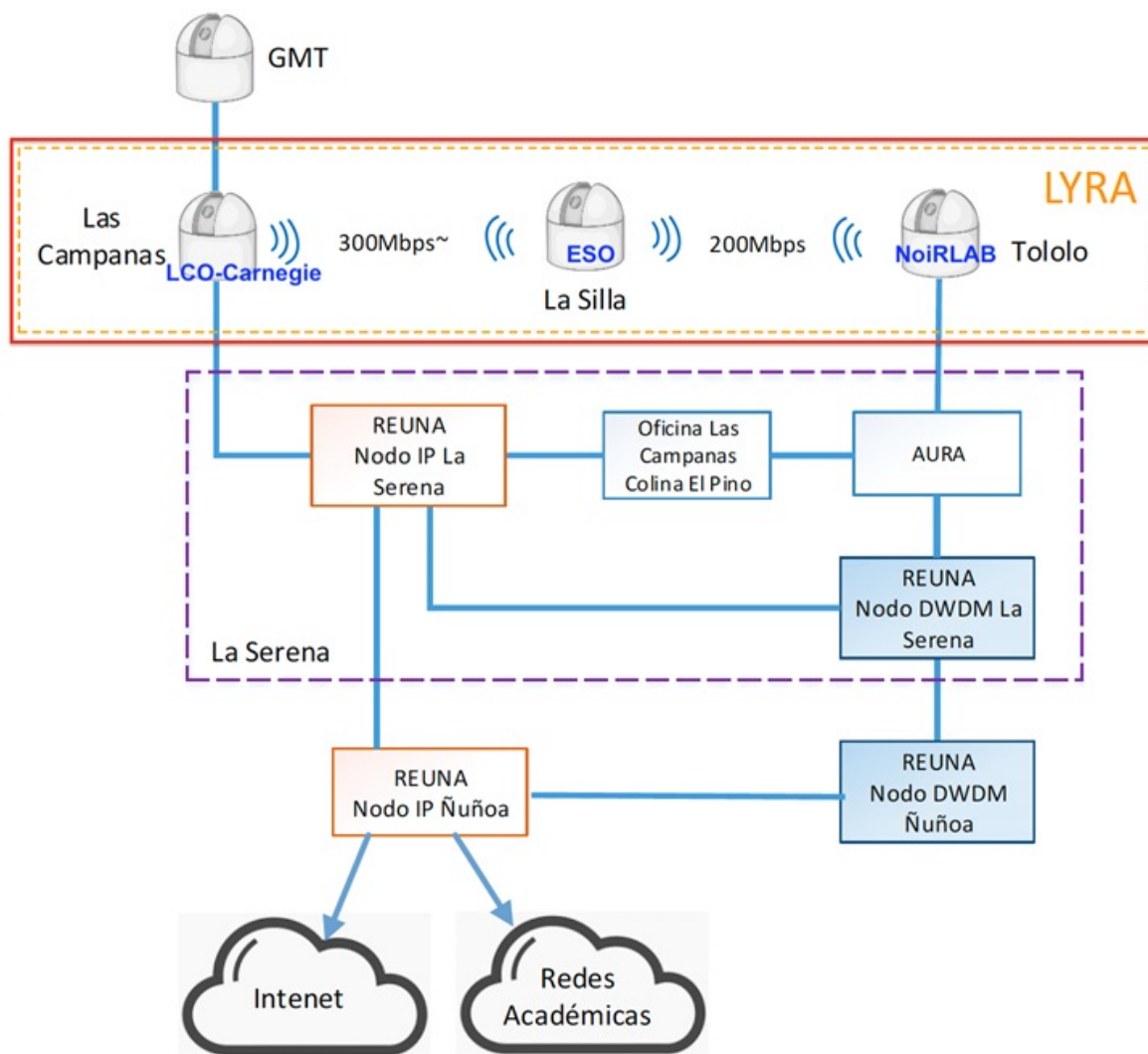
- The red line in Figure represents the preliminary layout that the new posts would have for laying the 23 kV MV power line, and therefore the laying of the fiber optic cable. This line would extend for approximately **30 km** from the GMT site to the **Pajonales** substation.
- The blue line in Figure 4 represents the layout of the fiber optic cable from post # 564 to the technical office located in the town of **Incahuasi**. This line would extend for approximately **22 km**



New Fiber – Reuna Continue



- The town of Incahuasi will be the point of union of the fiber coming from Cerro Las Campanas with La Serena

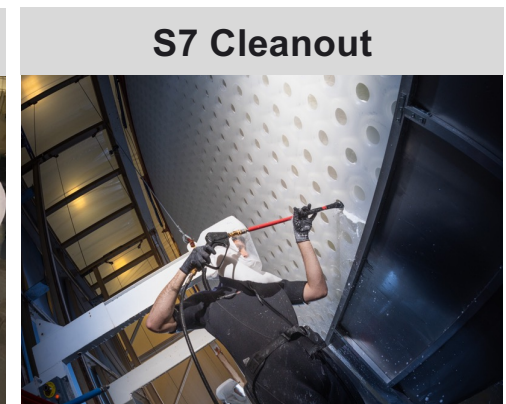
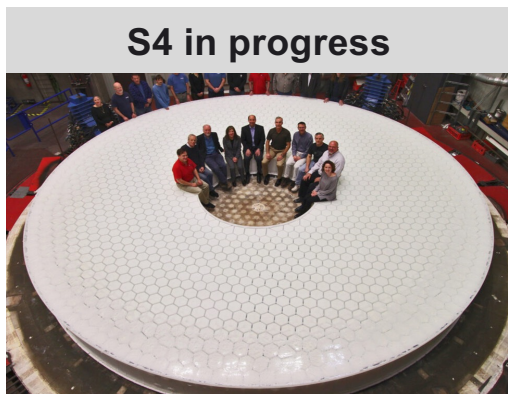
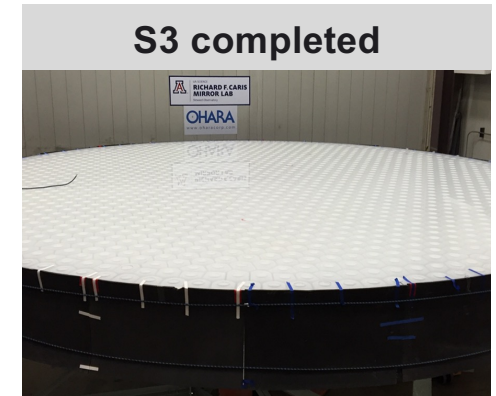
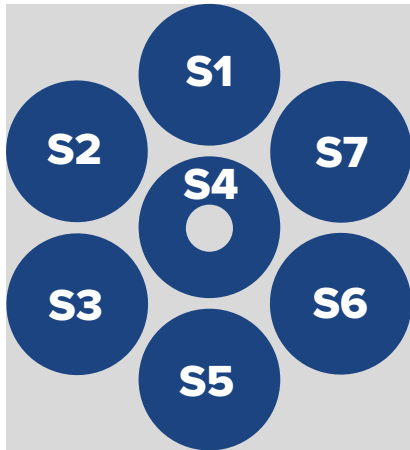


Conceptual Wireless – NOIRLAB/REUNA

Giant Magellan Telescope (GMT) - Updates

- **M1 Optics Fabrication: S7 Casting**
- **M1 Subsystem (Adaptive Secondary Mirror)**

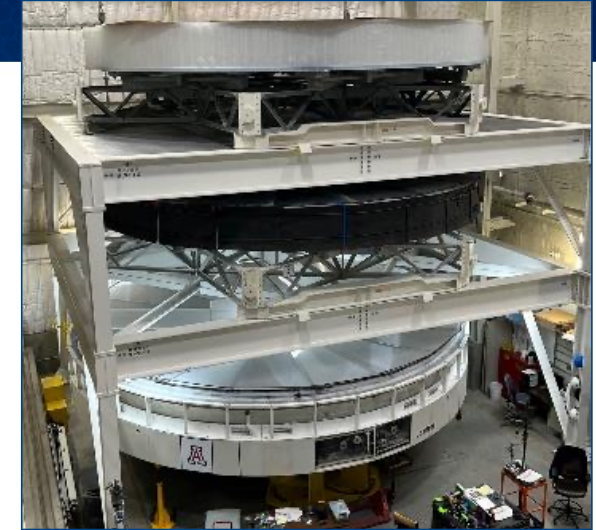
Seven M1 8.4m Segments Comprising Full 25.4m Aperture (Fabrication at the University of Arizona R.F. Caris Mirror Lab)



Primary Mirror - M1 Optics (M1O) Status



M1O	Config.	Mirror Segment Production Status
S1	Off-Axis	Complete – In Storage
S2	Off-Axis	Complete – In Storage
S3	Off-Axis	Complete – waiting for Test Cell for Active Optics demo
S4	On-Axis	Thermocouple installation – Front surface generating is next
S5	Off-Axis	Front surface fine grinding in progress – Polishing is next
S6	Off-Axis	Casting Complete – Rear surface generating is next
S7	Off-Axis	Casting Complete – Core Clean-out planned for June
S8	Off-Axis	Ohara Glass on order for potential spare segment



S6, S4 & S5 in UA RFCML Stacking Rack



S2 Joins S1 in Storage near Tucson Airport in 2019

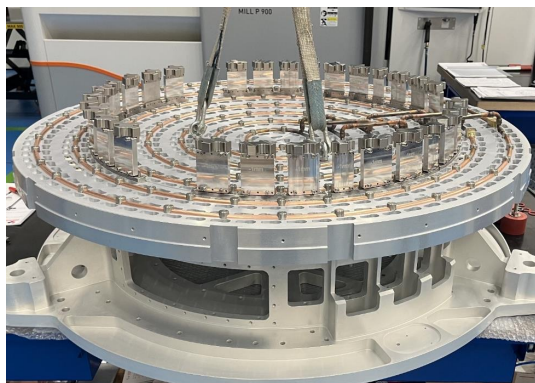


S3 Polishing Complete November 2022

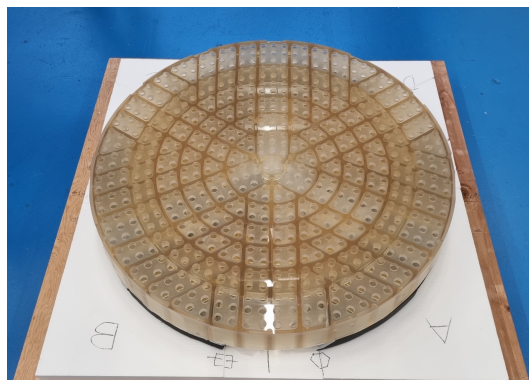


S7 Successfully Cast in January 2024

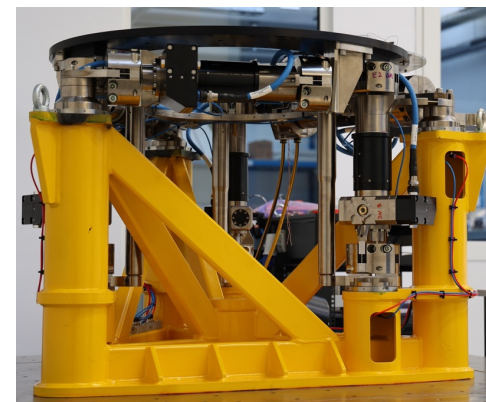
GMT Adaptive Secondary Mirror (ASM) First Unit Parts Completed



ASM segment structure integration
(Actuators)



The Zerodur Reference Body



The ASMS Test Stand



ASM Thin Shell #1 - Completed



Electronics - Completed

- All first unit components are complete
- Integration Readiness has been verified
- First ASM unit assembly and test is pending

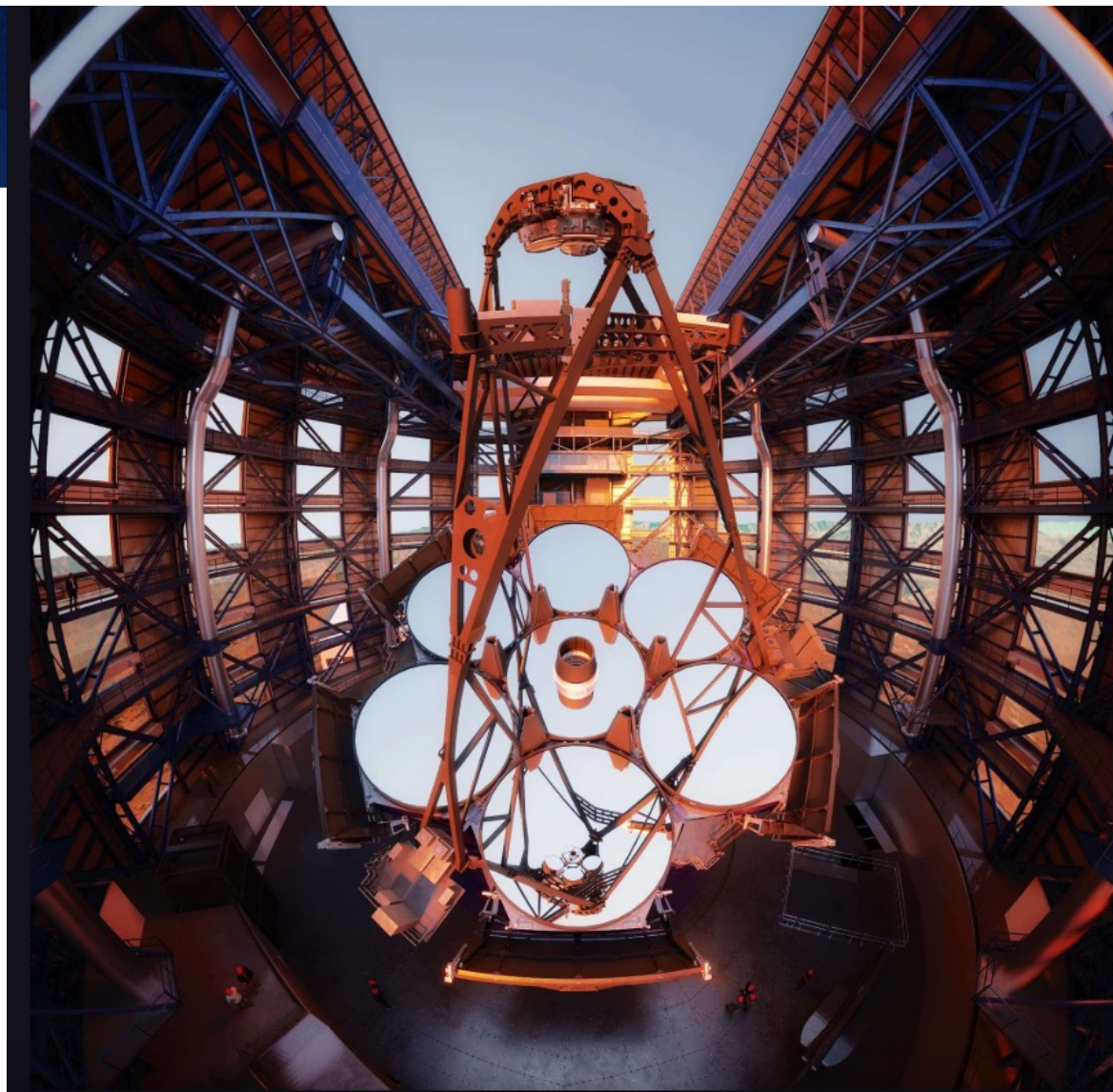
NSF Sponsored Testing will confirm Phasing Performance

NSF is sponsoring a Phasing Testbed that will demonstrate mirror position sensing and control performance using first ASM unit components

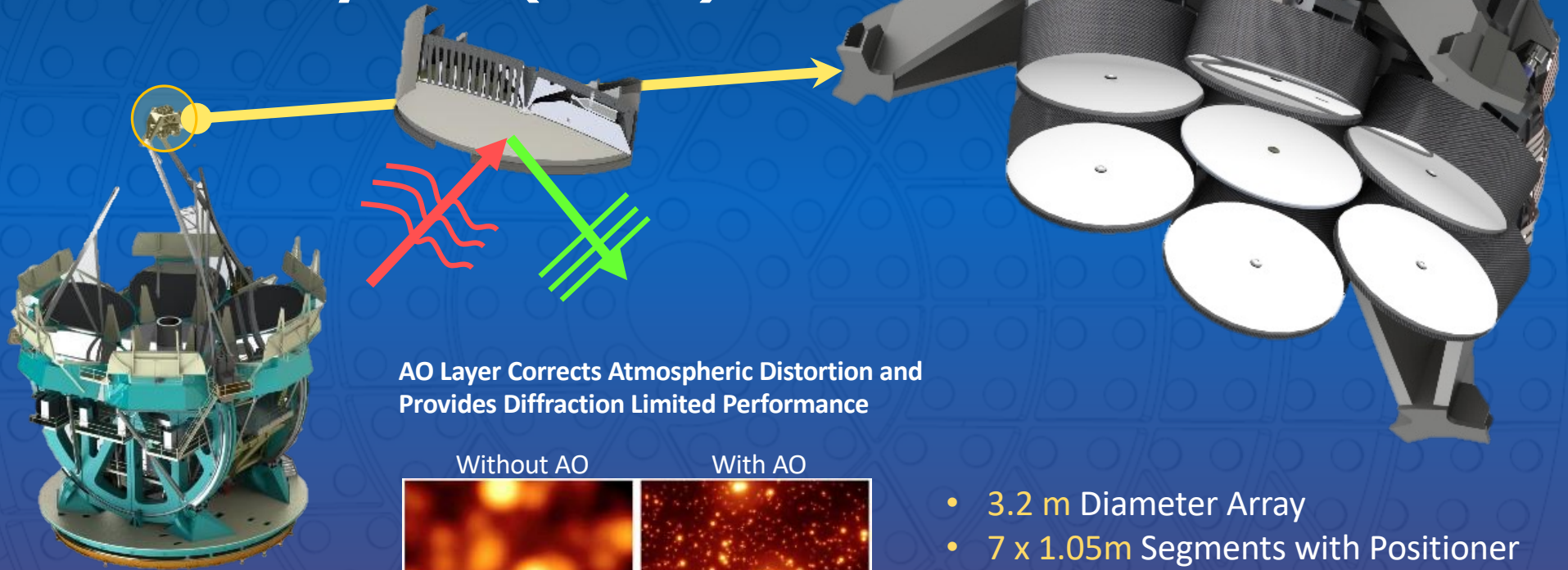
- The ASM segment assembly is ready for integration with the testbed
- The testbed equipment is complete and verified ready for integration
- Phasing Testbed integration started in April 2025
- Testing to begin this summer at AdOptica in Italy



Testbed structure assembled with ASM simulator during Dry run of the integration procedure

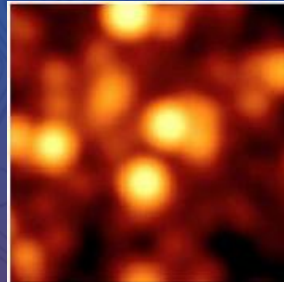


Adaptive Secondary Mirror Subsystem (ASMS)

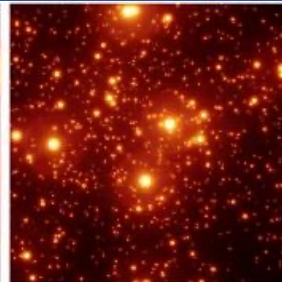


AO Layer Corrects Atmospheric Distortion and Provides Diffraction Limited Performance

Without AO



With AO



*GMT Simulated Adaptive Optics (AO) Performance

- 3.2 m Diameter Array
- 7 x 1.05m Segments with Positioner
- 8,000 kg Mass with Mount Top End
- MMT, LBT, VLT Heritage

Adaptive Secondary Mirror Segment (ASM)

- AdOptica Consortium is on Contract for ASM Design and as subscale Prototype
- ADS Microgate in Bolzano & ADS in Lecco Italy



Large Binocular Telescope ASM showing facesheet with magnets



Cold Plate
Material: Aluminum
Removes actuator heat

Reference Body
Diameter: 1.05m
Thickness: 120mm
Material: Zerodur

Segment Positioner
6 Degrees of Freedom
Course Motion Control

Actuators
Qty: 675

Facesheet (Mirror)
Diameter: 1.05m
Thickness: 2mm
Material: Zerodur





GIANT MAGELLAN TELESCOPE
THE UNIVERSE AWAITS

Thank You

<https://www.giantmagellan.org>



GiantMagellan.org