

The background of the slide features a large, curved, light-colored structure with a hexagonal grid pattern, resembling a telescope's primary mirror. Above this structure, the letters "TMT" are displayed in a metallic, 3D font. The top portion of the slide shows a dark space scene with a glowing galaxy and a bright star or nebula.

TMT

[79.03] The Thirty Meter Telescope (TMT) Project

Gary H Sanders for the TMT Project Partnership

AAS 205th Meeting, San Diego

Providing Access to U.S. Astronomers for the Next Generation of
Large Ground Based OIR Telescopes

January 11, 2005



[79.03] The Thirty Meter Telescope (TMT) Project

Abstract: The Thirty Meter Telescope (TMT) Project is engaged in a design and development phase. TMT is proposed as a private-public partnership of the California Institute of Technology and the University of California (partners in the earlier CELT design study), AURA (designers of the earlier GSMT concept), and the Canadian ACURA consortium (designers of the VLOT concept). The partners are developing a 30 meter diameter, finely segmented filled aperture telescope with seeing-limited and diffraction-limited capabilities to address the broad range of GSMT science goals. The paper will present the status of the project development and telescope and instrument design.



TMT

This talk

- Introduce myself
- Our partnership and goals
- Introduce TMT
 - Reference design established
 - Building the project office and team
 - Overall strategy
- Site selection campaign
- Primary mirror development
- Instrumentation development program
 - Announcement of Opportunity to US/Canadian community

TMT

Introduce Myself

- Experimental high-energy physics for 27 years working at MIT, Princeton, Los Alamos, on accelerator-based experiments at Brookhaven, DESY (Hamburg), CERN (Geneva), Fermilab, Los Alamos, SSC
- Project Manager and Deputy Director for the Laser Interferometer Gravitational Wave Observatory (LIGO) for 10 years
- Joined TMT in April 2004 as Project Manager

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The Thirty Meter Telescope



Our partnership and goals

- TMT follows the NAS Decadal Survey recommendation that a public-private partnership is the best way to build and operate a US-led 30-m telescope
- TMT has the goal of a 50-50 public-private partnership
- Current partners are
 - UC
 - Caltech
 - ACURA (Canada)
 - AURA (NSF)
- *AURA's special role is to engage the U.S. community in the project.*
- Although partners are currently “equal”, ultimate shares (e.g. of observing time) will be based on contributions to capital & operations.
- The partnership is open to joining with others to build the intellectual, technological & financial base necessary for a project of this magnitude and promise.

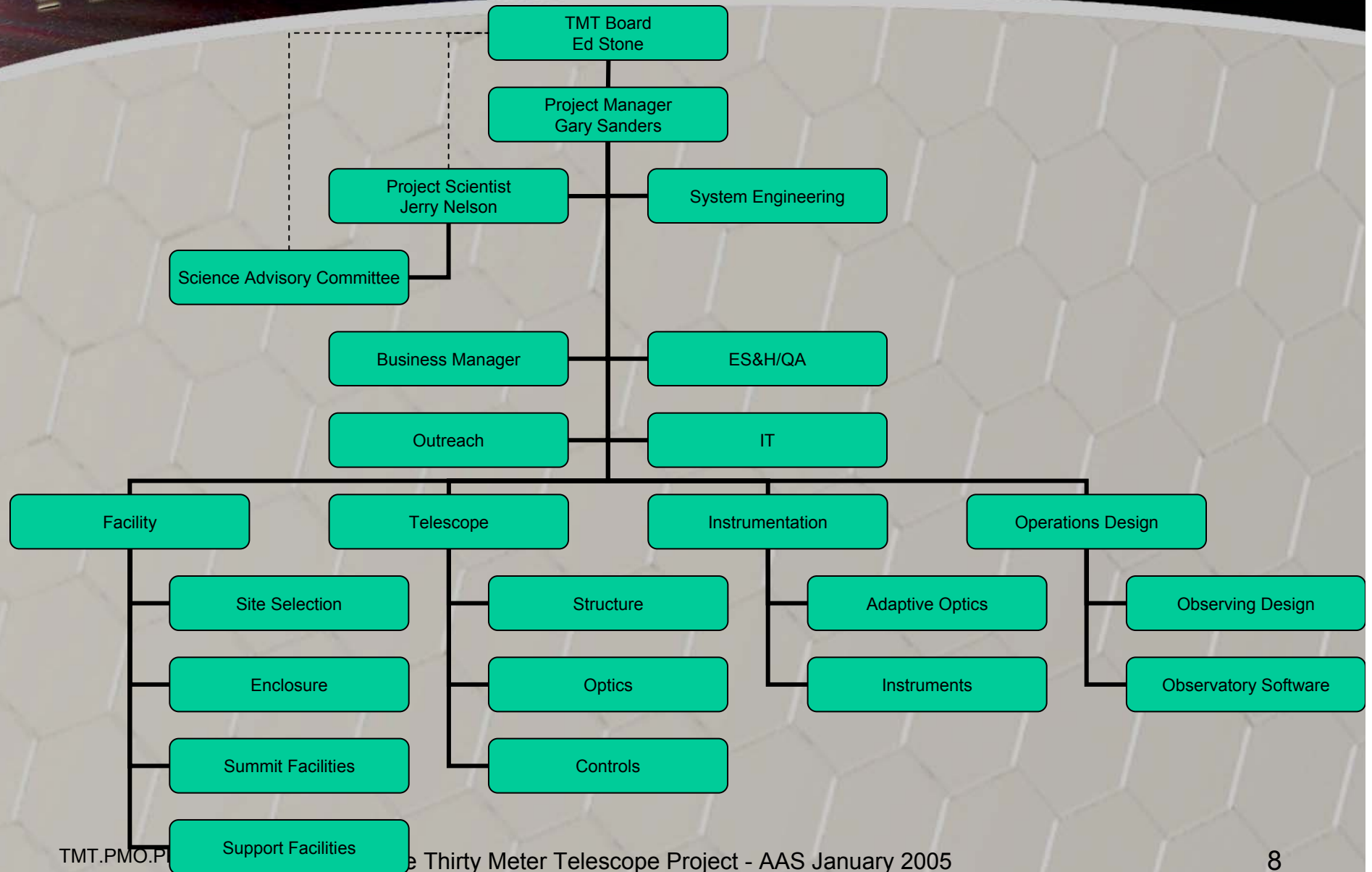
- TMT governance established in June 2003
 - Agreements between the partners
 - Formation of Science Advisory Committee
 - Includes institutional representatives, and through AURA, community representatives
 - Formation of Board of Directors
 - Appointment of Project Manager (April 2004)
- Development Phases
 - Design and Development Phase (**DDP**) (2004-2008)
 - \$35M secured from G&B Moore Foundation (Caltech/UC)
 - \$17.5M sought from each of Canada and AURA (NSF)
 - Canada has just been awarded first funding
 - Construction phase (2008 – 2014)
 - Science Operations (2015 -)

(Assuming timely delivery of capital & operational resources)

- Project Office established and key staff appointed
 - Temporarily housed at Caltech
 - Will move to permanent quarters in Pasadena April 2005
 - Project Manager (Gary Sanders)
 - Project Scientist (Jerry Nelson)
 - Central Project Office already has ~ 20 employees (35 in steady-state)
 - Additional ~35 at partner locations
- Science Advisory Committee
 - Equal membership from all 4 partners
 - 4 AURA members are 2 from NOAO + 2 from US community
 - Science Requirements Document complete and approved

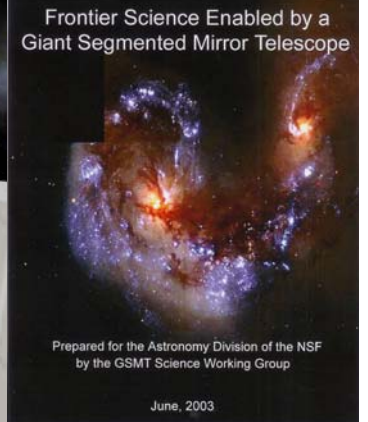
TMT

TMT Project Organization



The logo for the Thirty Meter Telescope (TMT) is displayed in a stylized, metallic, 3D font. It is positioned in the upper left corner of the slide, set against a dark, starry background that suggests a night sky or space.

Science with the TMT



The science case for the TMT has been explored in depth by our Science Advisory Committee (SAC), composed of representatives of all four partners. The TMT science case is congruent with that of the GSMT Science Working Group:

High level objectives listed in the SWG report

- Origin of large scale structure in the Universe
- Assembly of galaxies in the early universe ($z > 3$)
- Extra solar planet detection and characterization
- Processes governing star and planet formation

TMT Science



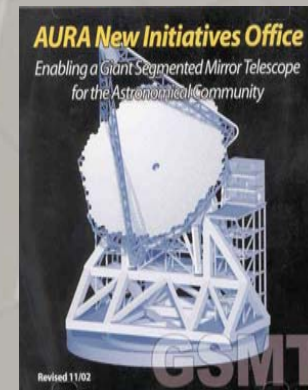
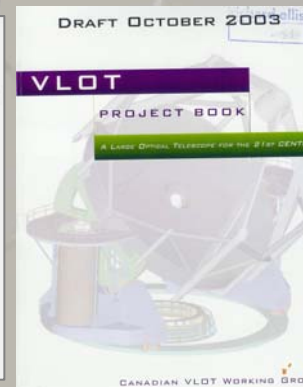
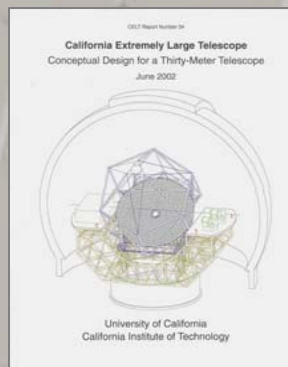
Toward a Single TMT Reference Design

TMT design follows from a careful consideration of three, independently-conceived & independently-reviewed, point designs representing $\approx \$6M$ total effort

CELT (UC+Caltech)

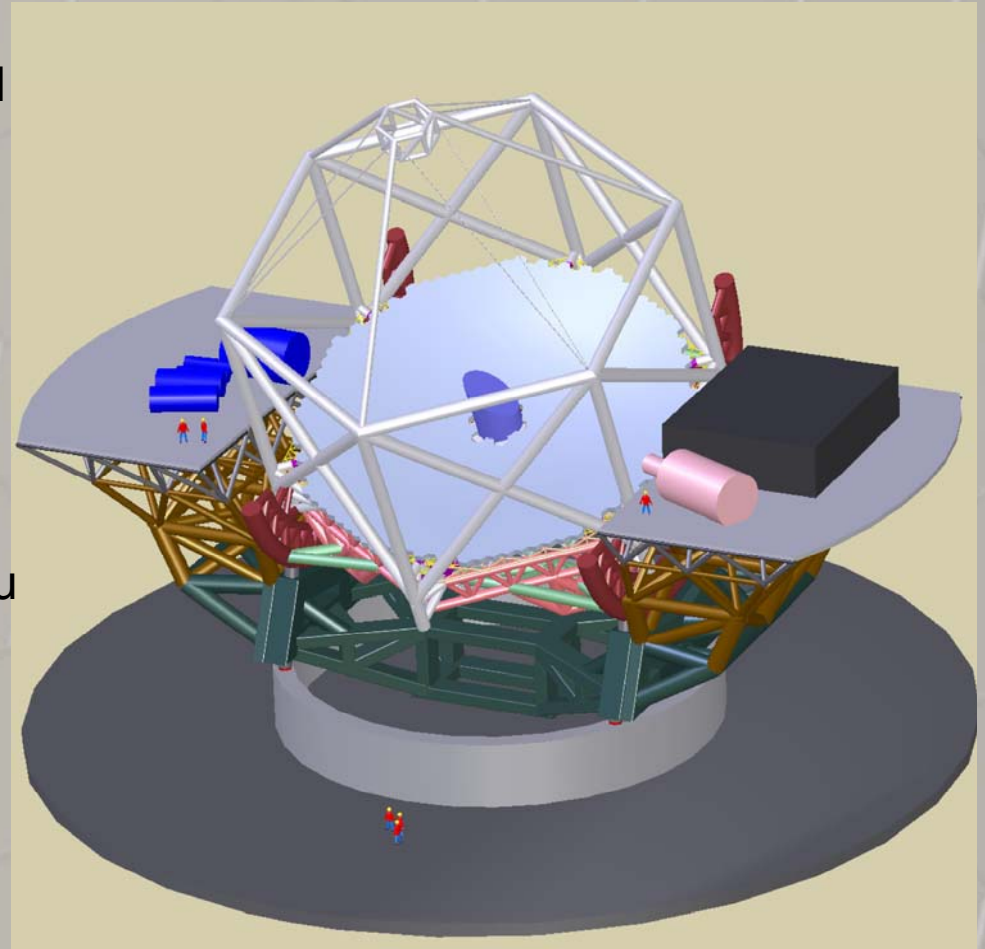
VLOT (Canada)

GSMT (NOAO/Gemini)



- Broad exploration of technical options
- Positive reviews by outside reviewers
- Studied consolidation of the best aspects of these designs
- **Single reference design now established by the Project**

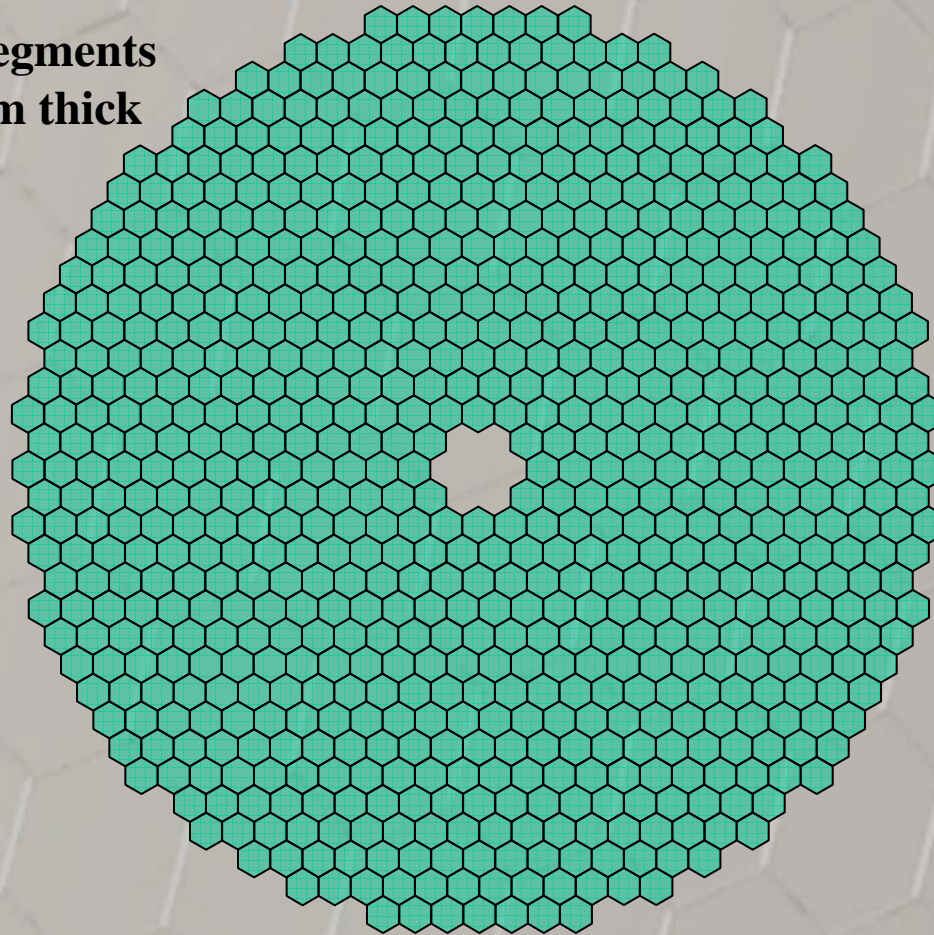
- 30m filled aperture, highly segmented
- Aplanatic Gregorian (AG) two mirror telescope
- f/1 primary
- f/15 final focus
- Field of view 20 arcmin
- Elevation axis in front of the primary
- Wavelength coverage 0.31 – 28 μm
- Operational zenith angle range 1° thru 65°
- Both seeing-limited and adaptive optics observing modes
- AO system requirements and architecture defined
- First generation instrument requirements defined



TMT

30m Primary Mirror Concept

**738 × 1.2m segments
each 0.060m thick**



- Sites in Chile, Mexico and Hawaii under study
 - Mauna Kea
 - San Pedro Martir, Baja Mexico
 - 4 – 6 sites in Chile
- Selection to be made in 2007
 - Scientific site quality
 - Programmatic factors (costs, labor, geotechnical, environmental)
- Currently collecting data on 4 sites in Chile and Mexico
- Hawaii campaign begins early 2005, following permits

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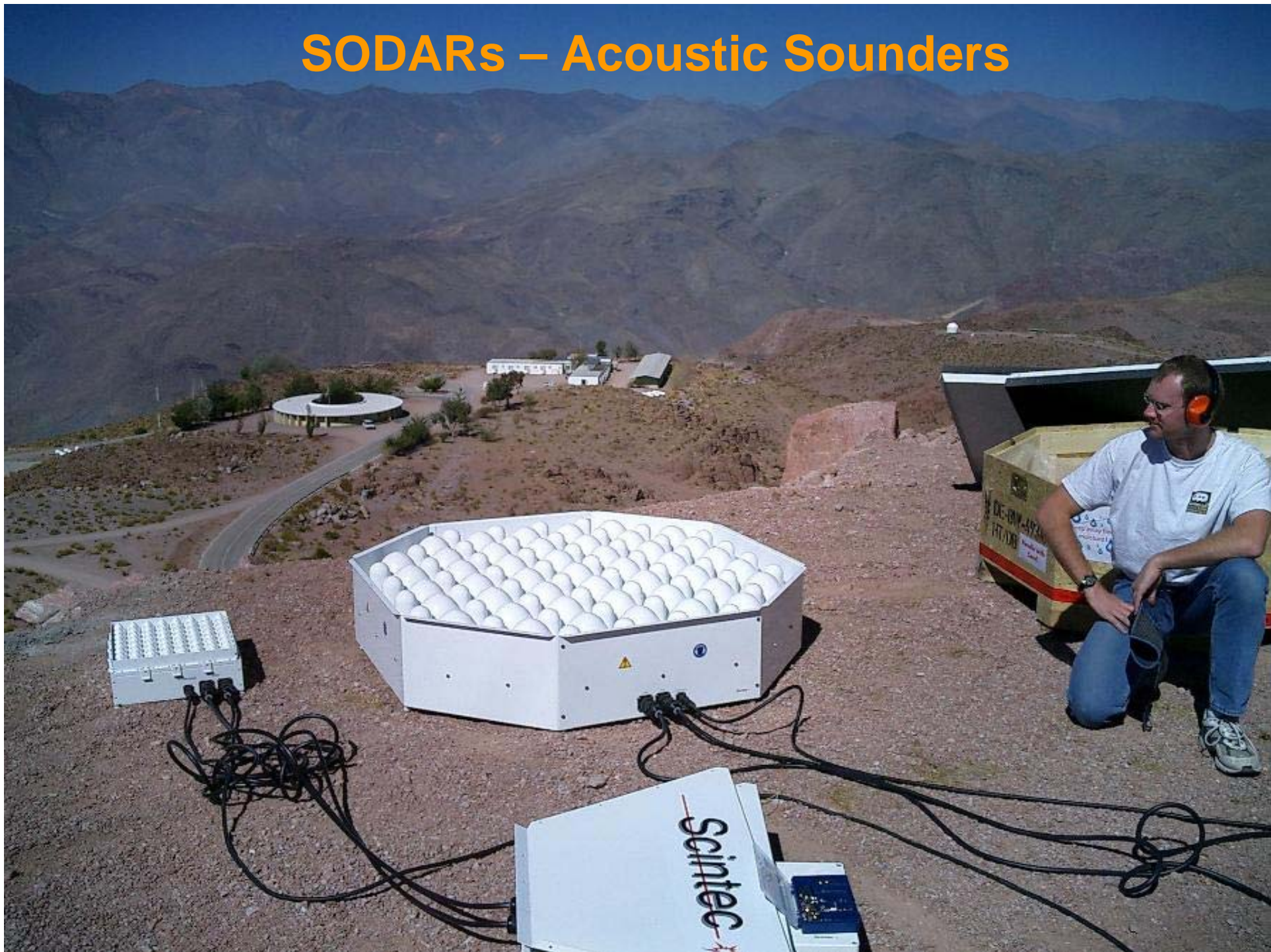
DIMM Telescope



Tololo Campaign Setup 3



SODARs – Acoustic Sounders





Primary Mirror Strategy

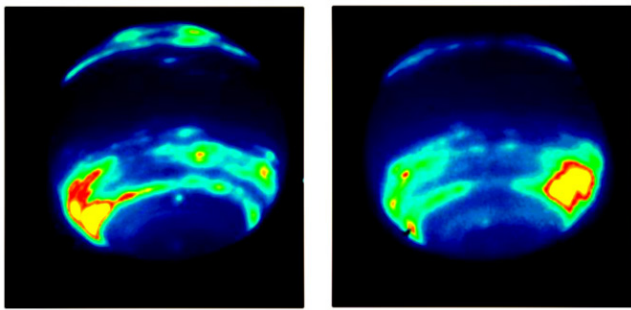
- TMT segmented mirror is an evolution of the Keck mirror
- 36 segments in each Keck telescope
- 500 to 1000 segments in TMT
- Polishing and segment module fabrication must be “mass produced” to cost and quality
- TMT is developing early industrial partners to compete production design, qualification and cost
 - RFP/tender process begun
- First phase of this to be completed in 2006



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TMT Experience of Adaptive Optics

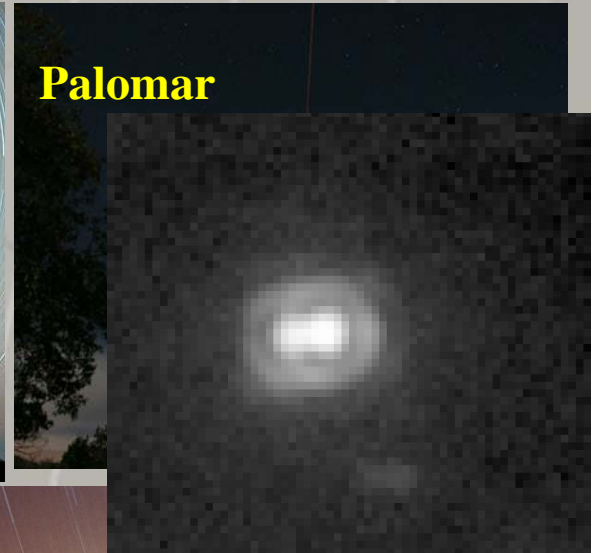
UC Lick



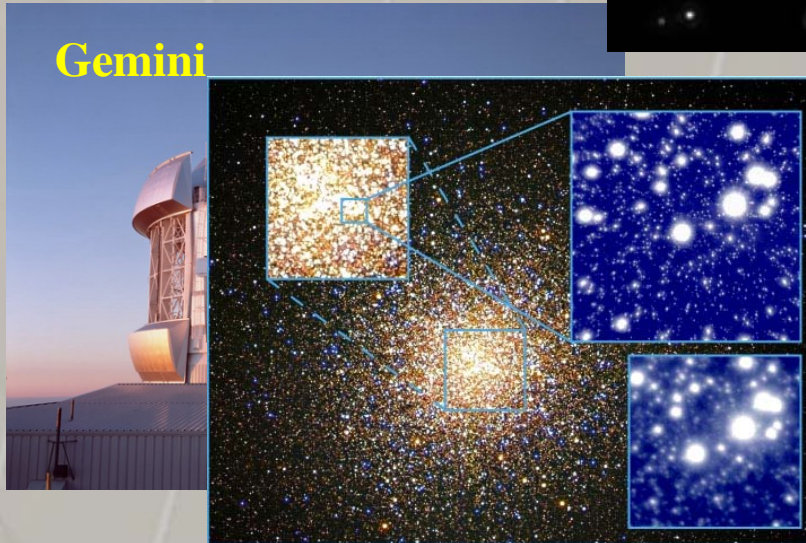
CFHT



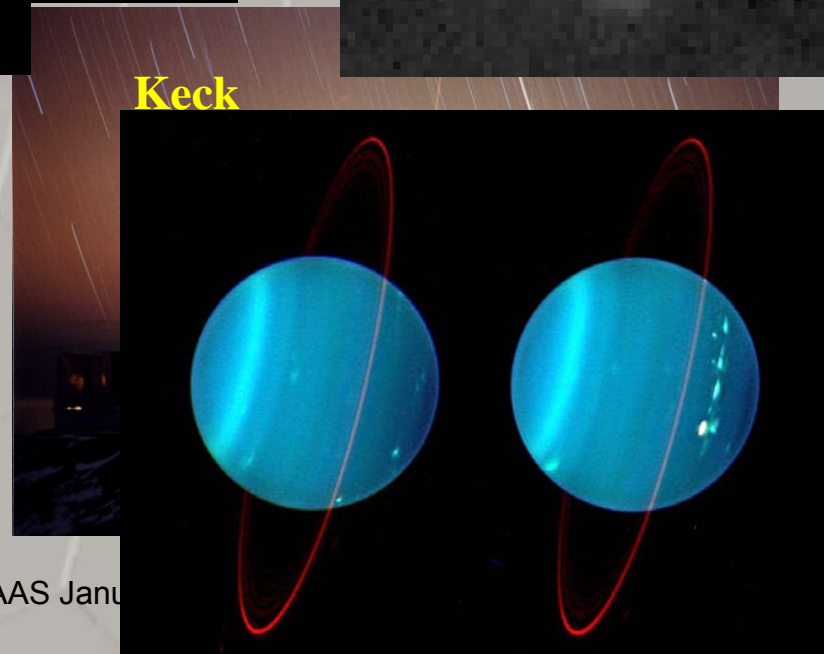
Palomar



Gemini



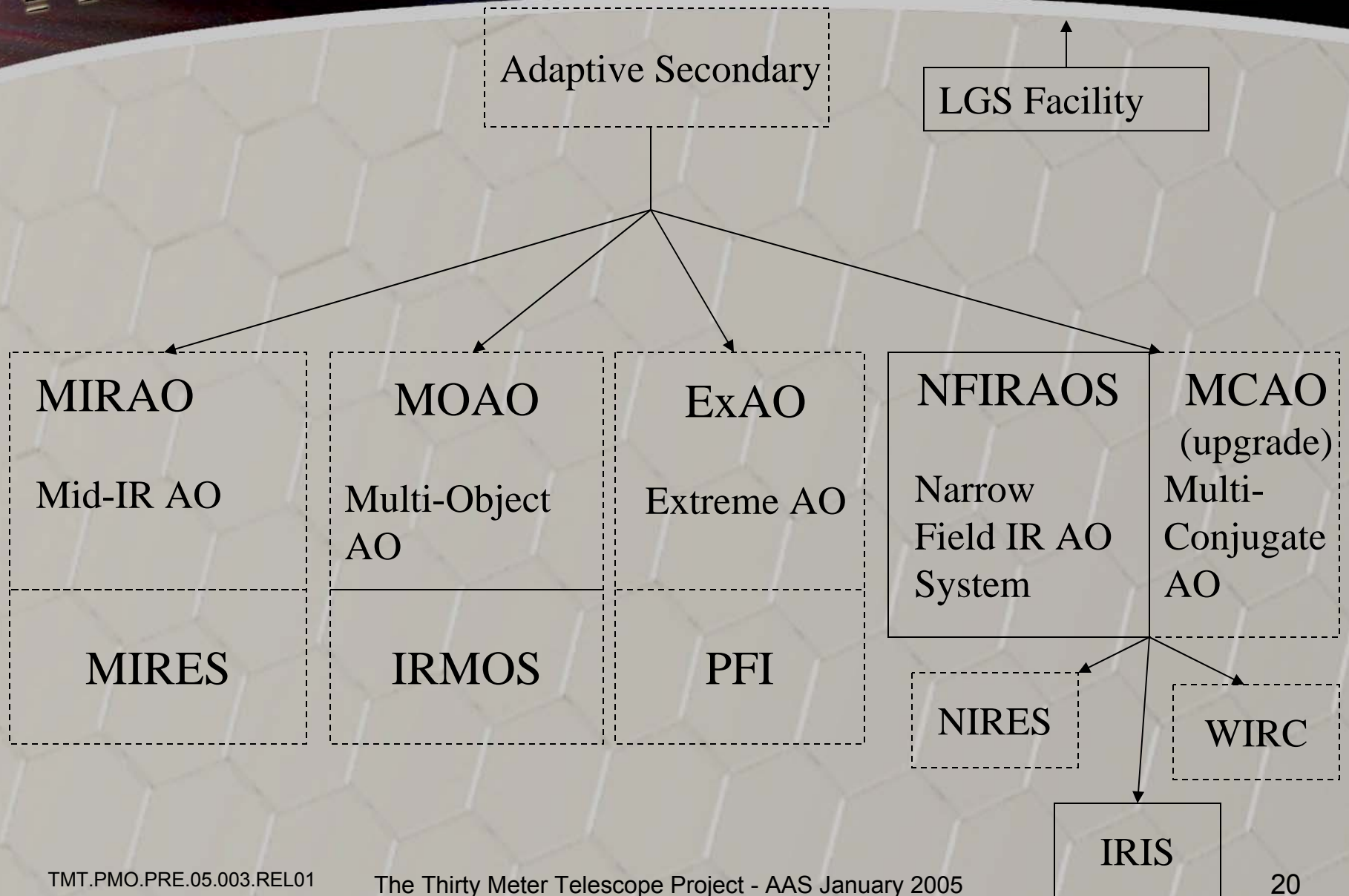
Keck



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The Thirty Meter Telescope Project - AAS Janu

TMT AO Reference Design Architecture



TMT Instrument Summary

Instrument	Spectral Resolution	Science Case
Near-IR DL Spectrometer & Imager (IRIS)	≤ 4000	<ul style="list-style-type: none"> • Assembly of galaxies at large redshift • Black holes/AGN/Galactic Center • Resolved stellar populations in crowded fields
Wide-field Optical Spectrometer (WFOS)	300 - 5000	<ul style="list-style-type: none"> • IGM structure and composition $2 < z < 6$ • High-quality spectra of $z > 1.5$ galaxies suitable for measuring stellar pops, chemistry, energetics
Multi-IFU, near-DL, near-IR Spectrometer (IRMOS)	2000 - 10000	<ul style="list-style-type: none"> • Near-IR spectroscopic diagnostics of the faintest objects • JWST followup
Mid-IR Echelle Spectrometer & Imager (MIRES)	5000 - 100000	<ul style="list-style-type: none"> • Physical structure and kinematics of protostellar envelopes • Physical diagnostics of circumstellar/protoplanetary disks: where and when planets form during the accretion phase
ExAO I (PFI)	50 - 300	<ul style="list-style-type: none"> • Direct detection and spectroscopic characterization of extra-solar planets
Optical Echelle (HROS)	30000 - 50000	<ul style="list-style-type: none"> • Stellar abundance studies throughout the Local Group • ISM abundances/kinematics • IGM characterization to $z \sim 6$
MCAO imager (WIRC)	5 - 100	<ul style="list-style-type: none"> • Galactic center astrometry • Stellar populations to 10Mpc
Near-IR, DL Echelle (NIRES)	5000 - 30000	<ul style="list-style-type: none"> • Precision radial velocities of M-stars and detection of low-mass planets • IGM characterizations for $z > 5.5$

- TMT Instrumentation program will be open to participants throughout the US and Canadian community
 - Announcement of Opportunity for all interested groups is now posted publicly
 - AAS Electronic Announcement #145 -- January 2004
 - <http://www.astro.caltech.edu/observatories/tmt/>
 - Includes opportunity to participate in several AO systems and in the first-light facility-class NFIRAOS system
- TMT Mirror Segment RFP process underway with final RFP to be released in February
- TMT Deformable Mirror RFP process initiated this month (January 20)
- More opportunities to follow...



TMT

TMT is off and running!

- TMT has set out to realize the public-private partnership for a 30m telescope envisioned in the NAS Decadal Survey
- The partnership is working extremely well: it has a scientific vision congruent with the GSMT SWG & has secured necessary private sector support for the DDP
- Project team is in motion, building a team anchored in a project office in Pasadena
- Reference designs for the telescope, AO and instruments are established
- Mirror procurement process has begun
- US community is engaged through AURA in the TMT SAC
- Instrument opportunities for all institutions in the US/Canada community now available

