



# **K**-GMT: Korean Extremely Large Telescope Project

Narae Hwang

Byeong-Gon Park, Young-Soo Kim, In-Soo Yuk, Jae-Joon Lee, Yang-Noh Yoon  
Korea Astronomy and Space Science Institute

- ❖ 1974: Korean Astronomy Observatory (KAO) founded
- ❖ 1978: Sobaeksan Optical Astronomy Observatory (SOAO)



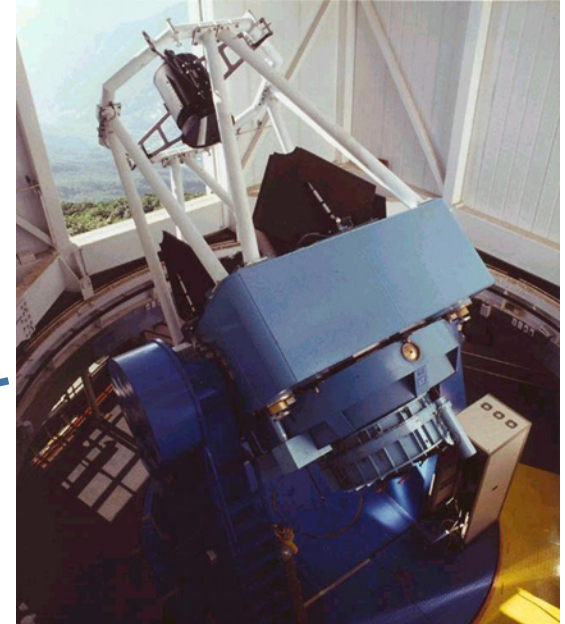
- SOAO Telescope
  - 61cm Reflector (Boller & Chivens)
  - Equatorial Mount
  - Equipped with 2K CCD Camera (2001)

## ❖ 1996: Bohyunsan Optical Astronomy Observatory (BOAO)



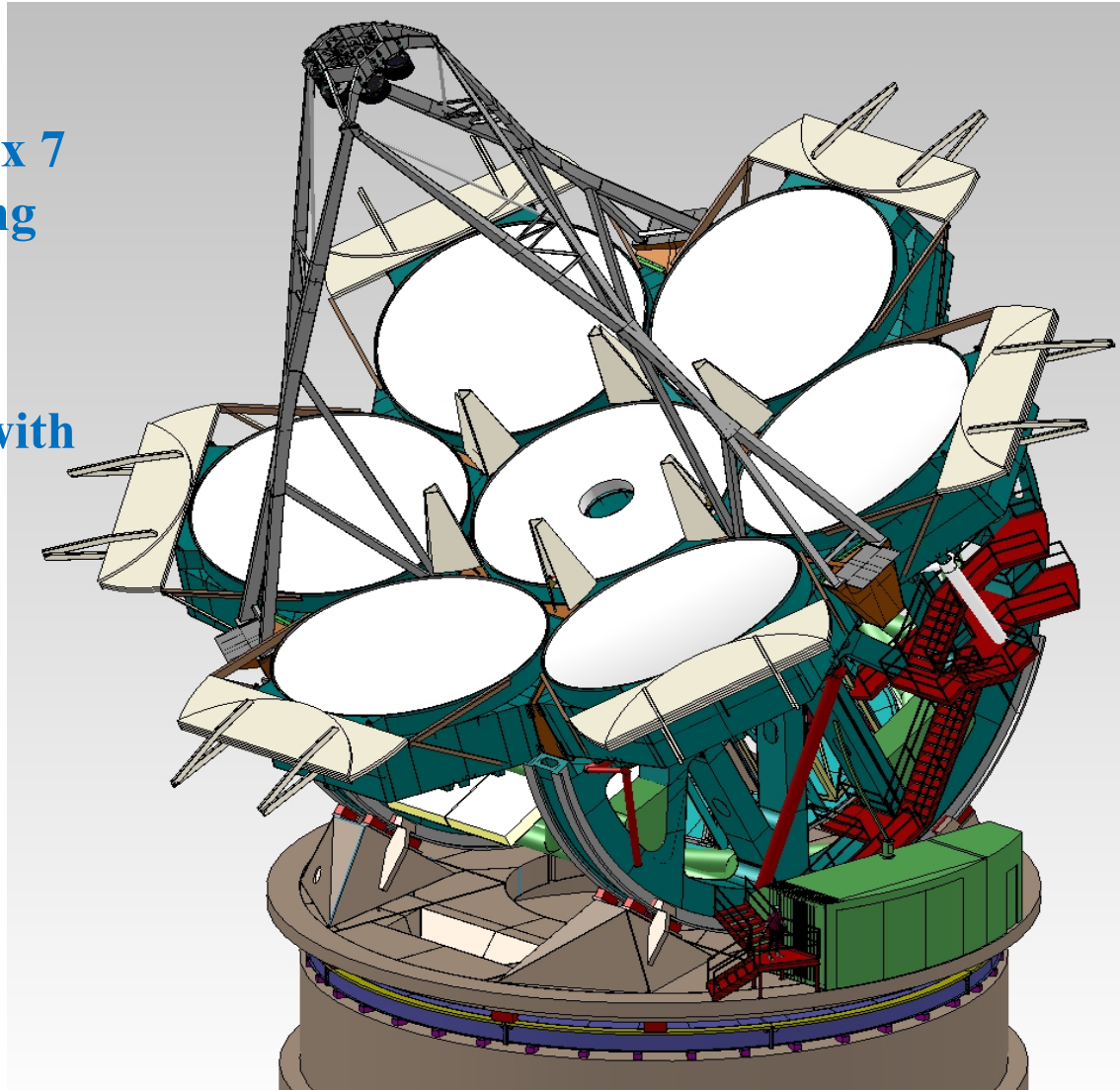
### ➤ BOAO Telescope

- 1.8m reflector
- Alt-Az Mount

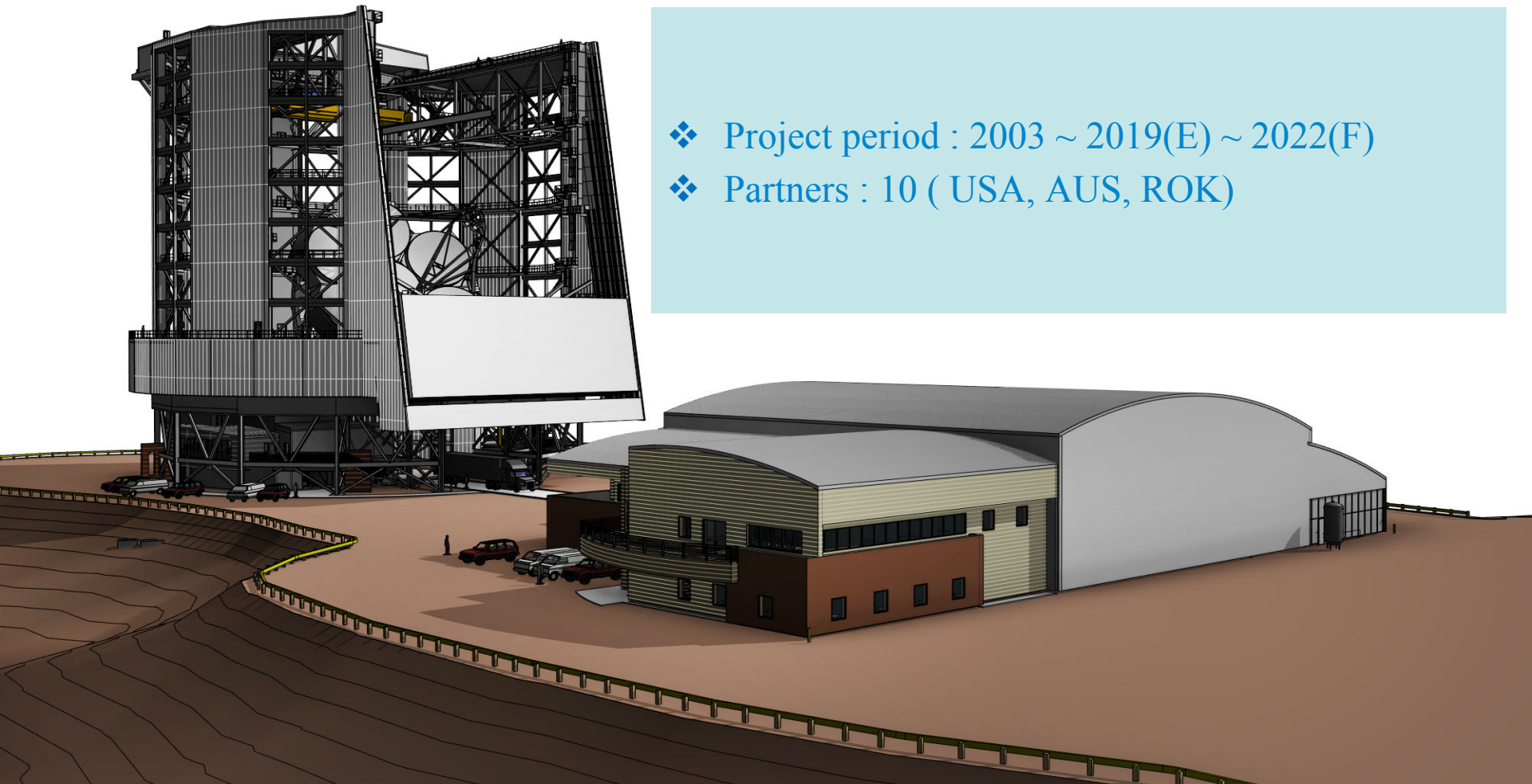


## Features

- ❖ Ground-based 25 m (8.4m x 7 mirrors) telescope operating at near UV, visible & IR wavelengths
- ❖ Gregorian optical system with segmented primary & secondary mirrors
- ❖ Alt-azimuth mount
- ❖ Active & adaptive optics operation
- ❖ Natural seeing and AO science instruments



# GMT Project Overview



- ❖ Project period : 2003 ~ 2019(E) ~ 2022(F)
- ❖ Partners : 10 ( USA, AUS, ROK)

# GMT Partner Institutions



# GMT Project Schedule

## Conceptual Design Phase

| 2003 | 2004 | 2005 | 2006 | 2007 |

Development of GMT concept, formation of partnership

KASI joins GMT!

## Design Development Phase

| 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |

Preliminary design, prototyping, start of primary mirror segments, site preparation

## Construction/Commissioning Phase

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |

Completion of design, fabrication, installation and commissioning

First Light / Early  
Science Operation

## Operations Phase

| 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |

Early operations, full science operations, ongoing development

Full Operation

## Off-axis primary mirror segments

<u>Segment</u>	<u>Status</u>
1	Completed (2012)
2	Cast, core clean-out (Backside processing in Feb. 2013)
3	Casting in Aug. 24, 2013
4	Glass purchased in 2012



GMT2 lift-off at SOML  
June 2012

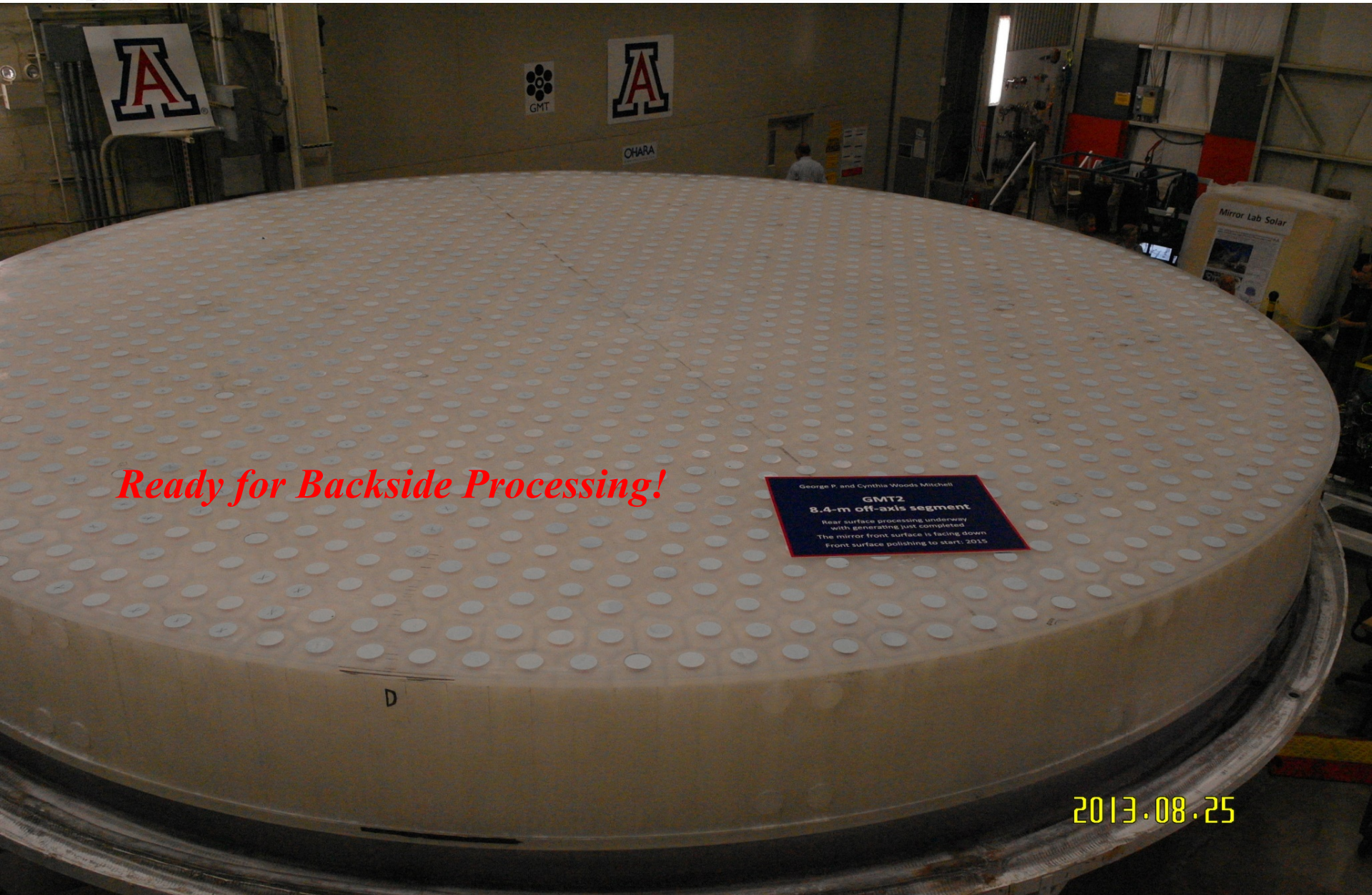
**GMT in Full Primary Mirror Production Mode**

# First Primary Mirror Segment

*Completed in 2012!*

**SOML**  
Steward Observatory Mirror Lab  
THE UNIVERSITY OF ARIZONA





*Ready for Backside Processing!*

George P. and Cynthia Woods Mitchell  
**GMT2**  
**8.4-m off-axis segment**  
Rear surface processing underway  
with generating just completed  
The mirror front surface is facing down  
Front surface polishing to start: 2015

2013.08.25

*Now in Spin Casting stage!*



## GMT4 8.4-m center mirror segment

20,000 Kg of glass purchased  
with 60% delivered to UA

Anticipated casting date:  
January 2015

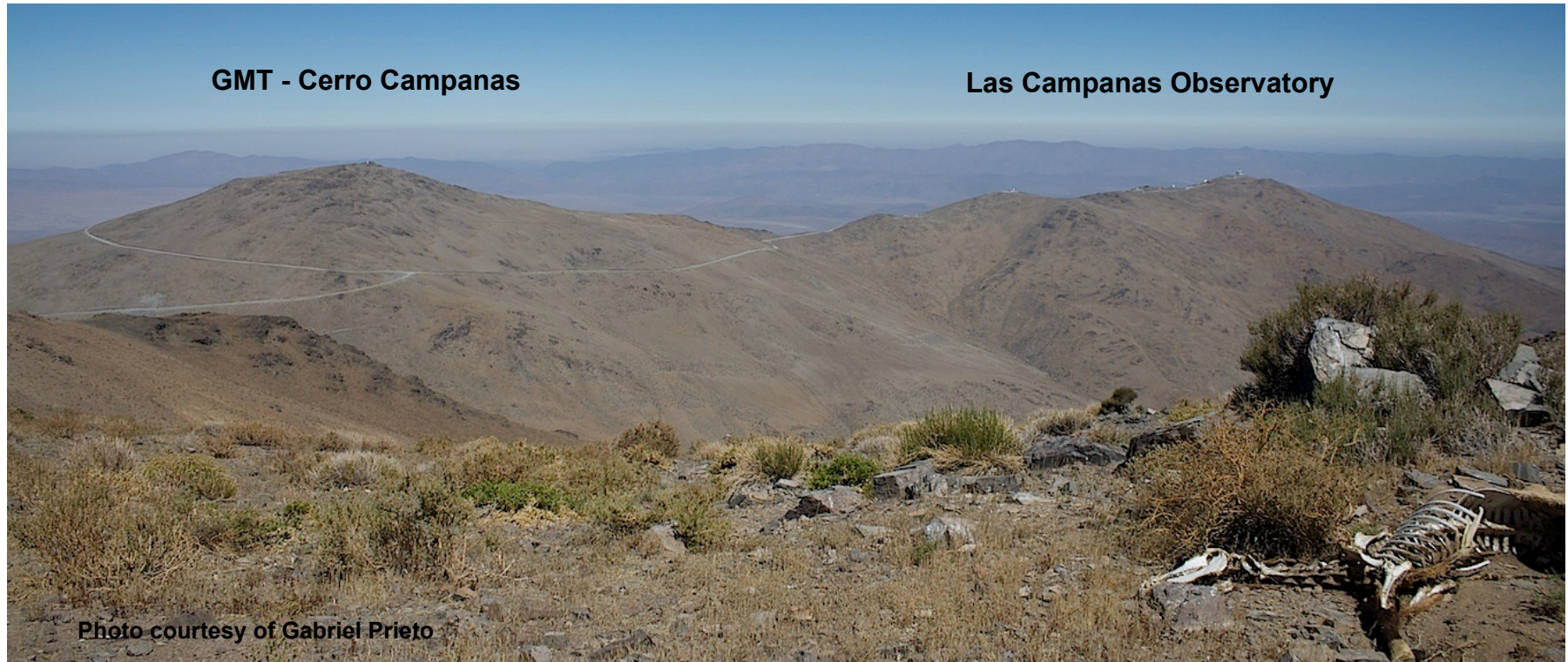
**OHARA**  
株式会社 オハラ  
TEL 042(772)2101

**OHARA**  
株式会社  
TEL 042(772)2101

CAUTION  
GLASS HAS SHARP EDGES  
PLEASE DO NOT TOUCH



2013.08.25



## Established infrastructure

- Access roads
- Water
- Power
- Communications network
- Maintenance shops
- Lodging
- La Serena headquarters

**These facilities  
will be upgraded  
for GMT**



## Site development timeline

- **Clearing:** Mar-Aug 2012
- **Geotechnical testing:** 2012-2013
- **Civil works:** 2014-2015
- **Facility construction:** 2015-2017
- **Enclosure installation:** 2016-2017

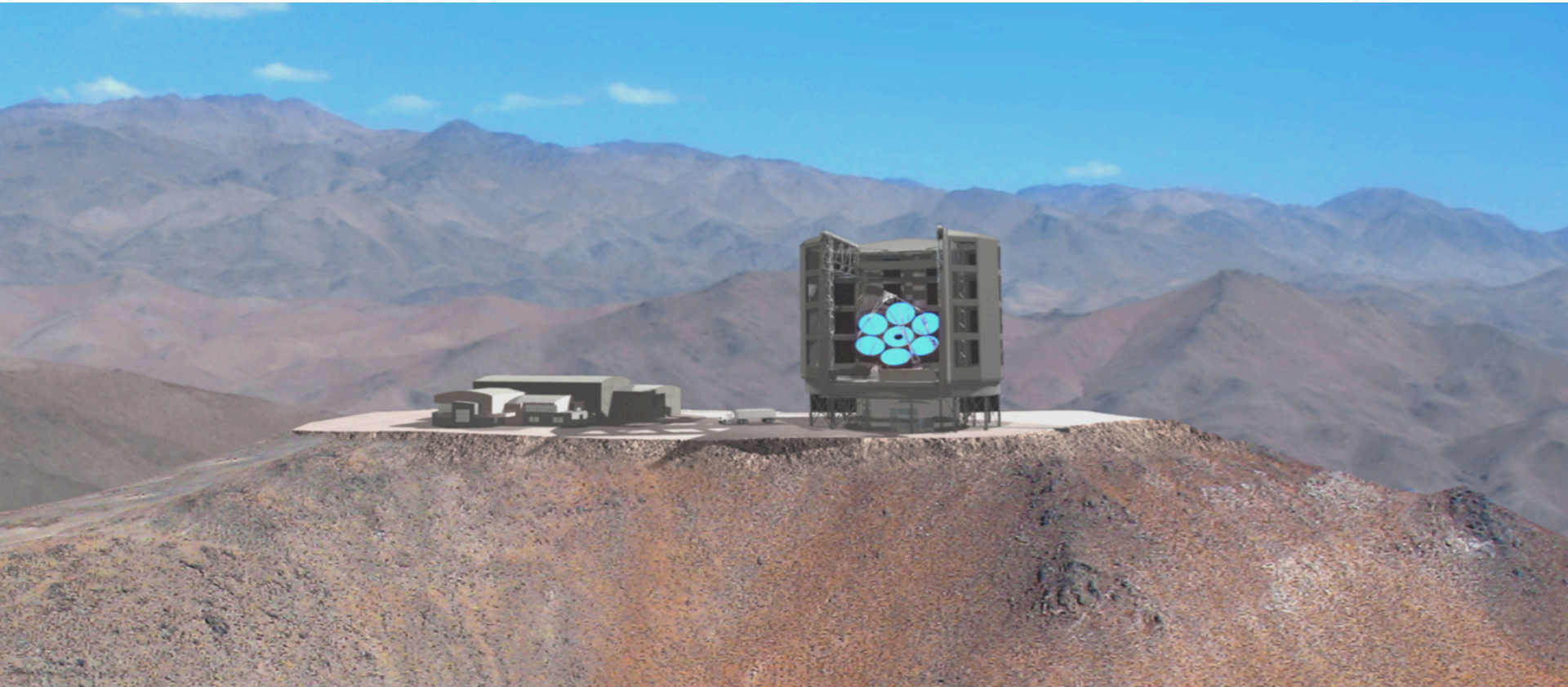


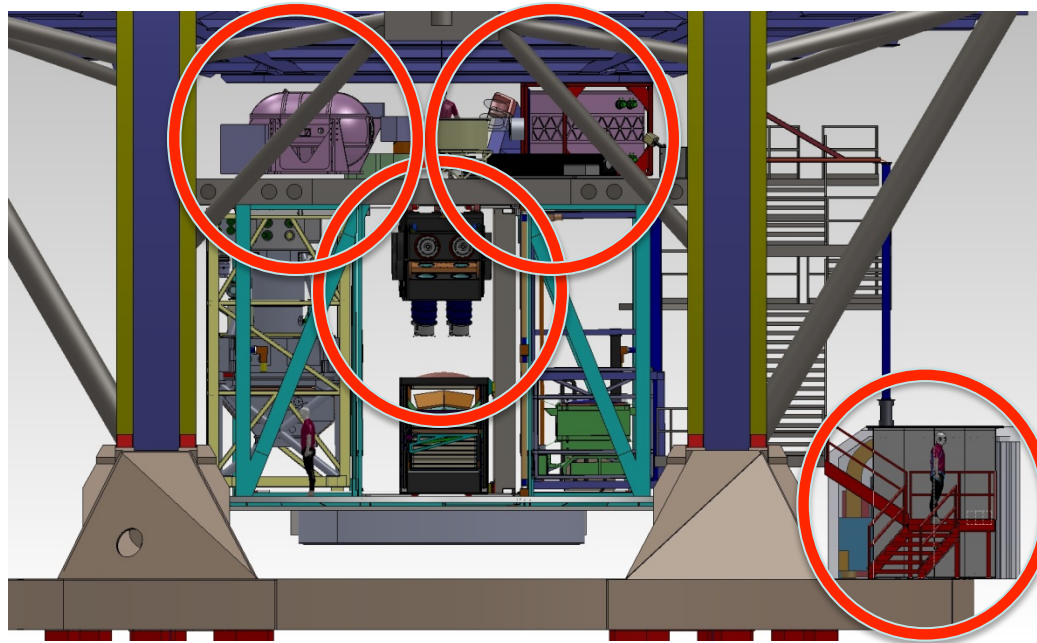
**First blast (3/23/12)**

# Before & After



# When Completed





Plus MANIFEST !!

Name	Function	Remark
GMACS	Wide field multi-object optical spectrograph	Non AO
G-CLEF	High dispersion, high stability optical spectrograph	Non AO
GMTNIRS	High-Resolution NIR/MIR spectrograph	AO
GMTIFS	NIR Integral-Field spectrograph	AO

❖ K-GMT Project Office is an official interface  
bet. KASI and GMTO

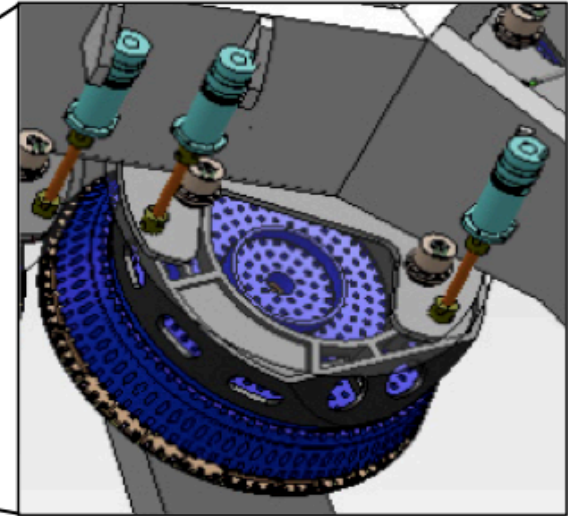
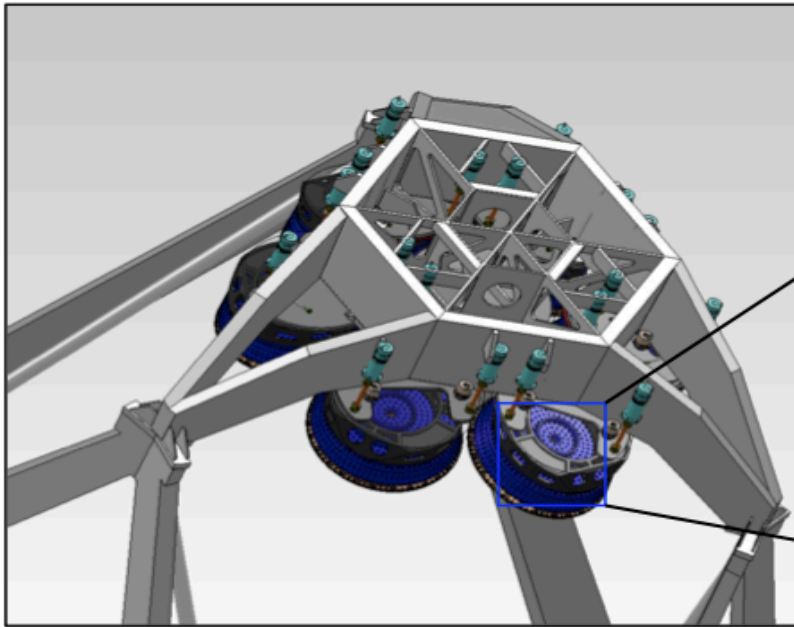
Project  
Management

FSMP Development

Instrumentation

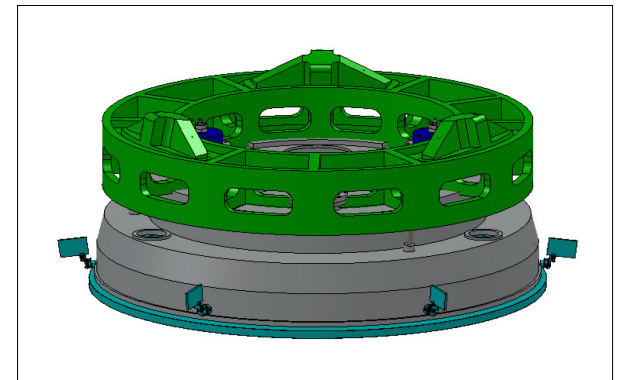
Science

- ❖ Founding member of GMT Consortium: 10% share
- ❖ Instrumentation
  - ◆ G-CLEF
  - ◆ GMTNIRS
- ❖ Secondary Mirror – FSM(P)
  - ◆ Domestic Final Test Review (FTR) – Completed in July 2013
- ❖ Enclosure
- ❖ Telescope Structure



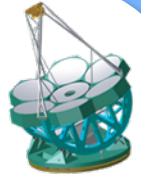
ASM

- **Seven 1.1 m M2 segments**
- **Individual six DOF positioning mechanisms**
- **Two interchangeable f/8 M2 assemblies**
  - **Adaptive Secondary Mirror (ASM)**
  - **Fast-steering Secondary Mirror (FSM)**
  - **Exchanged using the Enclosure crane**

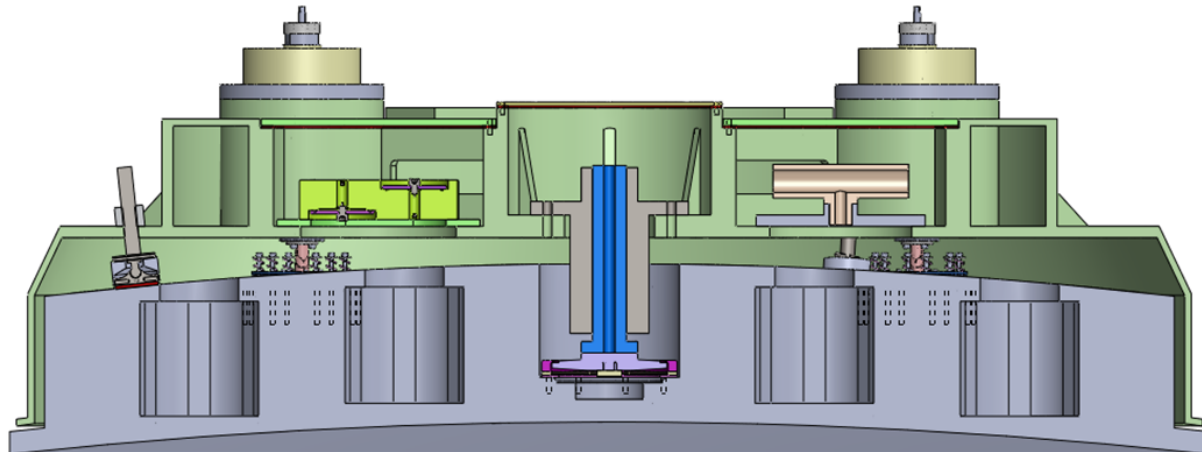


FSM

# FSMP Development

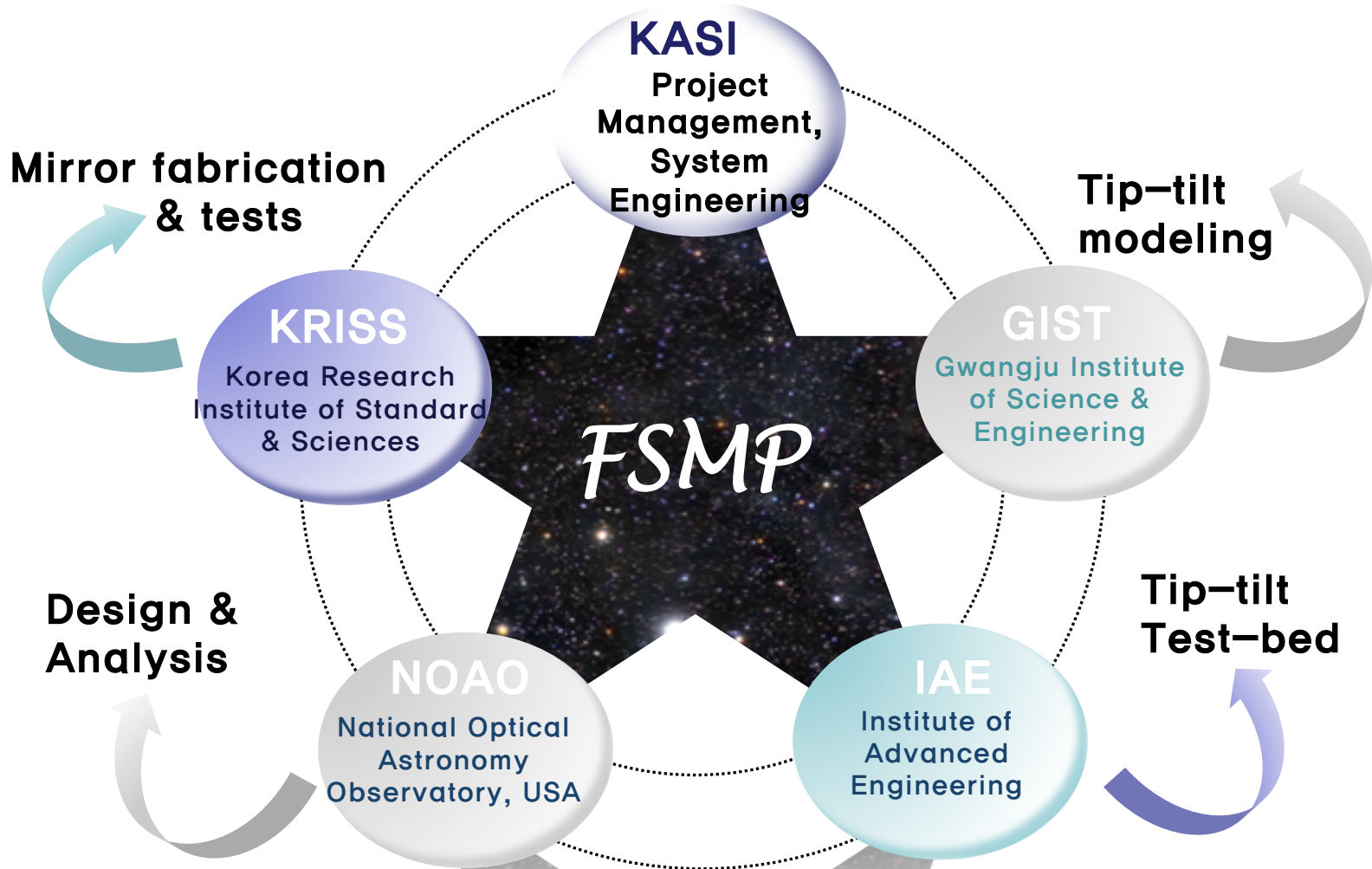
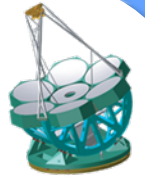


- **FSMP** : FSM Prototype
- **Objectives** : To acquire key technologies required for the FSM development.
- **Product** : 1 full size segment (Hexapod not included)
  - A 1.06m off-axis mirror
  - A tip-tilt test-bed

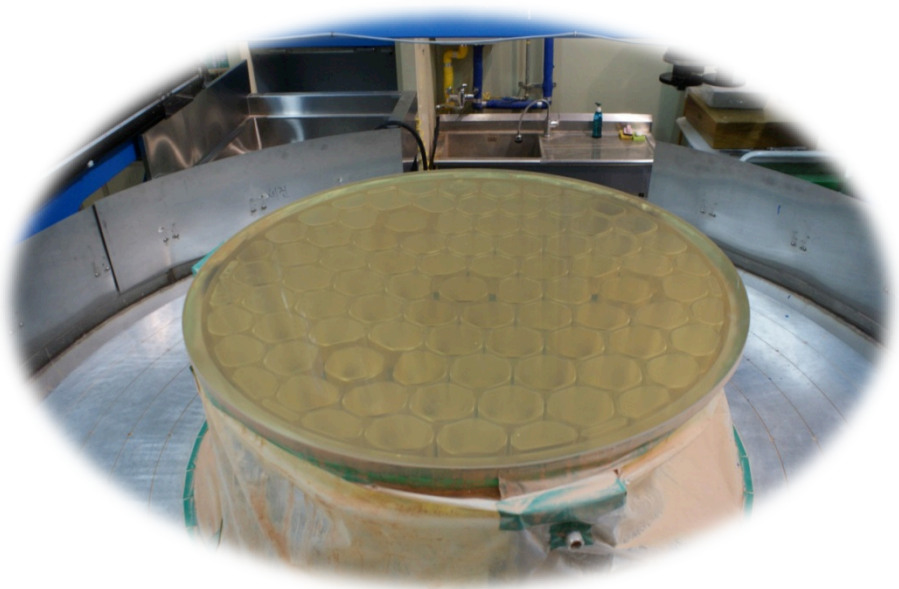
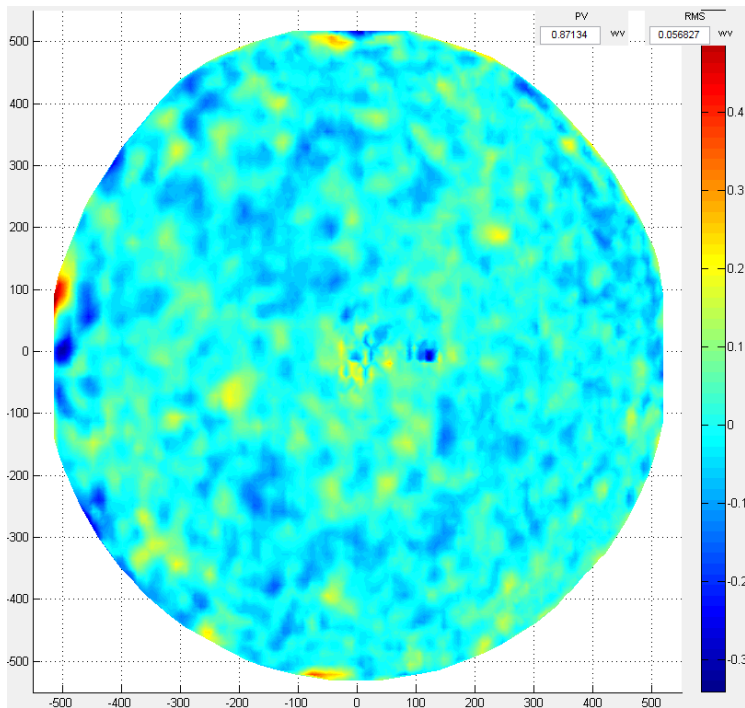
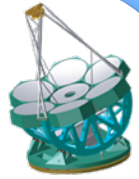




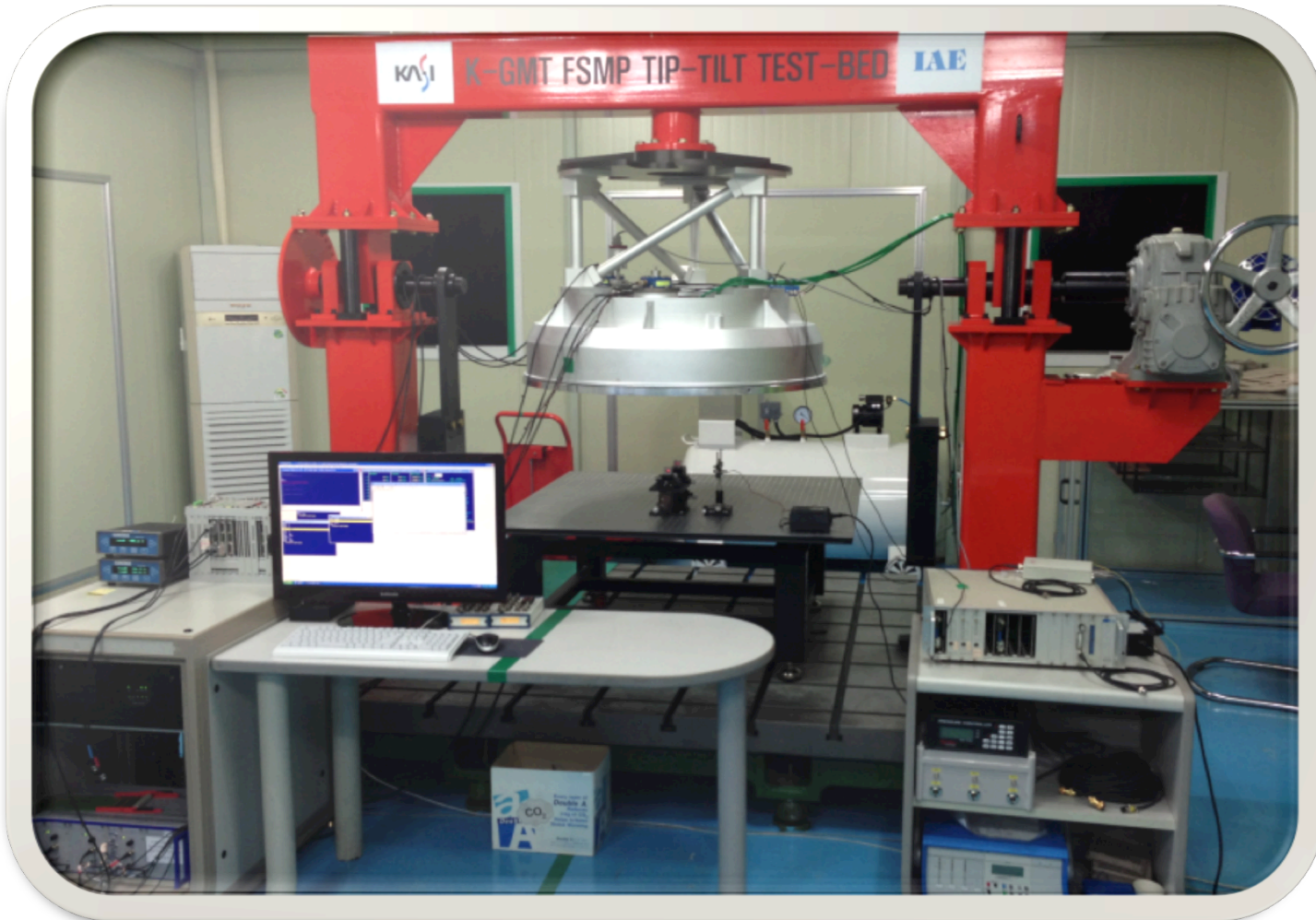
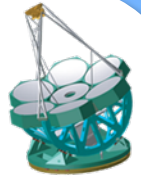
# Consortium - FSMP



# Wavefront Map



# Tip-Tilt Test-bed



## ❖ Objective:

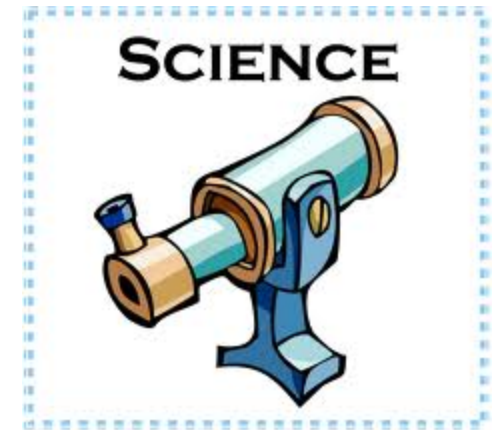
- ◆ *Boosting up the scientific research capability of Korean Astronomy Society for the GMT era.*

## ❖ Approach:

- ◆ *Provide access to mid-to-large telescopes*

## ❖ Telescope Line-up

- ◆ CFHT (2012~)
- ◆ MMT (2014~)



## Call for Proposals 2014

K-GMT Science Group invites observing proposals for CFHT and MMT.

[Submit Proposal for 2014](#)

### CFHT

0 0 0  
Hours Minutes Seconds  
until the deadline

### MMT

0 0 0  
Hours Minutes Seconds  
until the deadline

This web form is only supported with modern browser, e.g., IE10, google chrome, firefox, safari, opera, etc. If you use IE9 or older, and you cannot install other browsers, please submit the proposal by email (see the call for proposal page for details).

[K-GMT Science Group Call for Proposal 2014](#)

[K-GMT Science Program Home Page](#)

## ❖ Objective:

- ◆ Prepare science cases that Korean community can lead in 2020
- ◆ Science cases broken down to:
  - Galaxy Clustering and Cosmology
  - Galaxy Formation
  - High-redshift Objects and Reionization
  - Stellar Populations and Chemical Evolution
  - Exoplanetary System
  - Star and Planet Formation

❖ Goal: 1<sup>st</sup> K-GMT SWP written in Korean around mid-2014.

## ❖ Objective

- ◆ Promote the prospective sciences with GMT among young scientists

## ❖ 3<sup>rd</sup> GMT Summer School in 2013

- ◆ Mission: Prepare observing proposals for GMACS/G-CLEF
- ◆ 63 participants including 11 lecturers & panelists and 5 staffs



9th East Asian Meeting on Astronomy, Oct. 14-18 2013, NCU, Taiwan



제3회  
**거대마젤란망원경  
여름학교**

날짜: 2013년 8월 27일 (화) ~ 30일 (금)  
장소: 강원도 홍천군 가람밸리 리조트  
등록기간: 6월 1일 ~ 6월 30일  
홈페이지: <http://kgmtscience.kasi.re.kr/SummerSchool/2013>

주최: 한국천문연구원 KASI 주관: K-GMT 과학·기기 워킹그룹

## ❖ SDSS4

- ◆ APOGEE-2
- ◆ MaNGA
- ◆ eBOSS
- ◆ Survey will begin as early as 2014 (for MaNGA)
- ◆ KASI (K-GMT) will join SDSS4 through Korean Scientist Group

## ❖ LSST

- ◆ K-GMT is leading MoU w/ LSST Corporation
- ◆ Korean Group is going to be an operation partner beginning from 2019-

- ❖ GMT will be a major breakthrough for Korean Astronomical Society
- ❖ K-GMT Project is working actively to contribute to GMT Project in terms of construction, instrumentation, and sciences
- ❖ K-GMT Project is also leading international collaborations
- ❖ K-GMT Project also hopes to promote the EA regional collaboration including the future GMT-TMT collaboration in 2020!

**Thank you!**