



Engineering and Technical Service (ETS).

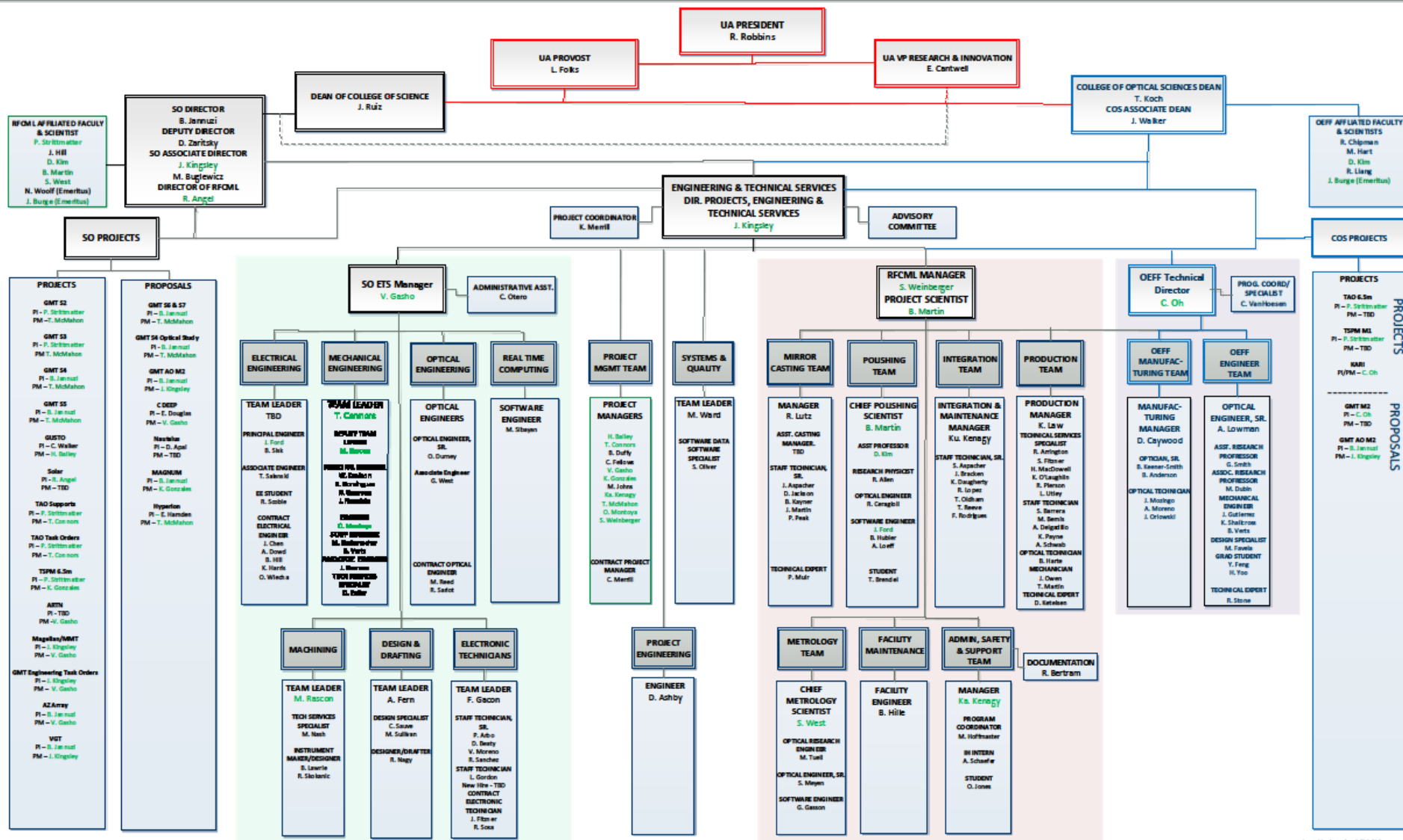
This is a **group of more than 120 scientist, engineers and technicians** with a very high level of competency who help carry out the research work of the faculty at Steward Observatory, College of Optical Science, Lunar Planetary Labs and other UA entities.

The mission of ETS is to support the research interest of the faculty and realize their vision in a cost effective manner.

This group is substantially soft funded and mostly direct charged.



UNIVERSITY OF ARIZONA
College of
Optical Sciences



GREEN indicates Multiple Assignment.

Last Updated: 9/23/15



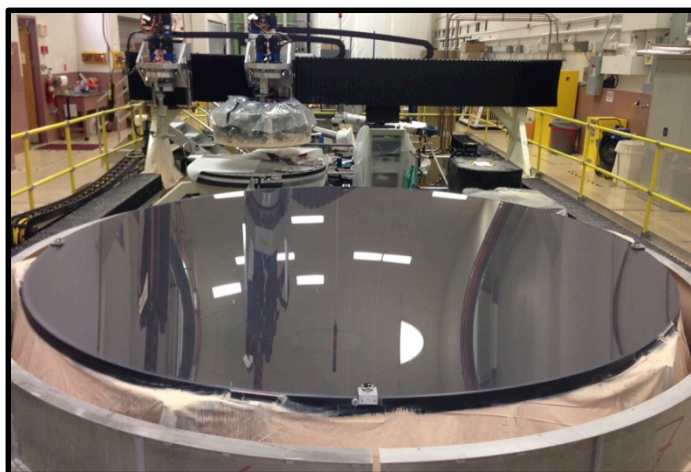
What can ETS do?



1. **Provide consulting in a host of technical and programmatic areas.**
2. **Provide technical services for proposals and projects.**
3. **Facilities to perform technical work** (*RFCML, OSC Large Optics Shop, Machine Shops, Opto-mechanics Lab and Electronics Shop to name a few*).
4. There is a **vast amount of equipment** that can be loaned or shared such as lasers trackers, interferometers, optical benches, test equipment, point source microscopes, divergers and many others.
5. **Produce items or deliver projects.**
6. **Able to multiplex people for high value and low cost options to researchers.**

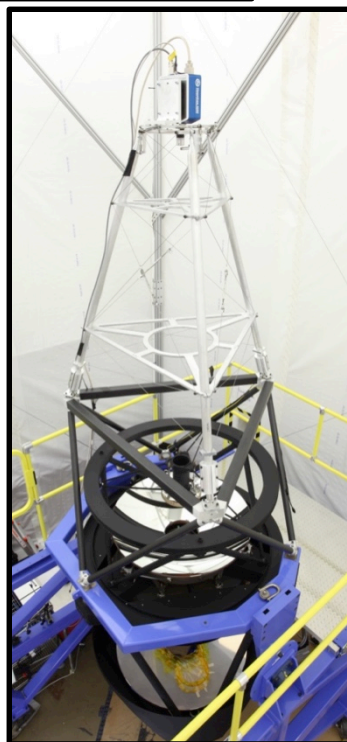


LSST M1M3 Mirrors delivered
May 2015 (\$20M)

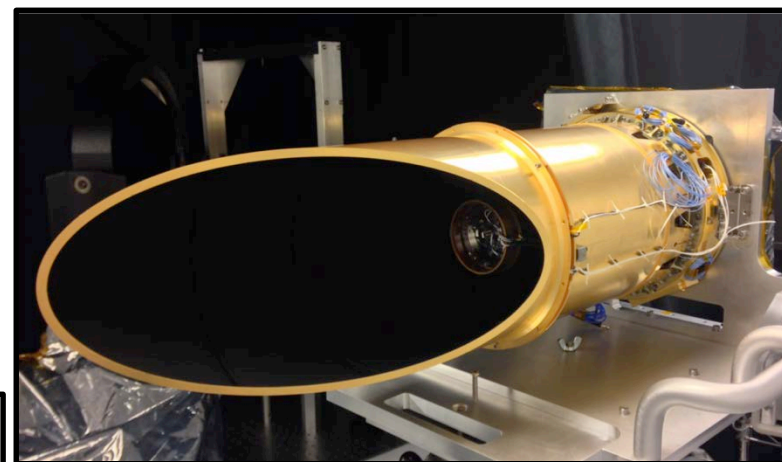


ATST off-axis primary mirror
to be delivered **November 2015 (\$14M)**

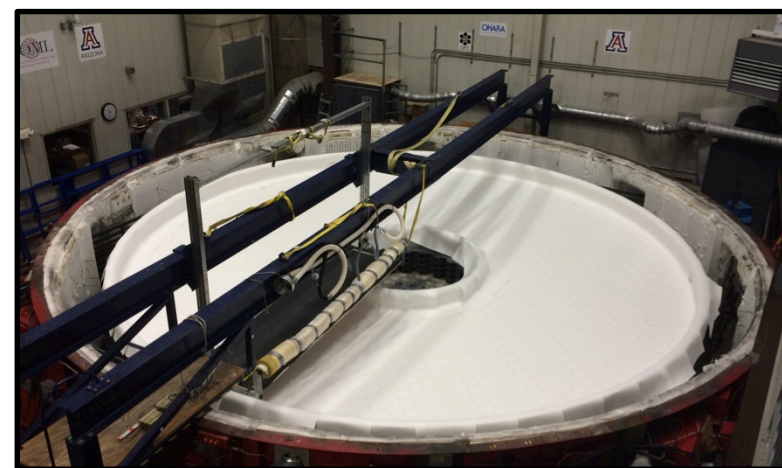
Three AO systems delivered for a LMC
optical interferometer in **July 2015**
(\$4M)



HET WFC delivered
June 2015 (\$5M)



PolyCam for OSIRIS-Rex delivered
August 2015 (\$6M)



GMT S4 Center Mirror cast
September 2015 (\$14M)



Facilities



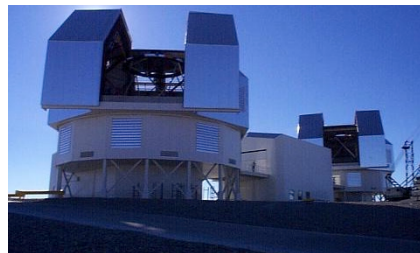
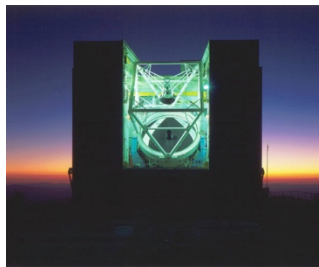
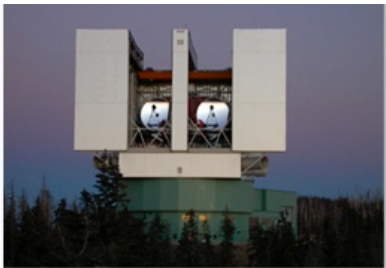
Department of Astronomy/Steward Observatory



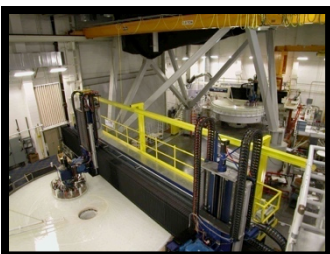
Richard F. Caris Mirror Lab



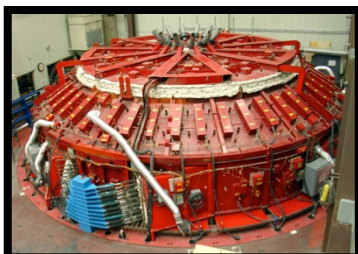
College of Optical Science



Steward Observatory has 20 telescopes on 7 sites worldwide



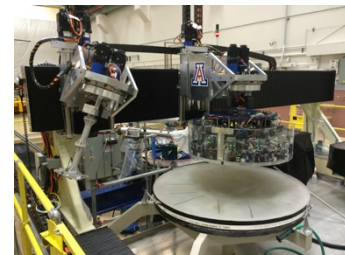
Large Polishing Machines



10-m rotating furnace



Mt. Lemmon Sky Center



OSC Large Optics Shop



Mechanical Engineering:

- Engineering in design, analysis, failure mechanics, machines, mechanism, instruments, optics and structures
- Demonstrated large and small project experience with precision mechanisms and optics
- Software tools: ANSYS, SolidWorks, HMSWorks & Inventor
- Six designer drafters capable of producing complex system

Electrical Engineering:

- Design of digital and analog circuits, systems and electrical power
- Machine design and control
- Instruments
- Software: Pspice and OrCad PCB Editor and Capture

Software Engineering:

- Machine control such as LPM, LOG, Casting furnace, telescope, AO systems & instruments
- Data processing tools and pipelines (*telescope data and optical metrology data reduction*)
- Software products: MATRIX, CCP, Polaris, NGTCS and many others
- Programming languages: C, C++, Java, Python and many others

Computer Support Group:

- Group supports more that three hundred people in the department with significant computing and networking demands including support at five mountain tops in Arizona
- High Speed computing EL GATO and others



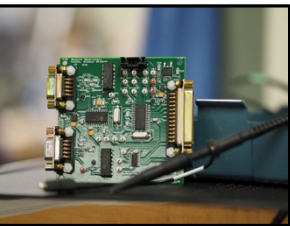
Opto-mechanics Lab:

- This is a lab at OSC with a manager and student support
- The lab tracks optical equipment and provides setup and testing service
- Produces opto-mechanical and electro-optical projects



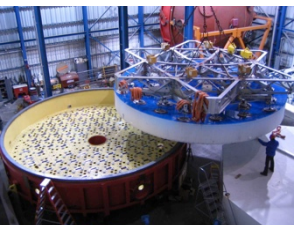
Machine Shops:

- Eight machinist at three facilities with more than 20 machines
- Programming languages: HMSWorks, G-Code, GibbsCam & others
- Specialty machines: Kern, Moore Free Form Generator and HASS VF-2 with 4th and 5th axis capability
- MIG, TIG, Plasma cutter and gas welding
- 65 ton Iron Worker



Electronics Shop:

- Five electronics technicians with considerable experience
- IPC and NASA certifications for cable, board and chassis assemblies
- Electronics lab with extensive equipment
- Board layout, assembly and testing including surface mount assembly and rework
- Oscilloscopes, logic analyzer, spectrum analyzer, synthesizers & power supplies
- Software: OrCad PCB Editor and AutoCAD



Mechanical Integration:

- Eight mechanical technician
- Skilled integration of opto-electrical and opto-mechanical systems



Project Management:

- More than 10 project managers
- Microsoft Project, Project Server, Customer software, Merlin and FastTrack
- A proven process to report time and purchases into the system for project reporting

Systems Engineering and Quality Assurance:

- New group just formed and located in the Sonnet Building from ETS and OCAMS staff
- Includes quality inspectors and some with NASA certifications
- Newly created Quality Manual for ETS

Safety:

- Large integrated safety group of more than six with participation from all groups
- Safety manual: https://www.as.arizona.edu/sites/default/files/Safety_Manual_2015_0.pdf
- Semi-annual inspections of all facilities
- Safety Website: <https://www.as.arizona.edu/safety>

Steward Observatory Electronics Documentations Management System (SOEDMS):

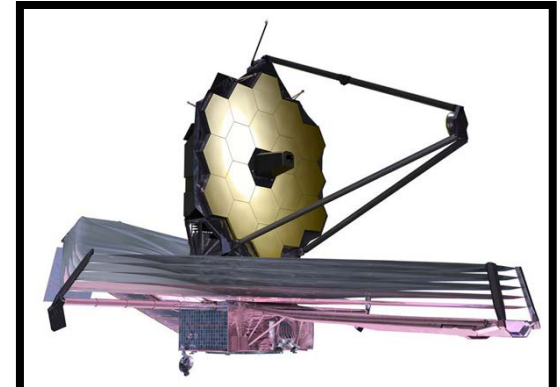
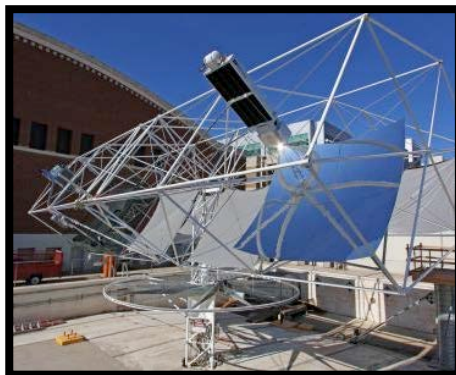
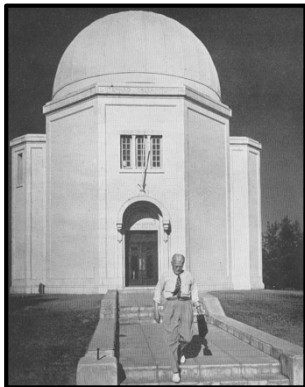
- Documentation system based on Content Central Software
- System is able to have authorizations, approvals and PFRs and ECRs
- System supported by more than four people as needed
- Backup at two separate locations on campus
- Website: <https://soedms.as.arizona.edu/Default.aspx>



Why have we been successful?



1. A very strong, innovative and active faculty.
2. ETS provides high level and cost effective support to realize the faculty's vision.
3. Strong support from colleges, departments and UA administration.
4. Very high level expert UA faculty to draw from when challenges occur.
5. Aggressive “can do” attitude and passion to do large challenging research projects.
6. Adapting the ETS organization to researchers needs of the faculty.

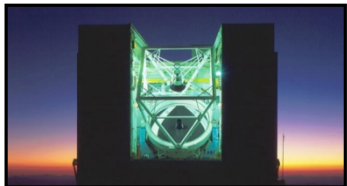




Historically successful projects?



Two 8.4-m primary mirrors and mirrors support system for Large Binocular telescope (**LBT**) the large fully steerable telescope in the world (\$60M).



MMT Telescope upgrade to a 6.5-m primary mirror and support system (\$20M).



Adaptive secondary mirrors and systems for MMT, LBT and Magellan telescopes.



GMT 8.4-m off-axis primary mirror segment in 2012 a \$30M demonstration mirror for the project. The mirror has 1,400 mm of asphericity! Five times more difficult than ever been done!

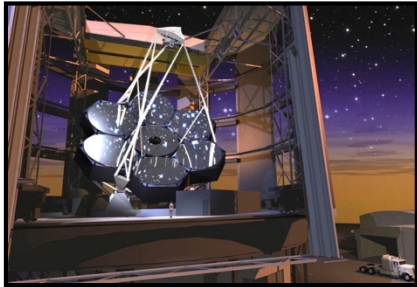


Transporting the UA obtained 12-m ALMA prototype antenna from VLA site in New Mexico to Kitt Peak in Arizona in 2014. A \$14M telescope and a \$2M telescope move.



Large Optical Test System (**LOTIS**) a 6.5-m auto collimator system for a thermo vacuum system for LMC.

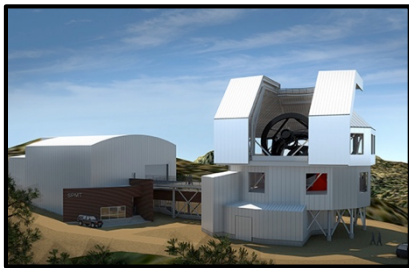
A few current and planned projects?



Seven **GMT** 8.4-m primary mirror segments valued at ~\$140M with plans to complete in 2022. This will be the world's large optical telescope.



Tokyo Atacama Telescope (**TAO**) 6.5-m primary mirror, secondary mirror and tertiary mirror systems valued at ~\$22M to be delivered in 2019. An observatory in northern Chile at 5,640 meter (18,000 feet).

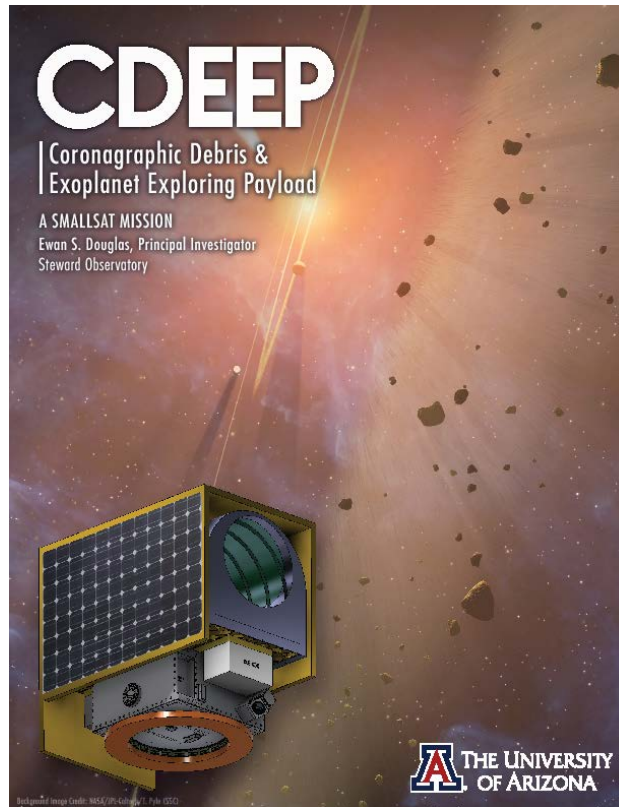


Telescope San Pedro Martir (**TSMP**) 6.5-m primary mirror, cell and support system for a telescope in Mexico at 10,000 feet elevation valued at \$30M.



The Arizona Robotic Telescope Network (**ARTN**) is a project to robotize progressively more of UA's telescopes for higher utilization and more efficient and cost effective usage.

Recent Proposals





Services can be accessed by contacting:

Jeffrey S. Kingsley Director of Projects, Engineering and Technical Services for
James C. Wyant College of Optical Sciences and Steward Observatory
520-626-3527 office jsk1@email.arizona.edu
520-289-0869 mobile

Dr. Chang Jin Oh Technical Director for the Optical Engineering and Fabrication Facility (OEFF)
520-626-5454 office chanjin.oh@gmail.com
520-609-9964

The cost structure of the services vary from direct charge of people to a standard shop overhead rate.

Please contact one of the above people for support on proposals early in the process. The more time provided the better the result and lower the cost.

Questions?