

Working at the W.M. Keck Observatory

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Electronics Engineering Manager

Introduction



- I hope to both satisfy and fuel your curiosity of what it's like to work at the Keck Observatory

(Please ask lots of questions – during and after!)



Rich's Background

- Born and raised on Oahu
- Attended University of Washington, B.S. Electrical Engineering degree in 1985
- 2 Summer Internships working for Wang Laboratories
- Worked at Boeing for 8 years including avionics design for the 777 airplane
- Began working at Keck in 1993



What I do for Fun

- Hang out with my wife Leslie and my two sons, Kyle (10) and Daniel (6)
- Surf
- Play and Coach Basketball
- Kick back with friends and family
- Play with my dogs, Roxy and Sandy

Let's Get to Know Each Other

- Your name, hometown, college, year, major?
- What are your goals for the short course and internship?
- What do you have in common?

Topics of Discussion

- What is the W.M. Keck Observatory?
- Working at Keck
- My Job
- Engineering Internships

W.M. Keck Observatory's Vision and Mission

Vision

A world in which all humankind is inspired and united by the pursuit of knowledge of the infinite variety and richness of the Universe



Mission

We advance the frontiers of astronomy and share our discoveries to inspire the imagination of all.

How We Got Our Name

- Named after William Myron Keck, the founder of The Superior Oil Company of California who, in 1954, founded the W.M. Keck Foundation with the mission “to benefit humanity through the disciplines of science and engineering, medical research and higher education.”
- The W.M. Keck Foundation provided the original funding of \$160,000,000 to build the Keck Telescopes.

What is Unique about Keck?

- Most telescopes use a single huge piece of glass or ceramic for their main (primary) mirror.
- By contrast, each Keck primary mirror consists of a mosaic of 36 1.8-m diameter (6 feet) hexagonal segments made of a special ceramic material called "zerodur".
- The Keck telescopes are the world's largest, each having a primary mirror 10-m or 33 feet in diameter.

Our Unique Site – Mauna Kea

- Nearly 14,000 feet high
- Above much of the water vapor in the atmosphere
- In the middle of the Pacific – stable winds
- Low levels of artificial light
- The largest collection of major telescopes on one mountaintop
- Not only scientifically significant but culturally significant as well – a sacred place for Native Hawaiians

Use of the Telescopes

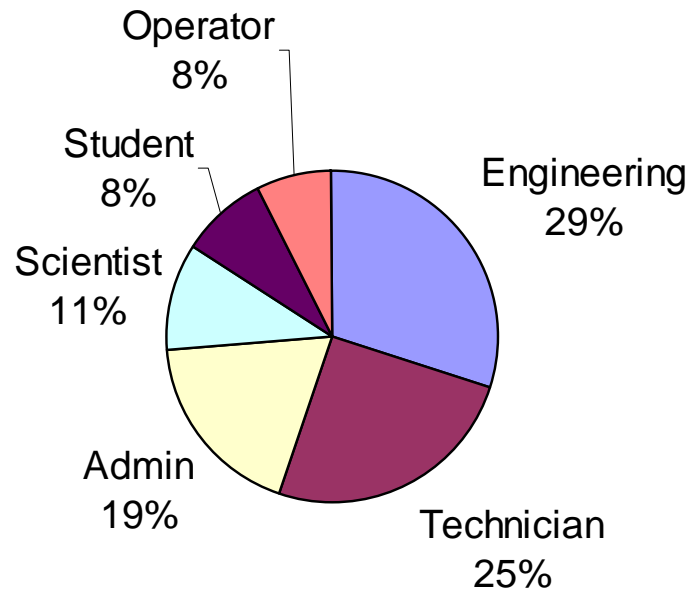
- Who gets to use it?
 - Astronomers from Caltech, UC, UH and NASA
- How much does it cost to operate?
 - About \$50,000 a night (\$1.50/second!)
- Do the astronomer's pay for each night?
 - No, they get to use the facility as a privilege of belonging to one of our parent institutions.
Naturally, as a result, these institutions attract the best and the brightest students and faculty.

Topics of Discussion

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The W.M. Keck Observatory

- How many people work at Keck and what do they do?



Examples of Jobs at Keck

Engineers – Electronics, Mechanical, Software, Facilities, Optics, Engineering Managers

Technicians – Electronics, Instrumentation, Mechanical, Machinists, Electricians, Optics

Administrative – Accountants, Public Information, Admin Assistants, Human Resources, Facility Coordinators, Custodial

Scientists – Support Astronomers

Students – Lab assistants, Office assistants, Shipping/Receiving clerk

Operators – Observing Assistants

When and Where Do the Workers Work?

When

- We observe 365 nights/year
- 75% of the staff works during the day
- 10% of the staff works during the night
- 15% of the staff works a combination
- Several day staff are “on-call” at night and on weekends in case of problems

Where

- 1/3 of the staff works mostly at the summit
- 2/3 of the staff works mostly at HQ

Unusual Jobs at Keck

Jobs you won't find at every observatory:

- Interferometer Specialist
- Librarian/Archivist
- Public Information Officer
- Vehicle Coordinator
- Housekeeper

A Typical Day at Keck

- 0500 "Early day crew" leaves for summit from Hilo and Waimea
- 0500 Director visits astronomers at the end of their night
- 0530 Observing Assistants park telescopes & close domes at end of night's observing
- 0600 Astronomers retire to sleep at VSQ
- 0700 Regular summit day crew departs from Waimea and Hilo
- 0745 Day crew arrives at Hale Pohaku for breakfast
- 0800 Start of business day for most of HQ staff
- 0900 Day crew arrives at summit
- 1030 "Swing tech" departs for summit
- 1400 Night's astronomers begin checking equipment from remote observing rooms
- 1600 All on-telescope activities cease on summit. Telescopes are readied for observing.
- 1700 Day crew departs summit for Hilo and Waimea
- 1700 C.O.B. at HQ
- 1900 Observing Assistants open domes for night's observing; observing commences
- 2030 "Swing tech" departs summit for Waimea or Hilo
- 2000 Night attendant departs Waimea for summit
- 2200 Night attendant arrives at summit

Topics of Discussion

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- Working at Keck
- *My Job*
- Engineering Internships

My Job:

Electronics Group Manager

- Manage a group of 20 engineers, technicians, aides and observatory attendants
- We are in large part responsible for daily preparation of the telescope for observing
- We also provide engineering expertise to development projects, e.g. the Interferometer and Laser Guide Star.
- Our annual departmental budget is approx \$1.5M
- My job is a mix of technical, personnel and project management

Pros and Cons of the Job

- The telescope is a really cool toy
- The people are great. Co-workers have turned into lifelong friends
- The challenges are relentless
- Working at high altitude is exciting yet physically demanding
- Being called at 3am to fix a problem is ... startling... but satisfying when you fix it!
- Our appetite for progress isn't always matched by the size of our wallet!

An Engineer's Viewpoint

What makes observatory work interesting –

- Massive equipment yet nanometer precision
- Environmental challenges – weather, dust, seeing, altitude
- Wide range of technologies – electronics, mechanisms, hydraulics, pneumatics, optics – all intertwined into complex systems
- Creating new capability in an operational environment
- Forces you to be a “systems” engineer

Topics of Discussion

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- My Personal Background
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Chad's Project: Measuring Windshake



- Chad Watanabe – Electronics Engineering Student from Loyola Marymount
- Problem: Telescope prone to “windshake” – devise a sensor that can measure wind vector to help monitor and understand this problem better
- Chad's solution was a sonic anemometer (measures windspeed as a function of the speed of sound)



Possible Summer Project

- Problem: Following bad weather, the dome shutters cannot be opened if there's any possibility of falling snow/ice. The dome must be inspected first. Climbing the dome ladder is hazardous under these conditions (slippery, falling ice, etc.)
- Possible Solution: Install a web-cam atop the dome.
- Constraints: Must be weatherproof. No wireless devices allowed. Dome slip rings are the only copper connection to dome.



What you Need to Succeed

- Academic talent gets you in the door, but it's your character that determines your success:
 - Positive Attitude
 - Motivation, Dedication and Perseverance
 - Reliability and Thoroughness
 - Flexibility
 - Willing to Take Risks
(Don't be Afraid to Ask Questions!)
 - Understand the Big Picture

Q&A?
