Refurbishment and Upgrades to the UH 88” and Hoku Ke’a Telescopes II
Recent work and future plans

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Mutual Cooperative Development

• UH Manoa UH88 and UH Hilo Hoku Ke’a have agreed to form a mutual cooperative development program for both telescopes.

• This involves refurbishment, repair, and upgrade of both telescopes together with shared usage.

• Shared usage will include undergraduates from both campuses and graduates from UH Manoa using both telescopes.
Current Status: UH88

• The plan is now to keep the UH88 operational for the next ~20 years.

• Additionally, finally get Hoku Ke’a on-sky!

• We have funding to improve/upgrade the facility, the telescope and the instrumentation.

• However, there are many areas requiring attention.

• Several major things have broken recently.

• Funding for operations is far from clear (as always).
Current Status: UH88

- Over the last few years we have had several major problems resulting in significant downtime.
- Dome hydraulic drive failure. Leak spilled many gallons of oil onto dome floor.
- RA hydraulic bearing pump issues leading to total failure.
- RA drive failure. Cannot complete slews. Drive system very noisy. Progressed from intermittent to total failure.
- Instrumentation controller problems. Intermittent to total failures.
Current Status: UH88

• Numerous areas of significant concern exist e.g.

• Telescope Control Software. Old, unique, and unsupportable.

• Dome shutter operation. Old, need overall.

• Windscreen. Non-functioning, corroded.

• Dec. drive system. Likely similar shape as RA drive.

• Mirror covers. Motors died, Need redesign, lighter covers.
• Small staff makes things rather difficult (1 + 2.75 + 3 + 1).

• Small budget makes things difficult.

• ~50% budget from UH/State. ~50% budget from external users.

• SNIFS and NAOJ have been longer term external users.

• Tholen NASA ROSES12 grant - 10% observing support for NEO observations.

• Recently - short-term external users - one semester (JAXA, Kavli).

• Continuing struggle to fund operations.

How we save electricity…
Current Status: UH88

- Instrumentation
  - Our main imager is the Tektronix 2028x2048 CCD which is over 15 years old. Used with LFW.
  - OPTIC is an optical imager also with two OT CCDs used for PSF shaping.
  - WFGS2 is a spectroscopic unit that works with Tek2K.
  - SNIFS is an integral field optical spectrograph used for nearby SN survey.
Current Status: Hoku Ke’a

Dome:
  • Not functional
  • Important design flaws
  • Already degrading

Telescope:
  • Not functional
  • Old design
  • Optics refigured
  • No control software
  • Unknown mechanics
  • Needs substantial modifications
Funding

- Several sources of funds for refurbishment work have come through.
- The State of Hawai‘i Capital Improvements Project fund has allocated $2.5M for our work.
- UH Manoa Facilities have promised ~$2.5M in deferred maintenance and capital renewal funds.
- Two UH Manoa VCs allocated $70K each which we matched from the “Lumb Family fund”.
- NASA grant of $1.6M (over four years) for “Improving Efficiency of NEO Recovery” approved.
- Operations funding is still problematic since our large external user (SNF) have almost completed their survey.
- Several smaller projects (one or two semesters) have been funded by external groups.
Plans: UH88

- VPRI+VCR+Lumb
  - TCS Upgrade. Two phases.
  - New 30kVA UPS system. More functionality.
  - CCC line upgrade. More instruments supported.
  - Sensor network upgrade. Full remote control.
  - Computer network (1Gb) upgrade. Internal and external.

20 year old UPS
Plans: UH88

• UH Facilities
  • Dome painting.
  • Aluminization.
  • New (electric) dome drives.
  • Water/Electrical repairs.
  • New Chillers/HVAC.
  • Building repairs.
  • Fix exterior paneling.
  • Dome/Tube venting.
  • Rotatable M3.
  • Telescope focus upgrade.
  • EHS.
Plans: UH88

- NASA ROSES13 Grant
  - New CCD camera (monolithic 10K x 10K) for NEO recovery (2014).
  - 10% observing time support for 3 years (2015,16,17).
  - Post-doc for three years (2015,16,17).
  - Grad student support for three years (2015,16,17).
Plans: UH88

- State CIP
  - Remainder of TCS upgrade focused on robotic operation.
  - Advanced adaptive optics with GLAO and Robo-AO systems (courtesy of Mark Chun and Christoph Baranec).
  - Other new instrumentation.
  - Other telescope system/sub-system upgrades.
Future: 1 to 2 years: UH88

• Aims are:
  • Reliable telescope operation.
  • Upgraded/supportable TCS.
  • Aluminized M1, M2, M3.
  • New optical imager commissioned.
  • Working sub-systems e.g. windscreen, mirror covers, dome, shutters, primary support.
  • All instruments using CCCs.

• Aims are:
  • New, expandable UPS system.
  • CCC support of seven cryostats.
  • Fully monitored and controllable building.
  • Dome exterior painted/renewed.
  • New dome drives and refurbished wheels/track.
  • New efficient dome/building cooling system.
Future: 2 to 5 years: UH88

• Aims are:
  • Dome and tube vented to improve image quality.
  • Rotatable M3 unit for quick instrument changes during night.
  • High efficiency NEO observing (20%).
  • GLAO testbed instrument working in optical and near-infrared.

• Aims are:
  • Functioning UV Rayleigh beacon AO system for diffraction-limited imaging.
  • Robotic operation of the UH88, fully programmable and automatic.
  • Operations fully supported.
  • New instrumentation available.
Final Thoughts: UH88

• We need to/plan to:
  
  • align observations on UH88 with strategic goals of IfA.

  • stabilize operations funding to minimize external users.

  • integrate UH88 and instrument development into graduate program.

  • establish UH88 as “testbed” for state-of-the-art techniques.

  • return the scientific contribution of the UH88 to “world class” status.
Plans: Hoku Ke’a

PlaneWave CDK700 telescope

- Corrected Dall-Kirkham design
- 0.7 meter, f/6.6
- Dual Nasmyth focus
- 60mm baffled field
- Direct drive motors
- High res encoders
- Field de-rotator
- Temperature sensors
- Cooling fans
- Industrial electronics components
- PointXP pointing model
- Modern TCS (classical/remote/robotic)
Plans: Hoku Ke’a

Our favored option: ASH-DOME 20-foot dome

- Company with long history of successes
- Good protection of equipment
- Upgradable for remote/robotic operations

Cost: ~ $75K (x 2)

Delivery: ~ 6 mths (?)
On the UH88 – HK Cooperation

• **UH Hilo, UH Manoa, and the Institute for Astronomy are excited by the ongoing and future cooperation between the UH 2.2 meter and Hoku Ke‘a.**

• Sharing observing time on both telescopes:
  • Increased value of Hoku Ke‘a
  • Increased training and experience for students
  • Increased research collaboration projects
  • Shared expertise
  • Better communication between UH system astronomy “centers” (not a bad thing!)
  • Graduate vs. undergraduate students
  • Increased recruitment and retention