

# Keck SSC Report – March 2015

J. Cohen and Crystal Martin

March 12, 2015

# Thank You !!

- Three senior observing support staff left or retired, and each played a critical long term role in Science operations. We thank them all for their many years of devoted service to the Keck Observatory and the community of Keck users.
  - Barbara Schaefer retired --> Carolyn Jordan
  - Bob Goodrich leaving for GMT0
  - Greg Wirth moved to NEON

# Observatory Report

- Strategic planning task forces being set up for:
  - NASA relationship esp. apropos strategic science goals (i.e. exoplanets) and missions such as JWST, TESS, WFIRST, and various planetary science missions
  - Keck/JWST synergy
  - Keck in the era of TMT
  - Time domain science leading up to LSST era
  - Evolutionary paths for AO and AO-assisted spectrographs
- Review of publications statistics.
- Archive could be more productive if data reduction pipelines were in better shape and more generally available
- Chief scientist recruitment underway with 6 candidates. Hope to make offer in April.

# Segment Repair

- On schedule
- Good progress on establishing tooling, first production assembly run, tests of bonding strength, etc.
- Permitting underway for new building for other production lines. Potential for 2-3 months of delay
- Dry runs of all processes leading to Pathfinder Readiness Review in early June 2015
- SSC impressed with the progress and careful attention to detail.
- The safe and efficient industrialization of this process remains a great challenge for the observatory and will require continued vigilance by WMKO management

# Proposals and Projects - 1

- NIRSPEC upgrade submitted as NSF/MRI proposal. Notification expected ~ June 2015.
  - New science detector, slit viewing camera optics and camera, electronics and software, improved grating stability
  - Sets stage for PRV upgrade.
  - Must maintain ability for K-band guider imaging while taking L/M band spectra.

# Proposals and Projects - 2

- KCWI-B integration and testing underway; on track for delivery to Mauna Kea by Sep. 2015 with first light end of November. Possibly ready for shared risk observing during 2016A.
  - Purchasing additional gratings for maximum scientific utility

# Proposals and Projects

- NIRES first of 3 cool downs successful
  - Subsequent cool downs to refine focus.
  - Software development underway
  - Commissioning planned in late April / May
  - Available in 2015B for shared risk
- Deployable Tertiary project addressing PDR recommendations. Looking for additional labor support to increase contingency to 20%. Detailed design review in January 2016

# Proposals and Projects

- TCSU on track with 2 months schedule slip but budget OK. Keck 1 handover planned for March 2016. Pointing goal of 2" rms in sight. Presently 2.4" improved from 6.5".
- Segment Warping effort to reduce surface errors to < 30nm.
  - Modern s/w package (Matlab) replaces original package. Identified bug in old code which could lead to significant improvements: 60→30 nm
  - Collaborating with TMT
  - On sky testing planned



# Principles in Developing 5 yr plan

- Maintain operations level
- Fully fund mirror segment repair
- Complete ongoing infrastructure and instrument programs
- Develop long range plan
- Implement cost savings program
- Mitigate risk

# Implementing Time Domain Astronomy

- As part of NSF funding proposal for K1DM3, WMKO committed to a 3-year staged plan to implement TDA observing capability.
- ToO observing: UCO and COO Directors have agreed to implement in 2015-B.
  - ToO policy approved by SSC at this meeting.
  - 1 hour/night max, no instrument changes initially
- Cadence observing: UC, UH and NASA interested in collaborating on this, beginning informally in 2015-B. Caltech not ready to participate yet.
  - WMKO will now accept “unmatched” partial night Cadence programs from TACs and will work to optimize the schedule.

# Implementing Time Domain: Details

- The appended document is an initial version discussed at the SSC meeting. This document was subsequently slightly modified in some details after additional discussion between the COO and UCO directors with input from the time domain working group.

# Framework for ToO on Keck: 2015B and beyond

-----  
A UC-Caltech partnership program for TOO on Keck for 2015B (and beyond)  
-----

Preamble:

An integral part of the Keck 1 Deployable Tertiary Mirror project (K1DM3) the CARA Board agreed to implement several modes of observing and applicable -across- the partnership. A summary of what we signed up is provided below:

"In Year 1, UC and Caltech would integrate their existing ToO programs and WMKO would enable ToO observations with any of the mounted instruments on K1. Cadence programs would be approved by each institution and scheduled by WMKO (1 program per night, restricted to the first-half).

In Year 2, the ToO program would expand to all WMKO partners including UH and NASA. Designating officials would resolve competing proposals and ToO programs would be executed on a first-to request basis on any given night. Cadence programs would be scheduled during any time of the night and may involve multiple institutions.

Finally, in Year 3 WMKO would invite additional institutions into the ToO program (e.g. NSF with a TSIP-like program) as desired and feasible. Back-up programs (i.e. foul weather) would be organized and executed within each partner institution (one instrument change, no going back)."

Currently, UC, UH and NASA have their own cadence program (some which are formal and approved by the TAC and some which are informal). These three partners have agreed to confer and begin the process of merging their cadence program potentially starting 2015B and certainly by 2016A. Caltech will offer a cadence program in 2016A and join the other partners in cadence by 2016B.

UC and Caltech and have agreed to start a joint TOO program starting in 2015B. Currently, UC and Caltech have their own TOO programs. These programs have been in effect for the past many years. So there is considerable experience in both institutions for this mode of observing. The proposed "joint" program is an "add on" to the existing programs at UC and Caltech.

The rules below are a balance between classical observing and the growing needs of time domain astronomy. The rules also aim to be equitable and fair to all participating partners. Sharing of resources lead to better returns for the Observatory as a whole (which is the primary motivation of the K1DM3 project) but as experience has shown it can also lead to friction and dispute. The rules are meant to reduce friction by absolute transparency, and encourage collaboration when possible. Since in the long run the proposed program will include other partners the final arbitration (in case of disputes) will be the Chief Scientist (this newly created position is expected to be filled in shortly).

Until the K1DM3 is commissioned TOO PIs cannot request a change of instruments. We also place a limit of no more than one interrupt per night per telescope.

1. UC or Caltech researchers can propose to their own TACs for "Partnership TOO" observations on Keck 1 and/or Keck 2.
2. Each TAC will judge the proposals sent to their committees. Each TAC can choose to forward up to 6 triggers to the "Partnership TOO" program.
3. The partnership program recognizes that there may be similar requests from UC and Caltech. In the interests of collegiality the "selecting" officials (UCO and COO Directors, in this instance) will exchange the summaries of the successful TOO programs.
4. Approved TOO PI should call and email Observing PI. In order to avoid "race" conditions requests made within 2 hours are considered to be simultaneous. In such cases both parties will have access to the data. Otherwise it is first-come, first served.
5. The maximum interruption is 1-hour wall clock. This includes required night time calibration and restoring back the instrument mode.
6. The Observing PI will make "best efforts" to accommodate the request by TOO PI. The Observing PI can be reasonably expected to complete their on-going observations (e.g. multi-slit sequence, attend to time-critical planetary observation, limited visibility of the prime target of the classical night time PI's program).
7. It is the responsibility of the TOO team to use their hour wisely (a possible suggestion: work with the observing PI to maximize the allocated 1 hour).
8. WMKO will set up an account system to keep track of executed TOO triggers. Upon the completion of the TOO observations the OA will complete a short form (TOO PI name, program, start and of TOO program). A formal report is sent by the Observing PI (in particular explaining potential delay in fulfilling the request, if any) [too@keck.hawaii.edu](mailto:too@keck.hawaii.edu). Likewise the PI of the TOO program is also expected to send her/his own report (quality of data, feedback) also to [too@keck.hawaii.edu](mailto:too@keck.hawaii.edu).

WMKO will report on the usage of the joint TOO program at first SSC meeting following the end of each semester. The spirit of this program requires that there should not be persistent imbalances of usage. Should such imbalances arise then the number of TOO triggers will have to readjusted.

# KCWI-B

- Good technical progress, new bench received, now in I&T phase, dewar integrated
- Major technical issues: AR coat on CaF<sub>2</sub> lens 5, failed adhesion test 2x, IFU slicer requires realignment, silver coating still problematic
- Current schedule: delivery to Keck Sep 2015

# KCWI-R

- KCWI-R is delayed as same team is working on finishing KCWI-B, project KCWI-R first light 3/2018
- Steps being taken to purchase long lead time items, CCDs and red camera



# Keck-1 Deployable Tertiary Mirror ("KIDM3")

- NSF/MRI + internal UCSC/WMKO funds to enable rapid instrument switches.
- Project is generally making good progress, with a slight schedule slip (~3 months) relative to start in Oct 2013.  
Updated milestones:
  - On-telescope prototype test: Sept 2015
  - Detailed design review: Jan 2016
  - Pre-ship review: Sept 2016
  - Commissioning: Nov 2016
- Team working on results from PDR (Nov 2014)
  - Done: detailed thermal analysis
  - In progress: better risk mitigation plan and I&T schedule
  - TBD: larger contingency

# SHREK

Overall SHREK team is focusing efforts on issues raised by SSC team visit report

- Error budget progress
  - Wavelength calibration using Th of 0.2 m/s in a single exposure (Th-Ar exposures before during and after maps systematic drifts)
    - Stabilized etalon and laser comb also being explored
  - Double fiber scrambler testing in image and pupil planes. Need quantitative measurement of input vs output. Need to achieve  $10^{-4}$  uniformity. Penn State tests of scrambler achieves  $< 10^{-4}$ .
  - Mechanical tolerances for optics established (all 6 degrees of freedom per component)
  - Goal of 0.3 m/s can tolerate long term 1 m/s drifts by using Th-Ar calibration before, during, and after observation
    - Mechanical motions must be linear over that period

# SHREK

- Additional progress
  - Green Camera (445-590nm) functional design complete (3-4  $\mu\text{m}$  rms spots). Clear diameters and glasses approved by Winlight
  - Explored installation access to the beam combining room
    - Annex port is suitable for installation
    - Environmental survey of temperature, pressure, and vibration in beam combining room underway
- Next steps
  - Hire mechanical engineer for mechanical analysis of steel bench, supports, and vacuum system
  - ROM costs from vendors
  - SDR in July. Committee charges being established

# Progress on Approved 2014 White Papers

- 1. Improved process for laser clearinghouse approvals: upgrade S/W
  - Completed conceptual design
  - Core S/W for target window processing completed
  - Design review in March/April 2015
  - Operational in 2015B
- 2. LRIS Python Data reduction pipeline
  - Now funded by KOA
  - Goal of Study: Estimate cost of converting LRIS Low-Redux DRP in IDL to Python
- 3. MKIDS (KRAKENS) Science Case Development
  - 13 Science cases proposed
  - Key capabilities
    - High sensitivity
    - High temporal resolution
    - Wide spectral range (350-1350 nm)
  - Next steps (Before April 2015 SSC meeting)
    - Evaluate science cases
    - Consider maturity of technology and existing science results
    - Consider MRI ~2M\$ (very preliminary \$), need UCSB MRI slot

# Additional Items

- IAU meets in August in Honolulu. Many events oriented around history of astronomy in Hawaii, coordinated by IfA/UH
- 2015 Keck Science Meeting hosted by UCLA will have focus groups for each instrument discussing pipelines etc with Instrument Masters with dates Sep 17-18, 2015.
- 2015 white paper call to be issued shortly, responses to be reviewed at June SSC meeting

# Agenda Items for Next SSC Meeting

- WMKO Director to present summary of engineering time usage.
- Discussion of contingency policy.
  - 30% on labor after PDR

WMKO Director to report on frequency and nature of summit calls by Waimea-based OAs to summit-based OA or other summit personnel for real time weather and/or technical evaluation as part of feasibility study for unattended night operations.

Improve observing tools to use Pan-STARRS images and catalogs.

# Instrument Reports

- ***SSC thanks the WMKO Instrument Masters for excellent reports and service.***
- ***SSC Comments***
  - ***1. Not clear how software upgrades are prioritized and whether community priorities are always reflected***
  - ***2. Many home-made DRPs available in the community. How should WMKO broker these DRPs?***
  - ***3. SSC would like to be informed re follow-up to NIRSPEC window cleaning incident.***
  - ***4. PSF variation issue with OSIRIS identified by Shelley Wright***
- Personnel changes. 3 senior observing support staff left/retired, and each played a critical long term role in Science operations.
  - Barbara Schaefer retired --> replaced by Carolyn Jordan
  - Bob Goodrich leaving for GMT0
  - Greg Wirth moved to NEON
- On-demand image quality monitoring (IQM) under development, continuous IQM options under consideration.

# SSC Suggestions Following Instrument Reports

- AO Guide Star Tool needs to be updated to help observers prepare to use TRICK. Should return infrared magnitudes of stars.
- SSC surprised to hear that MAGMA software for designing MOSFIRE slitmasks was being upgraded. Getting DSIMULATOR functional for DEIMOS should be a higher priority.



# Instrument Reports

- Detailed reports on status of current Keck instruments, plans for 2015, etc.

# Instrument Reports (1)

- Software/DRPs
  - Slitmask design S/W ownership transferred to WMKO, work in progress.
  - MOSFIRE DRP – Luca Rizzi
    - Transfer of responsibility to WMKO for distribution, support, development of DRP is complete
    - Development issue reporting & tracking site working
    - Developments: Longslit reduction developed and being tested. Long2pos observation.
  - OSIRIS DRP issues
    - Bad spaxels introduced by DRP (rectification matrices). INVESTIGATING. A fix exists (median scan method) which will be implemented for all modes in 2 months
- OSIRIS -- Jim Lyke
  - Upgrade Updates Progress
    - SPEC
      - 1. H2RG in hand 2. Focus mechanism nearing design completion 3. Detector controller in development 4. First light Jan 2016
    - IMAG
      - Optical design nearly finalized. Design review July 2015. Installation late August 2015.

# Instrument Reports (2)

- ESI -- Jim Lyke
  - Issues
    - 1. Vacuum leak, soft vacuum and broken ion pump. FIXED.
    - 2. Dirty optical communication fibers. Lost 2 nights. FIXED.
    - 3. Mechanism repeatability. INVESTIGATING.
- NIRSPEC -- Greg Doppman
  - Improvements
    - More efficient slit centering capability
    - 6 months optics cleaning schedule to be implemented (see issue)
  - Issues
    - 1. artifact in flat fields linked to dust on cal unit optics. FIXED.
    - 2. Dust emission from NIRSPEC window. Long wavelength. FIXED.
      - Window cleaning did not follow procedure and cracked window.
      - POTENTIALLY CATASTROPHIC FAILURE (GOT LUCKY).
  - Future Innovations
    - 1. Dual laser comb successfully imaged onto NIRSPEC detector
    - 2. Proposed NIRSPEC upgrade

# Instrument Reports (3)

- HIRES -- Scott Dahm
  - Issues
    - 1. Bias level dropped suddenly, bias=0 in high gain mode (not often used). To Be FIXED.
    - 2. Failure of SPARC5 card (CPU) for the motor crate (FIXED)
  - Future Plans: Install a blue optimized flat field lamp, new deuterium lamp
- LRIS -- Luca Rizzi
  - Improvement Projects
    - 1. New IQM/focusing procedure. ONGOING
    - 2. Fix longstanding issue with red grating tilt. FIXED
    - 3. New LRIS Calibration system. IMPLEMENTED.
- NIRC2 -- Hien Tran
  - L-band vortex coronagraph installation Mar 17, 2015
  - Other updates
    - New recover script for Alad server crashes
    - Detector monitoring
    - source of K-band glow identified (mirror). NOT FIXED yet.
  - Monitoring temperature instability

# Instrument Reports (4)

## – MOSFIRE – Marc Kassis

- Issues

- 1. Reduced fault times. 7% in 2012 to 1% in 2014 !
- 2. CSU failure avoidance strategies restricts PA for CSU moves.
- 3. Missed telescope moves. 1 every 3000 nods. 2-3 times per run. FIXED.
- 4. Slit drift. ~1 pixel per hour. MODEL EXISTS.
- 5. CSEM: request fix amp board cold sensitivity and “Fatal Error”

- Planned Upgrades

- 1. Fix slit drift by updating guider S/W.
- 2. Fix CSEM electronics temperature sensitivity by modifying all 92 boards
- 3. Update slit mask design s/w.

# Instrument Reports (5)

## – DEIMOS -- Marc Kassis

- Actions for 2014/15
  - 1. Minor s/w/updates. DONE
  - 2. replace obsolete host computer. DONE
  - 3. grating system servicing. 1<sup>st</sup> PHASE DONE.
  - 4. new blue grating. ONGOING. 1.7x better at 400 nm.
- 2015 Tasks
  - Grating Service mission: continued effort
  - Replace noisy amps
  - replace V-band filter
  - continue towards procuring new blue grating

## – AO Operations -- Randy Campbell

- Status Report
  - Efficiency metrics
    - » Faults going down year by year. 8% now.
    - » Overheads trending up. Due to partial nights?
  - Performance metrics
    - » LGS Strehl. NIRC2 no obvious trends. LGS FWHM no obvious trends.

# Instrument Reports (6)

- AO Operations -- Randy Campbell
  - Improvements
    - Keck II AO bench tweaks
    - 2015 Priorities
      - » 1. Performance improvements: AO bench optical alignment; Keck I FST efficiency; computer upgrade
      - » 2. Transition TRICK to operations
      - » 3. Transition KII CLS to operation
      - » 4. Transition NGL to operation
      - » 5. Support PSF reconstruction project
      - » 6. Vector vortex coronagraph project
      - » 7. Fix vignetting (NIRC2 wide field mode)
      - » 8. Complete "Sky Tiles" project
      - » 9. MLOG coordination
      - » 10. Further develop AO PM program
      - » 11. Overhaul AO web pages