

SSC Meeting Report

Jean Brodie and Judy Cohen

Observatory report: Highlights

- MOSFIRE operational again
- KCWI-Blue delivered and I&T commenced. First on sky testing in April
- UH/IfA has provided 1 night/year to DD time for WMKO staff science. (Previously there were 6 nights/year DD time.) 2 hours of the UH contributed time will be used for local high school students through Maunakea Scholars program, working with support astronomers.
- New Keck Visiting Scholars Program initiated, supported by private funding to bring graduate students and postdocs to WMKO.
- Plans for conference in Santa Cruz to honor Jerry Nelson, April 22-23 (tentative).

Observatory report: Projects

- Highest Priorities for 2017
 - MOSFIRE (recommission for 2017A)
 - Segment repair (complete 27 segments)
 - TCSU (complete by 2017B)
 - KCWI-B (2017B shared risk science)
 - OSIRIS imager upgrade (2017B shared risk science)
 - Deployable tertiary (2017B shared risk science)
 - OSIRIS spectroscopic DRP fixes complete

Programs in Progress

Project	Status	First light	Shared Risk
K1 Near-IR tip-tilt sensor	Testing on sky	June 2015	2017B
TCS Upgrade	Facility rotator re-commissioning	Apr 2015	2017B
OSIRIS imager upgrade	Preparing for integration	Jan 2017	2017B
KCWI-Blue	I&T on telescope	Apr 2017	2017B
NIRES	Final I&T in lab	Oct 2017	2018A
K1 Deployable Tertiary	Fabrication & assembly	Aug 2017	2017B
NIRSPEC upgrade	Design & procurement	Mar 2018	2018B
K2 AO IR wavefront sensor	Preliminary design	Apr 2018	2019A
Keck Planet Finder	Preliminary design	Oct 2019	2020A
Unattended Night Ops	Preliminary design	June 2019	2020B
KCWI-Red	Preliminary design	Aug 2020	2021A

Observatory report: Major Projects-1

- KCWI-B
 - Successful arrival at summit on Jan 20, 2017
 - First light April 2017, then 3 commissioning runs (1/month)
 - Shared Risk starting August 2017
 - KCWI-R (Keck Cosmic Reionization Mapper)
 - Kick off meetings Jan 2017 to develop work plan (UCSC, JHU, WMKO, Caltech), schedule, etc., leading to PDR in early 2018
- Segment Repair
 - First two production segments now being repaired
These were previously unusable
 - Ramp up to 3 repair stations in summer 2017

Observatory report: Major Projects-2

- Telescope Control System Upgrade (TCSU)
 - Incorporate recommendations from MOSFIRE incident reviews w.r.t. to rotator control system
 - Resume daytime testing in March
 - Complete testing on all instruments by June 2017
- K1 Deployable Tertiary
 - On track for installation in August 2017 commissioning in Oct 2017
- MOSFIRE back on sky Feb 12, successfully returned to science operation. Great thanks to UCLA, Caltech and WMKO teams
- SSC will institute regular reporting to MOWG

Observatory report: MOSFIRE Incident Response

- MOSFIRE accident occurred on Sept 13, 2015. Its investigation had 3 components:
 - Incident report fully diagnosed technical causes (Sept 30)
 - Internal Incident Investigation (Oct 18) looked at greater context of what caused technical issues
 - External Review looked at overall observatory management & engineering practices (Dec 15 report)
- External report charter: risk posture, balance of safety & efficiency, technical expertise, and suggested improvements.
- MOSFIRE has been repaired and has been successfully used for science in mid-February

Observatory report: MOSFIRE Incident Response (2)

- External committee had 6 recommendations:
 - Improve technical expertise; encourage peer interactions and expert expertise; strengthen internal WMKO projects; incorporate safety mechanisms; more careful test planning & prototyping; improve awareness of equipment safety
 - Most issues stem from increasingly complex systems, legacy components, and losing technical staff with deep expertise
- WMKO has set up task forces to implement all recommendations with reports due April 1.
- WMKO management and staff were very transparent throughout all investigations. Final report was made available to staff, SSC, and CARA Board.
- Incident & outcome were shared with other MK observatories during operations meeting in Hilo.

Observatory report: Keck Cosmic Web Imager

- KCWI shipment was successful
- It is in the telescope beam undergoing fine alignment
- There are no significant technical problems
- All Level 1 requirements were met
- Grating BH1 is delayed at the vendor due to the complication of fabricating it
- Grating BH3 suffers from low throughput, and it will be remade at no cost after BH1 is complete
- First light on sky planned for April 11, 2017.

Keck Cosmic Reionization Mapper

- Key engineering staff from KCWI-B team no longer available – new team is being assembled
- Will apply lessons learned from KCWI-B
- Engineering resources from WMKO, UCSC (mechanical), JHU (opto-mechanical), Carnegie (project management, machine & electronics shops)
- Instrument lead: Matuszewski (Caltech)
- Integration & testing to be done at Caltech
- Currently selecting detector, specifying camera

5 Year Plan

- Major Goals:
 - Improve project performance and observing support
 - Near-term, at-risk infrastructure improvements
 - Maintain our current operations service level
- Key Elements
 - Realistic NSF proposal assumptions
 - Key infrastructure repair projects
 - 8% increase to infrastructure over previous years due to ageing infrastructure
 - Seismic upgrade status
 - Conducting a study of impact of major event
 - Modest changes to staffing level
 - Instrumentation funding

5 Year Plan Details

- Staffing Additions:
 - Add 1 SA due to increased work (more instruments, DRPs, more scheduled programs); go from 9 to 10
 - Hire an AO operations scientist to maintain AO at peak performance and implement upgrades
 - Add Systems Engineer to prevent and diagnose complex systems problems (MOSFIRE Incident outcome)
- Completion of current instruments & projects, some new ones (see next page)
- Operations constitute ~50% and instruments ~30%, 20% infrastructure

Projects & Instruments in 5 Year Plan

Operations	Instrument and AO Upgrades	New Instruments
Routine operations	Instrument Studies	AO RTC
Keck Observatory Archive	Advanced AO	KCWI-Red
	AO performance optimization	Keck Planet Finder
Infrastructure	Fiber Injection Module for NIRSPEC	Data Reduction Pipeline development
ACS nodebox upgrade	K1 Deployable Tertiary	Program development & management
K2 Shutter windscreen	K2 Deployable Tertiary	NIRES
Routine infrastructure renewal	K2 AO Wavefront Sensor	KRAKENS
Segment Repair	NIRSPEC upgrade	NSF TBD Instruments
Seismic upgrades	Phasing camera upgrades	Major Inst. Seed funding
Spare Secondary	Targeted instrument upgrades	
Unattended night ops (UNO)		Cost Savings
		Summit photovoltaics

SA Reports

- Over the past year there have been 2 SA departures, 1 promotion from the SA corps, 3 SA arrivals, with 1 SA job advertisement out. Total group now 9 people, to become 10.
- *The Keck SSC thanks the SAs for the tour de force presentation of their various activities, including instruments, observing support, and archive interface.*
- Information was shared on: current status, progress over past year, primary activities for the next year, and instrument development timelines alongside historical usage.
- Topics ranged from progress with new instruments, one recovery from catastrophic failure, major upgrades, minor upgrades, minor desirable improvements, and the context of aging infrastructure.

WMKO Instruments

- Observatory efficiency metrics are similar from 2015 to 2016, but there is no simple basis for comparison to other observatories.
- SSC notes these metrics have been very useful in diagnosing problems and prioritizing improvements.
- Instrument productivity is determined by not only observatory efficiency, but also observer/science efficiency. Publications by instrument were presented.

WMKO Instrument Suite

Instrument	Status	Development Work?	Delivery Date	Retired
NIRES	NEW	Construction	2018	
KCWI	NEW	Installation	2017	
MOSFIRE	Inoperable	Major Repair	2012	
OSIRIS	Operational	Major Upgrade	2005	
DEIMOS	Operational	Medium repair	2002	
NIRC2	Operational	Minor upgrade	2001	
NIRSPEC	Operational	Major Upgrade	1999	
ESI	Operational		1999	
LWS	Retired		1996	2003
HIRES	Operational		1994	
NIRC	Retired		1994	2010
LRIS	Operational		1993	

Instrument Planning

- It is notable that WMKO is simultaneously:
 - introducing new instrumentation without any plans to retire existing instruments
 - engaged in development work on the majority of its instruments
 - supporting more individual programs per semester (increased from 60 to 100 over lifetime of observatory)
 - asking staff to also take on data reduction pipelines
- *The Keck SSC is concerned that*
 - *the work load is more than the current SA staff can handle in a sustainable way*
 - *the success of mainland observing is isolating staff from the community of experts who can contribute ideas/work to instrument maintenance and also pipelines*
 - *while major upgrades and minor improvements are keeping WMKO instruments at the forefront, aging infrastructure issues need to be planned for*

Adaptive Optics

- Accomplished: TOPTICA laser on KII, progress on laser propagation/acquisition issues on KI, fixed TBAD oversensitivity, reduced number of WFC crashes
- Ongoing: linux upgrades, KI Trick operation, PSF-R, LTCS upgrade, PM, LBWFS failure
- Planned for 2017: sky tiles, documentation, addressing obsolescence, continued project support
- AO was used to discover, characterize, and fix poor image quality issue on KII, which was due to azimuth oscillation
- Presentation of detailed breakdown of LGS-AO faults, which approach 1 hour/night.

NIRC2

- Accomplished: distortion solution updated, vector vortex coronagraph installed and in use
- Planned for 2017: recommission with TCSU, work on detector server reliability
- Obsolescence of detector and electronics demands consideration of a major upgrade

OSIRIS

- Accomplished: upgrade of spectroscopic detector, RECMAT, release of DRP
- Ongoing: upgrade of imager with warmup on 15 February and back to science on 13 May
- Planned for 2017: work on DRP flux misassignment issues with help from user community

NIRSPEC

- Accomplished: mitigation of spectral artifacts, of ice inside dewar, and of server crashes, replacement of the cold head
- Ongoing: DRP development for KOA
- Planned for 2017: major upgrade with SPEC and SCAM detectors both ordered, and SCAM optics design finalized; schedule has NIRSPEC off telescope in early 2018A and back in <1 semester.

ESI

- Accomplished: no attention needed; used only 10-20 nights/year
- Ongoing: diagnose some recent grumpy behavior
- Planned for 2017: re-commission with TCSU

HIRES

- Accomplished: shutter unit replacement, updated echelle format simulator released
- Ongoing: keyword history monitoring and detector characterization measurement for purposes of monitoring
- Planned for 2017: deuterium lamp purchase for improving blue flats

MOSFIRE

- Accomplished: recovery from one major issue that caused 40 nights of lost instrument time; otherwise faults are measured in minutes (not hours)
- Ongoing: quantify return-to-sky performance, monitor CSU configuration issues, plan for filter wheel alignment monitoring, updates to manual and to DRP
- Planned for 2017: DAR correction for slit drift, MAGMA update, automatic detector logging

DEIMOS

- Accomplished: major service mission resulting in fault reduction from 66% to 37%
- Ongoing: computer and FCS upgrade work
- Planned for 2017: new blue grating deployed fall 2017 (may also need new blue lamp), keyword history server enabling real-time telemetry
- MIRA monitoring during DEIMOS nights led to improvements of telescope focus model

LRIS

- Accomplished: fixed rotator faults and blue-side crashes (due to dirty fibers during instrument installs)
- Ongoing: unix/linux migration, performance monitoring, grating port hardware/software upgrade, keeping an eye on ADC connector
- Planned for 2017: replace shutter, update focus flexure calibration, commission a multi-width longslit, re-commission with TCSU

KCWI

- Completed integration and pre-ship review
- Shipped and delivered to WMKO
- Installation at telescope in progress

(further details elsewhere)

NIRES

- Accomplished: specifications met -
 - 1-2.3 μ m in five orders
 - noise of $<10e^-$ in 4 reads and $5e^-$ in 16 reads,
 - dark current of 0.1 e^- /sec (compare to 0.03)
 - slit viewing camera
 - data acquisition software
- Ongoing:
 - CIT: remaining tasks, especially flexure compensation
 - WMKO: hardware prep, MAGIC guider integration, software prep, web documentation
- Planned for 2017: pre-ship review in march, commission in september, and available for use in 2018A.

Data Reduction Pipelines

- The SSC did not hear a formal report on DRPs but full realization remains a high priority
- The SSC emphasizes the critical need for Data Reduction Pipelines (DRPs) to maximize the utility of Keck instruments for all users and the productivity of the Observatory. WMKO should pursue a long term goal of making publically available DRPs and archived (KOA) datasets for all instruments and modes.
- The SSC recognizes the magnitude of this effort and suggests that WMKO work with the community via discussions with its partners to develop a prioritized list indicating which instruments and modes should be worked on first.
- The SSC notes that instrument teams or other “power users” have in many cases written private DRPs and should be encouraged to collaborate in the process of adapting these existing codes into ones which can be operated and maintained by WMKO.
- Establishment of a pipeline task force is underway but has been delayed due to the higher priority tasks associated with KCWI arrival (assigned to the same SA).
- DRP development proceeding for many instruments due to KOA. However, the OSIRIS DRP issues have not been fully understood. Continued Keck / community interactions are necessary.

Mainland Observing

- Exploring ISDN alternatives
- ANU, USRA, UCSB sites now upgraded to "mainland only" status with more mainland-only sites being considered; growth is factor of 10 over 10 years.
- As of last year, majority (55%) of observing is happening in mainland-only mode
- While there are many benefits of this, the Keck SSC is concerned that staff are becoming more isolated from astronomical community which does impact staff morale.
 - How can partnership ensure high levels of engagement on both sides?

Keck Science Meeting 2017

- September 14-15, at a UC location TBD
- September 13: a 1-day meeting on Keck and Time-Domain Astronomy
 - Focused on opportunities for transient and time-domain science taking advantage of K1DM3 and surveys such as ZTF
 - Also an opportunity for long-term thinking about Keck-LSST opportunities