UH Managed lands – Project Proposal

for projects anticipated to be classified as having "Minimal Impact"

Observatory Name

W.M. Keck Observatory (WMKO)

Brief Descriptive Title of Project

A Solar Calibrator (SoCal) for the Keck Planet Finder (KPF) Instrument

Project Description

This project would install an integrating sphere on a sun-tracking mount on the roof near the recently commissioned PV array. Light from the sun would be fed by optical fibers to the building interior where it can be used for calibration of the KPF spectrograph. We anticipate delivery of KPF early in 2022. The SoCal would be relatively small. The enclosure is expected to measure (H X W X D) about 42" X 42" X 60".

Identified Land Use (see HAR § 13-5-22 through 13-5-25)

§ 13-5-22 P-9 STRUCTURES, ACCESSORY

(B-1) Construction or placement of structures accessory to existing facilities or uses.

Identify the existing CDUP this proposal alters or affects, if any

Keck I HA-1646 (1984) and Keck II HA-2509 (1991)

Identify University of Hawai'i exemption per HAR § 11-200-8(a), if any

Exemption Class #1.w. Operation, repair or maintenance of existing structures, facilities, equipment or topographical features, involving negligible or no expansion or change of use beyond that previously existing. Scientific equipment used for research, instructional, and experimental functions, including but not limited to, lasers, x-rays. Spectroscopes, oscilloscopes, analyzers, distillers, computers, electron microscopes and diathermic apparatus.

- SoCal is intended to provide calibration and verification data for the basic research activity of searching for planets beyond our solar system. No disturbance to environmental resources will occur.

  Exemption Class #6 – Construction or placement of minor structures accessory to existing facilities.
- The portion of SoCal external to the observatory will be small and placed on the roof of the facility.

Tax Map Key(s)

4-4-015:009 – Mauna Kea Science Reserve (por.)

Proposed Commencement Date

01 October 2021

Proposed Completion Date

01 February 2022

Estimated Project Cost

$25k

Total size / area of proposed use

The SoCal enclosure will be placed on the roof near the current PV array and thus within the existing building footprint.

Project Purpose and Need

Next generation, extreme precision radial velocity instruments intended to search for planets beyond our own solar system are turning to sunlight for calibration and verification purposes. Light emanating from the full solar disk is used. This "disk integrated" light from the sun is then fed by fiber to the instrument as if it were light from a distant star. The sun is a star so close though that we know precisely what it is doing in terms of motion with respect to the earth, activity in its' outer layers, etc. i.e. we can observe the sun directly and we know precisely what the earth's motion is around it.

Has professional peer-review occurred

Systems like SoCal have been designed, built, and installed for use at other telescopes, i.e. this is demonstrated technology. The system will be built, for the most part, with commercial off-the-shelf parts. Much of the funding for existing systems and for SoCal is from peer-reviewed grant proposals.

Are there any related ongoing, pending, or planned projects associated with this submission?

As mentioned, SoCal is intended to work with KPF, a new instrument slated for deliver to WMKO early in 2022. There are no ongoing, pending, or planned projects associated with SoCal though that require a project proposal for UH managed lands.

Existing Conditions at Project Site(s)

Geology, Climate, & Hazards

The proposed work will occur on the existing central rooftop. There are no climate issues or hazards at the proposed project site. Project related work will not occur during snow days or in any other bad weather conditions.

Flora, Fauna, Ecology, Water Resources

No flora, fauna, ecology or water resources will be altered or disturbed. All work will be conducted in areas on or attached to existing WMKO built facilities.

Cultural Resources

No cultural resources will be disturbed. All work will be conducted in areas on or attached to existing WMKO built facilities.

Recreation

No recreational activities are conducted where the proposed project is to be located.

Built Infrastructure

SoCal will be mounted on the roof in a manner similar to the racking for the PV array sited there. Conduit for power, communications and the optical fibers will follow the same routing into the building as for the PV array.

Landscaping & Visual Conditions

No landscaping or visual conditions will be disturbed. All work will be conducted in areas on or attached to existing WMKO built facilities.

Description of the Project

Location

With respect to year-round unobstructed view of the sun, the optimal location for SoCal on the roof is indicated in Fig. 1. This location is near the edge of the roof and towards the Keck II dome. One, or both, of the domes obstruct the view of the sun to varying degrees depending on the time of day and time of the year for other locations on the roof.

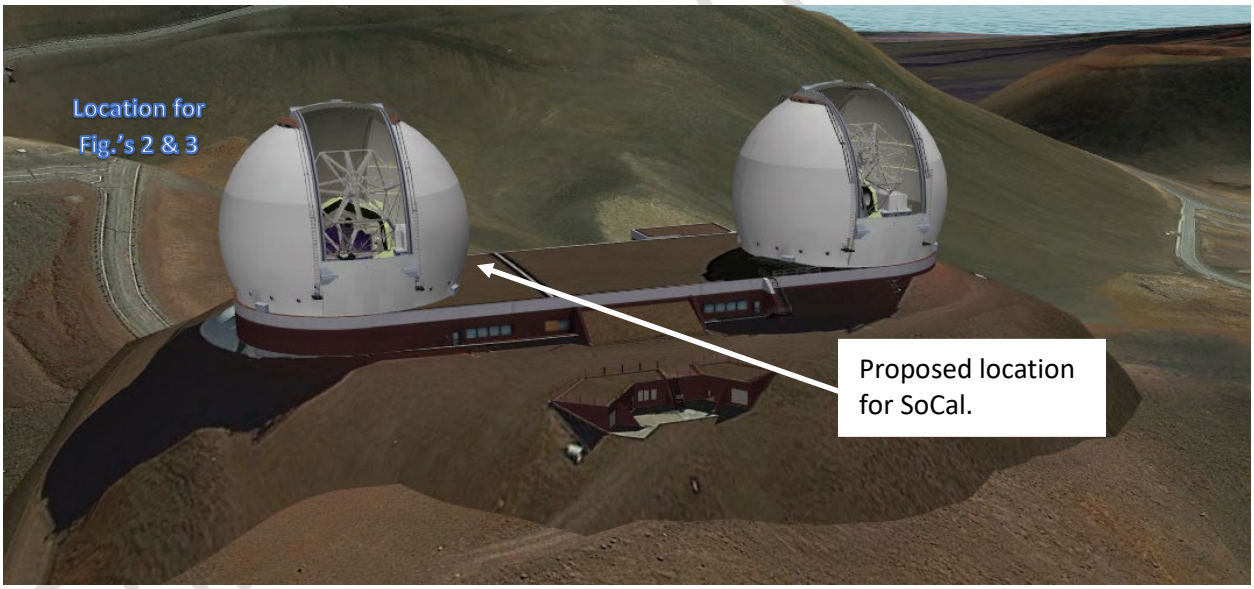

Figure 1: Depiction of WMKO facility with proposed location for SoCal and showing where the photos for Fig.'s 2 & 3 were taken.

Once located as show in Fig. 1, SoCal would not be visible from ground level anywhere on the WMKO grounds. Driving toward WMKO, it would become visible as the road crests near the IRTF entrance. Fig. 1, indicates this location and Fig.'s 2 and 3 show what the facility looks like without, and with SoCal respectively. Fig. 3 has a person standing in the approximate location intended, beside whom has been placed a white square of the expected size of the SoCal enclosure. Fig. 4 shows the device itself (with no enclosure), and a candidate enclosure.

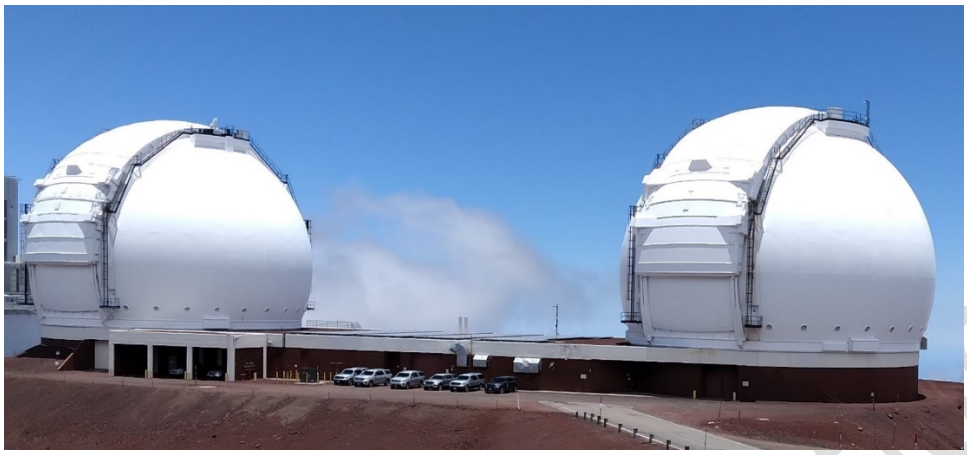

Figure 2: View of WMKO facility from road crest near IRTF entrance. Photo taken on 5/27/2021 from location indicated on Fig. 1.

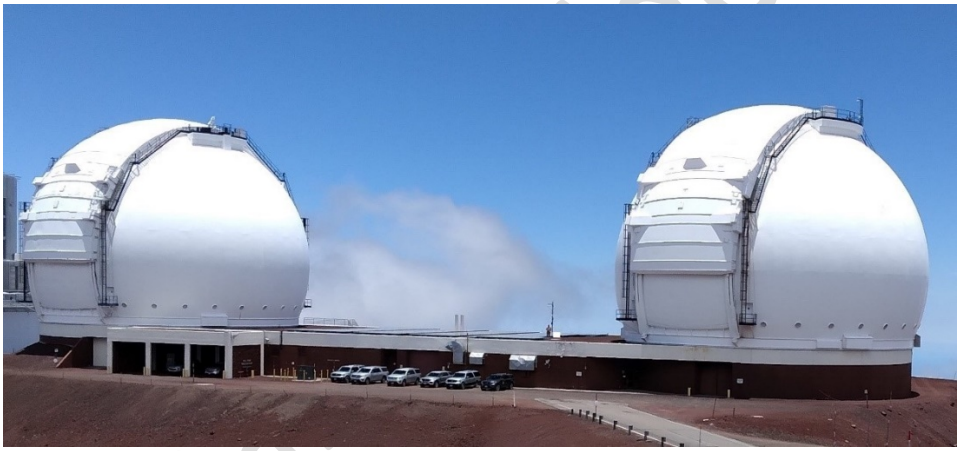

Figure 3: Same as previous with a person and an appropriately sized white square where SoCal would be located.

Figure 4: Left: the integrating sphere and sun-tracking mount. Right: example enclosure design based on commercial product at another site.

Description of the process of completing the project

The roof between the two Keck domes includes a 12-in top layer of volcanic cinder acting as cover and ballast over an impermeable membrane. Racking for the PV system is mounted to base plates buried in the cinder. Considerable engineering analysis was performed by professional engineers licensed in the state of Hawaii to ensure this would withstand hurricane force winds. The SoCal enclosure may be mounted similarly, or it may be mounted to the adjacent PV racking. Conduit bearing power and communications cabling to the unit and fiber transmitting light from it would run across the roof, down the side of the building and then inside, following the same path as cabling for the PV system. All work would take place on the roof, so no ground disturbance would occur. All parts are small enough that they can be carried up to the roof. No forklift would be required. The location on the roof, combined with the relatively small size of the SoCal enclosure implies there will be minimal visual impact resulting from its' installation.

Who will do the work?

Work will be performed by WMKO staff with assistance from Caltech personnel.

Equipment & Transportation

Component parts are all small enough that they can be transported via regular WMKO day crew vehicles.

Measures to protect the environment and/or mitigate impacts

Impacts

The SoCal enclosure will be mounted on the roof, hence there will be no ground disturbance. It will not utilize liquid coolant and will not emit light.

Protective Measures

It is WMKO's top priority to ensure this project is planned and carried out without negative impact to our sensitive location during the installation of the proposed project. WMKO will comply with the following:

- Notify CMS in writing at least 5 days prior, and no more than 14 days prior, to beginning field work on UH managed lands (Halepōhaku, Road Corridor, Maunakea Science Reserve, or Astronomy Precinct).
- All project participants will attend a Maunakea orientation prior to participating in field work.
- Use 4-wheel drive vehicles, with 4-wheel drive engaged, when traveling above Halepōhaku is required.
- Allow OMKM Rangers to visit and monitor activities.
- Comply with all actions and measures described in the proposal, including (community) benefits, CMP compliance list, and mitigation measures.
- Ensure that loose tools or equipment are not left unattended and are properly stored at the end of each day.

- In preparation for high wind conditions protocols must include measures to ensure debris and equipment are not blown from the job site. Projects occurring in the summit region must verify that temporary and permanent infrastructure can sustain 120mph winds.
- All improvements will be designed and installed to withstand the severe weather conditions on the mountain.
- Remove and properly dispose of all waste material. All perishable items including food, food wrappers and containers, etc. will be removed from the site at the end of each day and properly disposed.
- Use of lighting from sunset to sunrise is prohibited unless otherwise stated in the project proposal and approved.
- Employ invasive species prevention best practices, including inspections of materials by a DLNR-approved biologist, as identified in the Maunakea Invasive Species Management Plan prior to entering UH managed lands. Every inspection request submitted to OMKM shall include correspondence with the observatory representative(s) identified in the initial notification. Inspections shall not occur on UH managed lands on Maunakea, at State or County parks, along public roadsides, or on Department of Hawaiian Home Lands.
- Motorized equipment, when stationary, must have a drain-pan in place suitable for catching fuel or fluid leaks. To allow for expansion with reduced atmospheric pressure, fuel tanks should not be more than 3/4 full prior to transport to the summit (unless used as the fuel source for transport to the summit).
- When closed to the public yet open to Observatories, vehicle access to the Maunakea Summit Access Road above the Halepōhaku Mid-Level Support Facility area is limited to expressly marked Observatory, MKSS, CMS, Federal, or State of Hawai‘i vehicles when operated by their approved employees or representatives on official business and possessing requisite orientation, training, safety, and self-rescue supplies.
- Large, heavy, non-4-wheel drive, or oversized loads must submit notification to the Maunakea Road Conditions listserve at least one-day prior to delivery. Loads requiring an escort on public roadways must have this escort accompany them to the final destination. Projects choosing not to do so must obtain approval from the Maunakea Rangers before arriving at Halepōhaku. Projects failing to submit notification or arrange for escort to the summit may be denied entry to Halepōhaku or above.
- Nēnē (Branta sandvicensis) may be present. If a nēnē appears within 100 feet (30.5 meters) of ongoing work, all activity shall be temporarily suspended until the animal leaves the area of its own accord. Feeding of nēnē is prohibited.
- The project approval/permit may not be transferred or assigned. A copy of the approval/permit must be present on-site and available for review at all times while are working on University-managed lands.
- Unless otherwise stated in the proposal, upon project completion copies of all data, field notes, photos, log books, collected specimens, and other forms of documentation will be shared with OMKM for future, unrestricted, use by OMKM or its designee. All geospatial data, metadata or applications must be in a format compatible with OMKM GIS software or other industry standard identified in advance.
- Collected specimens that are not consumed in analysis will be returned to OMKM unless otherwise specified.
- No use of mechanized equipment is allowed unless authorized by this permit.

- Identify and comply with other permit requirements, such as County of Hawaii building permits or Department of Land & Natural Resources (see both any applicable DLNR permit and HAR §13-5-42 Standard conditions).
- Placement of permanent: markers, monuments, mag nails, survey pins, etc. is not allowed without explicit prior approval from OMKM (and the State if required) for this purpose. ALL surveyors work must be shared with OMKM in digital format (i.e. CAD file as well as PDF) with coordinate info stored in and using a common, transferrable coordinate reference system such as “State Plane Coordinates (NAD83), Hawaii Zone 1”.
- Use of cell-phones, other than in airplane mode, is prohibited except in case of emergency.
- Use of real-time GPS during any surveying or equipment operation requires advance written approval from CMS and the Institute for Astronomy. Written approval should be request at least 4 weeks prior to the proposed activity.
- Electronic and paper copies of all publications resulting from the work will be provided to OMKM.
- When applicable, annual and final reports must be submitted to CMS. CMS will provide guidance on content to be included in such reports.
- When applicable, a brief, approximately 1-page, non-technical summary suitable for public outreach (school groups, community meetings, newsletter articles, etc.) must be provided to CMS within 90 days of project completion or publication. Photos and illustrations are encouraged.
- Notify CMSin writing when field activity associated with the project is completed. This notification must list all steps identified in the "notice to proceed" and explicitly communicate the status of completion.
- The project must be completed within the time frame specified in the proposal and (when applicable) DLNR approval. Projects not completed within this timeframe are not allowed to continue (or commence) without explicit, prior, written approval from CMS.

Compliance with Lease, Sublease, or Comprehensive Management Plan (CMP)

The project is not a lease or sublease compliance action.

Identify other required or associated permits

OCCL Site Plan approval may be required. WMKO will investigate if this approval is required.

Five Year Outlook

This project was not included in the Five-Year Outlook. Full awareness of the need for this device occurred after submission of the Outlook.

Community Benefits

Benefits to other Maunakea entities and/or global astronomy community

As noted above, solar calibrators are becoming standard ancillary devices for extreme precision radial velocity spectrographs. As such, this project will enable KPF to achieve its’ full utility in the search for planets beyond our solar system.

Benefits to the Hawaii Island community

Maintaining WMKO's position at the forefront of astronomy research helps to provide jobs for the local community and inspiration to our keiki.

Will data, publications, or other products be free and available to the public?

Yes, per current WMKO policies, data becomes available after a proprietary period.

DLNR Evaluation Criteria

After approval by the Maunakea Management Board, the Department of Land & Natural Resources or Board of Land & Natural Resources will evaluate the merits and approve the project based on the following eight criteria (§13-5-30). See http://dlnr.hawaii.gov/occl/files/2013/08/13-5-2013.pdf

1. The purpose of the Conservation District is to conserve, protect, and preserve the important natural and cultural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety, and welfare. (ref §13-5-1) How is the proposed land use consistent with the purpose of the conservation district?

The proposed project does not negatively impact the level of conservation, protection or preservation of the natural and cultural resources of the site.

2. How is the proposed use consistent with the objectives of the Resource subzone of the land on which the land use will occur? (§13-5-13 The objective of this subzone is to ensure, with proper management, the sustainable use of the natural resources of those areas. This subzone shall encompass: lands necessary for providing future parkland and lands presently used for national, state, county, or private parks. Land suitable for outdoor recreational uses such as hunting, fishing, hiking, camping, and picnicking. [And other lands not applicable to Maunakea.])

The proposed project is consistent with the current use for this subzone in that it is purely for scientific research conducted by WMKO. The project will not negatively impact the natural resources. All work will be located on pre-existing built structures.

3. Describe how the proposed land use complies with the provisions and guidelines contained in chapter 205A, HRS, entitled "Coastal Zone Management".

The proposed project does not impact the provisions and guidelines related to recreational resources, historic resources, coastal ecosystems, coastal economic uses, coastal hazards, beach protection, or marine resources. The site of proposed use is over 20 miles from the coast and is not hydrologically connected to shoreline resources.

4. Describe how the proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region.

The proposed project will not cause adverse impact to existing natural resources within the surrounding area, community or region. All work will be located on pre-existing built structures.

5. Describe how the proposed land use, including buildings, structures and facilities, is compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.

The proposed project does not change the land use and will be located on pre-existing built structures. The proposed project will not affect the natural resource, or historic properties in the summit region.

6. Describe how the existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon.

The proposed project will use the same aesthetic that currently exists around the observatory, so it will not appear out of character with its surroundings.

7. If applicable, describe how subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District.

This is not applicable to the proposed project.

8. Describe how the proposed land use will not be materially detrimental to the public health, safety and welfare.

The proposed project will not use liquid coolant and will be inaccessible to the public.