Keck Adaptive Optics Note 297
New procedures for laser spotters
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1. Introduction

This document describes new procedures for communication between the laser spotters, the observing assistant (OA), and the AO and laser operators during laser guide star adaptive optics (LGSAO) nights at the W.M. Keck Observatory. It amends KAON 213 "Use of Aircraft Spotters for K2 AO Laser Safety" dated 29 Oct. 2002. The new procedures were devised to improve our observing efficiency while maintaining the safety and redundancy of the current system, to protect passing aircraft from distraction or injury.

Under these new guidelines, the AO operator will take routine control of the laser fast shutter from the laser operator. As before, every propagation permissive must be set to "grant" for the fast shutter to be open (those of the OA, LTCS, East Spotter, West Spotter, DCS, and the boresight camera), unless the laser operator agrees under unusual circumstances to override a permissive. The primary change in the spotter's operating procedure will be that approval for laser propagation in a given direction will be considered valid until either:

1) >2 minutes have passed since last propagation.
2) A spotter shuts the laser due to aircraft or clouds within 25° of the stated direction.
3) The spotters have been given the order to stand down.

Therefore, the AO operator will no longer need to request permission to propagate in a given direction if the beam has been shuttered for less that 2 minutes and no permissives are set to "deny."

2. New Spotter Procedures

These new procedures complement those described in KAON 213 section 3.3, which did not explicitly cover the steps described below. However, they are a change in procedure from that commonly used over the past two years.

When desiring to propagate the laser, the AO operator will state to the OA:
"Control, we request permission for laser propagation at the current telescope location."
The OA will then poll the East and West spotters, giving the direction of expected propagation:
"Spotters, we request permission to propagate at altitude 60 degrees, azimuth 180 degrees."
If no aircraft are nearby, and the sky is free of clouds within 25° of the stated propagation direction, the spotters should verify that their permissive be "granted" and answer, in turn:
"This is Eastside Spotter. You are clear to propagate in that direction."
From this moment on, the spotters must watch the direction stated and inform the OA of any aircraft or clouds approaching the said direction, whether or not the laser is propagating, following the communication and safety protocols described in KAON 213, sections 3.3.17 to 3.3.19. If the laser has been shuttered for >2 minutes, the AO operator will consider the permission "stale" and again
request permission to propagate in that direction when needed.

Continuing with the propagation sequence, the OA should then set their permissive to "grant", and inform the AO operator:

"Operator, you are clear to propagate."

If all permissives are set to "grant", the AO operator will then open the fast shutter, allowing the beam to propagate. Once propagating, the AO operator will frequently shutter the beam for a brief period of time (<30s) to take a wavefront sensor background measurement, and occasionally longer to perform an NGSAO observations or due to technical difficulties. The spotters need not report the appearance and disappearance of the beam during this period in which they have granted permission to propagate.

If the beam has been shuttered for >2 minutes or observations on a given target are complete, the AO operator should report to the OA:

"Control, we request that the spotters stand down for XX minutes."

The OA should set his permissive to "deny" and relay the message to the spotters:

"Spotters, we request that you stand down for XX minutes (and get into a vehicle if >10 minutes, or come inside the building if >20 minutes, as appropriate)"

Finally, the spotters should radio back their receipt of this order.

The AO team at headquarters understands that we have in the past given the spotters too little information regarding the current status and the expected time to next propagation. While this has frequently been due to unforeseen difficulties, these new procedures will require more diligence on the part of the AO operator to inform the OA and spotters of expected (or unexpected) downtime.

3. Laser Operator Role

The AO operator will henceforth open and close the fast shutter to control beam propagation on the sky, as needed for science observations. The 4 pump laser shutters and pre-amp shutters will also be closed when closing the fast shutter for more than a few seconds, to preserve the dye and amplifier cell. The laser operator's role will be to ensure the safety of observatory personnel and the laser itself by monitoring the laser's status and performance, operating the LTCS system, and resolving LTCS and other permissive-related failures.

4. References