*Failure To Provide All Requested Information May Delay Processing of Your Notice*

# NOTICE OF PROPOSED OUTDOOR LASER OPERATION(S)

## 1. GENERAL INFORMATION

| | |
|---|---|
| To: *(FAA Regional Office)*<br>Attn: Manager, Airspace Branch<br>Western Pacific Region, AWP-520<br>P.O. Box 92007<br>Los Angeles, CA 9009 | From: *(Applicant)*<br>Elinor Gates<br>Lick Observatory<br>P.O. Box 85<br>Mount Hamilton, CA 95140 |
| Event or facility Lick Observatory, 120-inch Telescope Dome | Report Date: 2018 February 5 |
| Customer<br><br>Same as proponent | Site address<br>Lick Observatory<br>120-inch Telescope Dome<br>7281 Mount Hamilton Road<br>Mount Hamilton, CA 95140 |

## 2. DATE(S) AND TIME(S) OF LASER OPERATION

| | |
|---|---|
| Testing and alignment<br>**N/A** | Operation<br>2018 Mar 29-Apr 4, May 24-27, July 2-5, July 20-25.<br>Subsequent dates TBD, anticipate 3-9 days per month<br>2018-2020 |

## 3. BRIEF DESCRIPTION OF OPERATION

The laser is part of an astronomical research adaptive optics system. A 15W sodium D-line (589 nm) laser, mounted on the 120-inch Shane telescope, is used to create an artificial star at an altitude of 90 km. This laser guide star allows one to measure atmospheric turbulence. The turbulence is corrected in real time with the adaptive optics system, yielding high resolution data images for astronomical research.

## 4. ON-SITE OPERATION INFORMATION

| | |
|---|---|
| Operator(s) Kostas Chloros, Donnie Redel, Anthony Watson | |
| On-site phone #1 408-238-0651 | On-site phone #2 408-238-0651 |

## 5. FDA CDRH LASER LIGHT SHOW VARIANCE (*if applicable)*

| | | |
|---|---|---|
| Variance # | Accession # | Expiration date |

## 6. BRIEF DESCRIPTION OF CONTROL MEASURES

Control measures consist of two visual plane spotters, stationed on the NW and SE sides of the 120-inch dome. Spotters are equipped with headsets for communication with the laser operator and emergency kill switches for fast laser shutdown. A radar system (7.5 degree cone) is mounted on the telescope and boresighted to the laser, which shutter the laser when triggered for safety.

## 7. ATTACHMENTS

| |
|---|
| Number of laser configurations *[fill out one copy of page 2 of this notice ("Laser Configurations Worksheet") for each configuration]* |
| List any additional attachments needed to evaluate this operation *(could include maps, diagrams, and details of control measures)*<br>I. Laser Configurations Description<br>II. Control Measures |

## 8. DESIGNATED CONTACT PERSON *(if further information is needed)*

| | | |
|---|---|---|
| Name Elinor Gates | Position Specialist | |
| Phone 408-238-9610 | Fax 408-238-0758 | E-mail egates@ucolick.org |

## 9. STATEMENT OF ACCURACY

| | |
|---|---|
| To the best of my knowledge, the information provided in this Notice and attached worksheet(s) is accurate and correct. | |
| Name *(if different from contact person)* | Position |
| Signature  | Date 2018 January 12 |

# LASER CONFIGURATION WORKSHEET

**1. CONFIGURATION INFORMATION**

| Configuration number __1_ of _1____ | Name of event/facility<br>Lick Observatory, 120-inch Telescope Dome | Report date<br>2018 February 5 |
|---|---|---|
| Brief description of configuration<br>See attached document Laser Configuration Description | | |

| **2. GEOGRAPHIC LOCATION** | Latitude _37_ *deg (°)* 20 *min (')* _34.931 *sec (")* |
|---|---|
| Site elevation *(ft above Mean Sea Level)* 4219 | Longitude -121 *deg (°)* _38 *min (')* 13.689_ *sec (")* |
| Laser height above site elevation *(ft)* 0 | Determined by: ❑ GPS X Map (*Quad*) ❑ Other *(specify)* |
| Overall Laser Elevation (a+ b) 4219 | Horizontal Datum ☐NAD 27 ☐NAD88 |
| | Vertical Datum ☐ NGVD 29 ☐NAVD 88 |

**3. BEAM CHARACTERISTICS AND CALCULATIONS** *(check one Mode of Operation only, and fill in only that column)*

| Mode of Operation | ☐ SINGLE PULSE | ☐ CONTINUOUS WAVE | X☐ REPETITIVELY PULSED |
|---|---|---|---|
| Laser Type<br>*(lasing medium)* | *( not applicable)* | | Nd-Yag and Dye |
| Power<br>*Watts (W)* | | *Maximum power* | *Average power* 15 |
| Pulse Energy<br>*Joules (J)* | | *(not applicable)* | 1.15e-3 |
| Pulse Width<br>*Seconds (s)* | *(not applicable)* | *(not applicable)* | 1.5e-7 |
| Pulse Repetition Frequency<br>*Hertz (Hz)* | | *(not applicable)* | 13000 |
| Beam Diameter @ 1/e points<br>*Centimeters (cm)* | | | 25 |
| Beam Divergence 1/e @ full angle<br>*Milliradians (mrad)* | | | 0.002 |
| Wavelength(s)<br>*Nanometers (nm)* | | | 589 |
| **(a) MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS** *(will be used to calculate NOHD)* | | | |
| MPE *W/cm²* | *(not applicable)* | | 7.07e-4 |
| MPE per pulse *J/cm²* | | *(not applicable)* | |
| **(b)VISUAL EFFECT CALCULATIONS** *(will be used only for visible lasers[400-700nm] to calculate SZED, CZED and LFED)* | | | |
| Pre-Corrected Power (PCP)<br>Watts (W) | *Pulse Energy (J) x 4* | *Maximum Power (from above)* | *Pulse Energy (J) x PRF (Hz) or Average Power*<br>15 |
| Visual Correction Factor (VCF)<br>**(Enter "1.0"or use Table 5)** | | | 8.698e-1 |
| Visually Corrected Power<br>*PCP x VCF* | | | 13.04 |

**4. BEAM DIRECTION(S)**

| Maximum elevation angle *(degrees)* 90 | Magnetic variation *(degrees)* |
|---|---|
| Minimum elevation angle *(degrees, where horizontal = 0°)* 45 | Azimuth ☐X True ☐ Magnetic<br>*(degrees)* ____ 0 to 360 |

| **5.CALCULATED DISTANCES**<br>(fill in all three columns) | **SLANT RANGE *(ft)*** | **HORIZONTAL DISTANCE *(ft)*** | **VERTICAL DISTANCE *(ft)*** |
|---|---|---|---|
| NOHD *(based on MPE)* | 2.692e6 | 1.904e6 | 2.692e6 |
| SZED *(for 100 μW/cm² level)* | 6.674e8 | 4.719e8 | 6.674e8 |
| CZED *(for 5 μW/cm² level)* | 9.438e8 | 6.673e8 | 9.438e8 |
| LFED *(for 50 nW/cm² level)* | 2.985e9 | 2.110e9 | 2.985e9 |

*If the laser has no wavelengths in the visible range (400-700nm), enter "N/A (non-visible laser)" in all blocks.

For visible lasers, if the calculated SZED, CZED and/or LFED is less than the NOHD, enter "less than NOHD."

**6. CALCULATION METHOD** ☐ Commercial software *(print product name)*

X Other *[describe method (spreadsheet, calculator, etc)* Calculator