

**A6.2 Sample Letter of Objection from FAA**

NOTE—This letter is an example. All names and places are intended to be fictitious and any similarities are purely coincidental.

Mr. John Doe  
Laser Coordinator  
John Doe Laser Co.  
0000 North St.  
Seattle, WA 00000

Dear Mr. Doe:

This letter is in response to your proposals for a laser show scheduled for July 4, 2000 at Seattle Fairgrounds, in Seattle, WA. An aeronautical study has been performed by this office regarding your request dated September 1, 1998 for a proposed laser light show at the Seattle Arena. Limitations on laser beam propagation into navigable airspace are necessary in order to integrate your show into the National Airspace System. The proposed site would be too close to the nearby Seattle Airport. That area is directly within the “laser-free zone” described in FAA Order 7400.2.

Therefore, the proposals are objectionable.

If you need further assistance, please contact me at (000) 555-0000.

Sincerely,

Tom Smith  
Airspace and Procedures Manager

### A6.3 Sample Non-Objection Letter from FAA for Scientific Application

U.S. Department of Transportation  
Federal Aviation Administration  
[Date]  
Mr. John Doe  
[ADDRESS]

System Operations Services  
800 Independence Avenue, SW.  
Washington, DC 20591

Dear Mr. Doe:

This is in response to your Notice of Proposed Outdoor Laser Operation(s) dated October 10, 2007, on the use of the [laser title] system at the [location] located in [any town], USA.

Specifically, the project involves using the [control] system to range the [object to be studied], using short pulse, low power laser energy. The system uses a Laser Hazard Reduction System (LHRS) radar, which is slaved to the telescope mount to ensure the laser is deactivated if an aircraft approaches.

The [name] has six instruments onboard to collect detailed information on the environment. The focus of the [name] mission is the [system]. The [name] will provide [scientific data] through laser altimetry.

Your request indicates the [object to be studied] will be visible from the earth for approximately 1 hour during its 2 hour orbit around the moon. However, the planned use of the system is intermittent, with possible operations happening 24 hours a day, 7 days a week.

This site is located in an area where a high volume of aircraft operations are conducted. It encroaches upon the Critical Flight Zones of 23 airports and the Laser Free Zones of 4 airports. Additionally, the irradiance levels calculated for the Nominal Ocular Hazard Distance associated with this mission are hazardous to aviation. Propagation of the [name] laser into the navigable airspace as described in your correspondence requires safety measures that will ensure aircraft are not illuminated during this operation.

Federal Aviation Administration personnel personally viewed the capabilities of the LHRS and its multiple fail-safe features and feel [agency name] has proven the efficacy of its radar detection safety system. We have reviewed your request in accordance with FAA Order JO 7400.2G, Procedures for Handling Airspace Matters, and do not object to the above-requested operations through April 30, 2010, contingent upon strict compliance with the following conditions:

1. The LHRS is designed to detect aircraft within a 26-statute-mile radius of the laser transmitter. To protect aircraft operations to 60,000 feet mean sea level, the minimum laser beam elevation angle should be at or above 20 degrees above the horizon. Beam characteristics below 10 degrees in elevation will require the use of a 5.4 Optical Density Filter. Visual observers are also required for the operation and should be positioned at adequate distances to effectively observe possible air traffic penetrations.

2. Laser irradiance levels that exceed the minimum exposure levels within the Laser Free, Critical Flight, and Sensitive Flight Zones, will be controlled to maintain authorized levels. If penetration of the laser beam is possible, the laser shall be shuttered or terminated until the area is clear.
3. As an additional precaution against any adverse effects to local aviation, you are required to contact the [FAA location] at (XXX) XXX-XXXX at least 2 hours before, upon commencement, and upon conclusion of any laser operation.
4. Additionally, at least 7 days in advance of the laser operation, you are required to contact the System Operations Support Center at (XXX) XXX-XXXX and request the issuance of a Notice to Airmen stating the following:

SPECIAL NOTICE... EFFECTIVE 0906..... UTC UNTIL 1006...\_.. UTC.

SCIENTIFIC AND RESEARCH LASER OPERATIONS WILL BE CONDUCTED AT THE [LOCATION] IN [ANYTOWN], [USA], LOCATED AT XXXXXXN/XXXXXXW. THE SYSTEM IS INTERMITTENT, WITH POSSIBLE OPERATIONS HAPPENING 24 HOURS A DAY, 7 DAYS A WEEK. THE LASER BEAM MAY BE INJURIOUS TO PILOTS/AIRCROWS AND PASSENGERS EYES FOR A DISTANCE OF XX,XXX FEET ABOVE GROUND LEVEL. HOWEVER, THIS SYSTEM USES A LASER HAZARD REDUCTION SYSTEM RADAR THAT IS SLAVED TO THE TELESCOPE MOUNT TO ENSURE THE LASER IS DEACTIVATED IN THE EVENT AN AIRCRAFT APPROACHES. THE AREA WILL ALSO BE MONITORED BY OBSERVERS AND THE LASER BEAM WILL BE TERMINATED IF NONPARTICIPATING AIRCRAFT ARE DETECTED. LASER IRRADIANCE LEVELS WILL NOT EXCEED THE MAXIMUM PERMISSIBLE EXPOSURE LEVELS WITHIN THE LASER FREE, CRITICAL FLIGHT, AND SENSITIVE FLIGHT ZONES. OTHER VISUAL EFFECTS, E.G., FLASH BLINDNESS, AFTERIMAGE, GLARE, AND DISTRACTION MAY OCCUR AT GREATER DISTANCES. THE [FAA LOCATION], AT XXX-XXX-XXXX, IS THE FAA COORDINATION FACILITY.

5. [Agency] personnel shall comply with any notification or coordination required by air traffic control (ATC). The [organization] Operations Specialist agrees to terminate any projections immediately upon the request of the ATC facility or the NCRCC in the interest of aviation safety. The direct phone lines to the [name] system are (XXX) XXX-XXXX and (XXX) XXX-XXXX.
6. All personnel associated with the [name] mission will be briefed on and have a complete understanding of the conditions and limitations contained herein in advance of the operation.

This letter does not relieve [agency name] or any other personnel associated with the operation from the requirements of title 14, Code of Federal Regulations, Section 91.11, Prohibition on interference with crewmembers. [Agency name] will assume complete liability for any interference with any crewmember(s) performing duties aboard an aircraft caused by any laser beam emission associated with conducting the [name] operation.

This appendix is not a normative appendix,  
but is intended for information only.

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Furthermore, this letter does not relieve [agency name], other [name] laser operators, or maintenance personnel from compliance responsibilities related to the laws, ordinances, or regulations of any Federal, State, or local government agency.

If we can be of further assistance, please contact [name], Manager, Airspace and Rules Group, at (XXX) XXX-XXXX.

Sincerely,

Signature

[Name]

Vice President, System Operations Services

**A6.4 Sample Request for Laser Clearinghouse Predictive Avoidance Support**

Classification: Unclassified  
 File Name: PRM\_ABC\_1.07um\_123W\_123urad\_20090224.txt  
 Message Purpose: Request for Predictive Avoidance Support  
 Message Date/Time (UTC): 2009 Feb 25 (056) 21:20:00  
 Type Windows Requested: Open  
 Point of Contact: xxxxxxxxxxxxxxxx  
 (Voice) 123-456-7899  
 (Fax) 987-654-3210  
 (E-mail) xxxxxxxxxxxxxxxx@xxxxxx.xxx  
 Emergency Phone #  
 at Operations Site: 123-456-7899  
 Remarks: None

## MISSION INFORMATION

-----  
 Owner/Operator: ABC Laser Program  
 Mission Name/Number: ABC\_1.07um\_123W\_123urad  
 Target Type: Fixed Field of View  
 Location: xxxxxxxxxxxxxxxxxxxxxxxx  
 Start Date/Time (UTC): 2009 Feb 26 (057) 00:00:00  
 End Date/Time (UTC): 2009 Feb 26 (057) 02:00:00  
 Duration (HH:MM:SS): 02:00:00

## LASER INFORMATION

-----  
 Laser: ABC\_1.07um\_123W\_123urad

## SOURCE INFORMATION

-----  
 Method: Fixed Point  
 Latitude: 01.000 degrees N  
 Longitude: 010.0000 degrees W  
 Altitude: 1.000 km

## TARGET INFORMATION

-----  
 Method: Fixed Field of View  
 Azimuth Range: 63.2 to 66.9 degrees  
 Elevation Range: 17.2 to 23.2 degrees

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Method:	Fixed Field of View
Azimuth Range:	339.0 to 6.1 degrees
Elevation Range:	11.0 to 19.6 degrees

END OF FILE

## A6.5 Sample Laser Clearinghouse Predictive Avoidance Findings

Classification: UNCLASSIFIED

UNITED STATES STRATEGIC COMMAND LASER CLEARINGHOUSE (LCH) TIME WINDOWS  
REPORT

Date: 2009 Feb 25 22:07:02  
From: JFCC-SPACE/J95 (LCH)  
To: XXXXXXXXXXXXXXXXXXXX  
Subject: LCH Authorized Shoot (Open) Windows

1. The attached information contains the coordinated and approved spatial parameters

(a) Authorized Shoot (Open) Windows

During Authorized Shoot Windows, the laser owner-operator (O/O) is authorized to operate the approved system laser in accordance with the Source/Target geometry definitions contained in this report.

2. The laser O/O may perform Hybrid Predictive Avoidance (HPA) during Authorized Shoot Windows, if previously certified in writing by USSTRATCOM to do so.

3. Any deviation from this authorization must be immediately reported to the Laser Clearinghouse at: Commercial 805-605-6565, 6578, 6546 (Manned 24/7). DSN=275-(xxxx).

4. See below for comments specific to this mission.

5. If you have any questions, please don't hesitate to contact LCH at the above listed phone numbers.

JFCC SPACE/J95 (LCH)  
747 NEBRASKA AVE RM B209  
VAFB, CA 93437

Mission ID: ABC\_1.07um\_123W\_123urad\_09061171310\_P  
Laser Owner/Operator: XXXXXXXXXXXXXXXXXXXX  
Report Date/Time (UTC): 2009 Feb 25 22:07:02  
Mission Name: ABC\_1.07um\_123W\_123urad  
Mission Start Date/Time (UTC): 2009 Feb 26 00:00:00

Mission Stop Date/Time (UTC): 2009 Feb 26 02:00:00  
Mission Duration (HH:MM:SS): 02:00:00  
Type of Windows in this report: Authorized Shoot (Open) Windows  
Comment: None  
Number of Targets: 3

YYYY MMM dd (DDD) HHMM SS	YYYY MMM dd (DDD) HHMM SS	MM:SS
2009 Feb 26 (057) 0000 00	2009 Feb 26 (057) 0003 46	0003:46
2009 Feb 26 (057) 0004 23	2009 Feb 26 (057) 0007 13	0002:50
2009 Feb 26 (057) 0007 48	2009 Feb 26 (057) 0023 34	0015:46
2009 Feb 26 (057) 0024 02	2009 Feb 26 (057) 0126 01	0061:59
2009 Feb 26 (057) 0126 53	2009 Feb 26 (057) 0132 45	0005:52

Percent = 90.53%

Source Geometry: (WGS-84)

Method: Fixed Point

Latitude: 01.000 degrees N

Longitude: 010.000 degrees W

Altitude: 1.000 km

Target Geometry: (WGS-84)

Method: Fixed Field of View

Azimuth Range: 63.2 to 66.9 degrees

Elevation Range: 17.2 to 23.2 degrees

YYYY MMM dd (DDD) HHMM SS	YYYY MMM dd (DDD) HHMM SS	MM:SS
2009 Feb 26 (057) 0000 00	2009 Feb 26 (057) 0000 28	0000:28
2009 Feb 26 (057) 0001 14	2009 Feb 26 (057) 0003 49	0002:35
2009 Feb 26 (057) 0004 19	2009 Feb 26 (057) 0006 45	0002:26
2009 Feb 26 (057) 0007 05	2009 Feb 26 (057) 0007 18	0000:13
2009 Feb 26 (057) 0007 50	2009 Feb 26 (057) 0023 15	0015:25
2009 Feb 26 (057) 0023 53	2009 Feb 26 (057) 0125 41	0061:48
2009 Feb 26 (057) 0144 32	2009 Feb 26 (057) 0200 00	0015:28

Percent = 85.76%

Source Geometry: (WGS-84)



## APPENDIX

This appendix is not a normative appendix,  
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Method: Fixed Point

Latitude: 01.000 degrees N

Longitude: 010.000 degrees W

Altitude: 1.000 km

Target Geometry: (WGS-84)

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Method: Fixed Field of View

Azimuth Range: 62.3 to 65.8 degrees

Elevation Range: 22.2 to 28.4 degrees

YYYY MMM dd (DDD) HHMM SS	YYYY MMM dd (DDD) HHMM SS	MM:SS
-----	-----	-----
2009 Feb 26 (057) 0000 00	2009 Feb 26 (057) 0004 18	0004:18
2009 Feb 26 (057) 0006 28	2009 Feb 26 (057) 0007 08	0000:40
2009 Feb 26 (057) 0010 41	2009 Feb 26 (057) 0013 15	0002:34
2009 Feb 26 (057) 0016 44	2009 Feb 26 (057) 0028 32	0011:48
2009 Feb 26 (057) 0030 00	2009 Feb 26 (057) 0038 22	0008:22
2009 Feb 26 (057) 0138 55	2009 Feb 26 (057) 0139 27	0000:32
2009 Feb 26 (057) 0140 56	2009 Feb 26 (057) 0144 01	0003:05
2009 Feb 26 (057) 0148 21	2009 Feb 26 (057) 0200 00	0011:39

Percent = 72.35%

Source Geometry: (WGS-84)

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Method: Fixed Point

Latitude: 01.000 degrees N

Longitude: 010.000 degrees W

Altitude: 1.000 km

Target Geometry: (WGS-84)

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Method: Fixed Field of View

Azimuth Range: 339.0 to 6.1 degrees

Elevation Range: 11.0 to 19.6 degrees

## **Appendix B**

### **Examples of Calculations, Hazard Evaluation, and Control Measures Implementation**

#### **B1. General**

Calculations and measurements are necessary for a hazard evaluation of outdoor laser systems. Each section of this appendix uses one set of laser parameters and several examples to illustrate various safety issues. The hazard evaluation techniques described in this appendix are designed to provide a reasonably conservative estimate of the laser hazards. Differing techniques will produce results that may vary by few percent.

#### **B2. Symbols**

The following symbols are used in the formulas of this appendix:

$a$  = Diameter of emergent laser beam (cm)

$d_e$  = Diameter of pupil of eye (cm)

$D_c$  = Diameter of collecting aperture of an optical system (cm)

$D_m$  = Diameter of a measurement aperture or aperture used for calculations (cm)

$D_f$  = Diameter of limiting aperture (cm)

$D_L$  = Diameter of laser beam (cm)

$D_e$  = Diameter of the exit pupil of an optical system (cm)

$D_{fp}$  = Beam diameter at the focal point of a lens (cm)

$D_0$  = Diameter of objective lens of optical aid (cm)

$D_p$  = Diameter of beam on a target (cm)

$D_w$  = Diameter of beam waist (cm)

$E$  = Irradiance ( $\text{W} \cdot \text{cm}^{-2}$ )

$f$  = Geometric focal length of a lens (cm)

$G$  = Gain of an optical system

$G_f$  = Effective gain of an optical system

$H$  = Radiant exposure ( $\text{J} \cdot \text{cm}^{-2}$ )

$L_e$  = Radiance of an extended source ( $\text{W} \cdot \text{cm}^{-2} \cdot \text{sr}^{-1}$ )

$M$  = Magnifying power of an optical instrument

MPE = Maximum permissible exposure value

MPL = Maximum permissible level ( $\text{W} \cdot \text{cm}^{-2}$ ); may represent any interference level

NOHD = Nominal ocular hazard distance (cm)

NOHD-M = Nominal ocular hazard distance when magnifying optics are used (cm)

NSHD = Nominal skin hazard distance (cm)

$D(\lambda)$  = Optical density at a particular wavelength