FAA Evaluation of Proposed Outdoor Laser Operations

Federal Aviation Administration

Presented to: National Aeronautics and Space Administration

By: Steve Rohring, FAA Focal Point for Outdoor Laser Operations

Date: February 28, 2007

Introductory Quotes

"A laser beam can burn through a 1/3 cm [thick] steel plate, yet it does not contain enough energy to boil an egg. The word "laser" often brings to mind the ray-guns and other fantastic apparatus of outdated science fiction. However, the laser's sometimes spectacular capabilities and its adaptability to new aspects of old technologies relate to the future than the past."

Introductory Quotes

"Although we can not foresee the development of all new laser applications, we can predict with confidence that laser solutions for many technical problems will be found by laser technologists who are also knowledgeable about the needs of other fields."

LASER TECHNOLOGY, A SURVEY, by Dr. Paul Zilczer

National Aeronautics and Space Administration, NASA SP-5116, 1973

Laser Incidents

Las Vegas, NV

In the mid 1990's, the cockpit of a Southwest Airlines aircraft was illuminated by a laser on departure from McCarran Airport. The pilot looked at the laser and became visually impaired. The pilot was later examined by flight surgeons and ophthalmologists who confirmed temporary visual impairment but no permanent damage.

Laser Incidents, cont.

Further investigation by FAA and FDA found at least 50 other incidents in the Las Vegas area. The military also indicated incidents had occurred. This demonstrated that a problem existed in the Las Vegas area.

At the FAA's request, the FDA issued a moratorium on all outdoor laser operations in the Las Vegas area. The moratorium stopped the laser incidents in the area and sparked the development of procedures used by the FAA to evaluate proposed outdoor laser operations.

Laser Incidents, cont.

Salt Lake City, UT

A Delta Airlines pilot was grounded for three weeks because of a laser eye injury sustained on final approach to SLC. He was treated for retinal edema.

Recent Incidents

Within the past two years there has been a dramatic increase in the number of reported laser incidents. These are predominantly green lasers and are thought to be intentional.

Organizations Involved in Developing Outdoor Laser Safety Guidelines

FAA

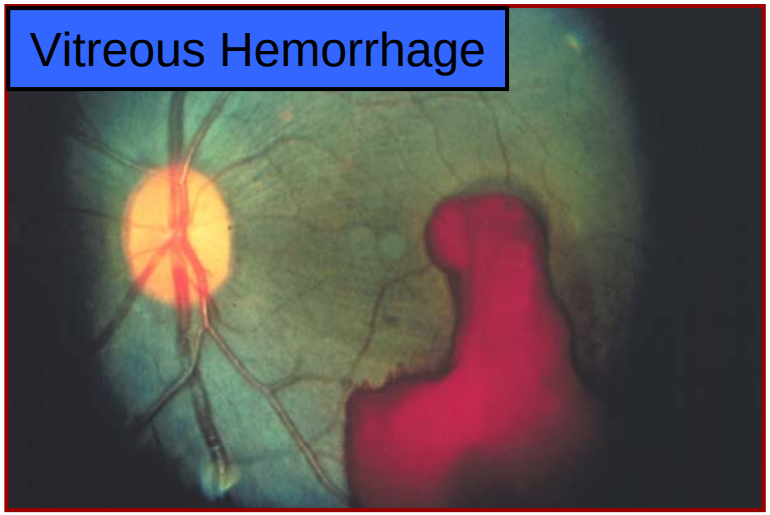
FDA - CDRH

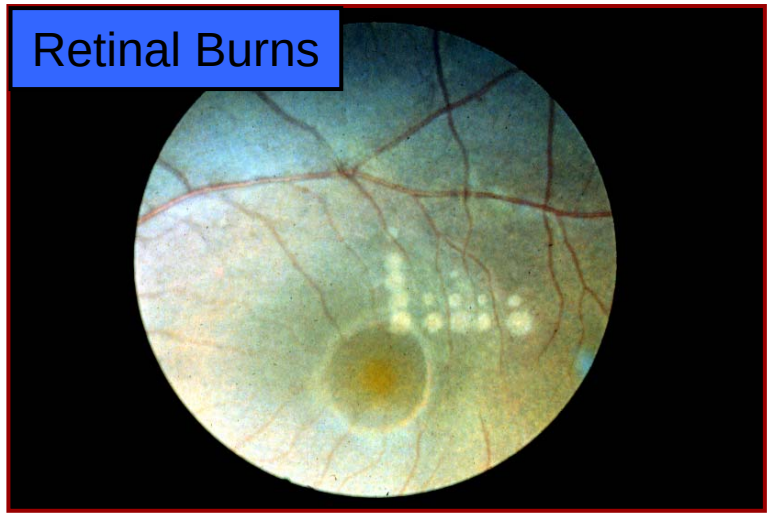
SAE G-10T, Laser Safety Hazards Sub-committee

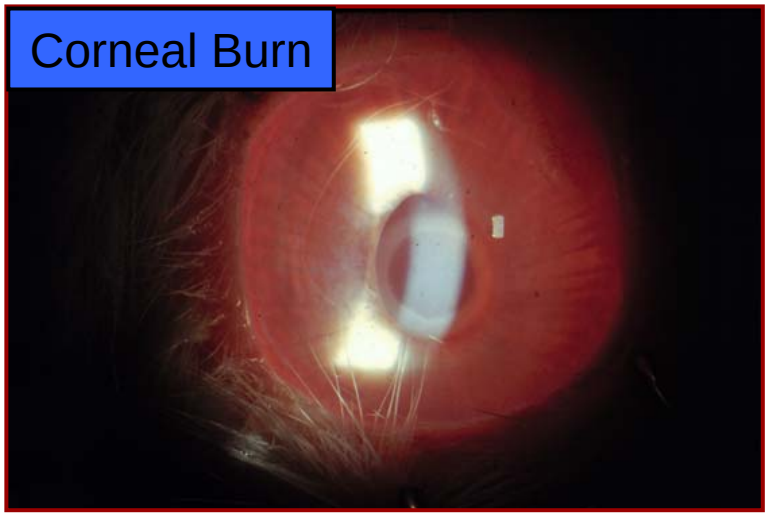
Airline Pilots Association

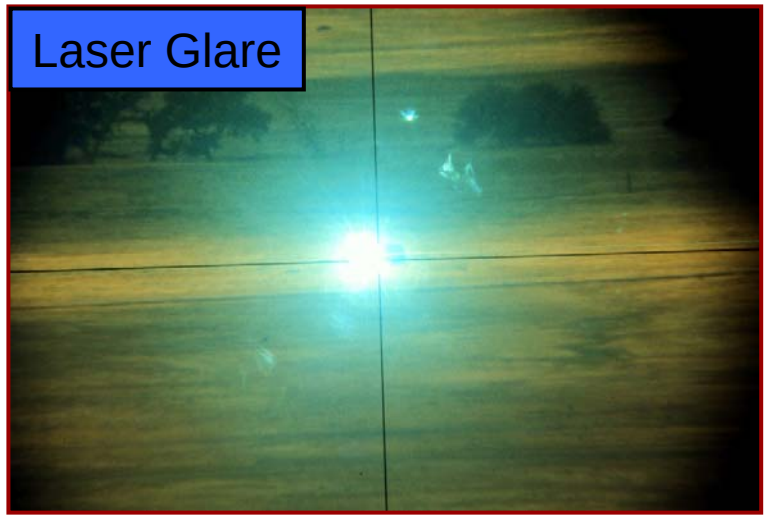
International Laser Display Association

Potential Laser Ocular Bio-Effects









FDA Responsibilities

The Center for Devices and Radiological Health (CDRH), part of the Food and Drug Administration (FDA) under Title 21 U.S.C. is responsible for establishing and managing the electronic radiation control program. Certain laser equipment and operations fall within their authority.

21 CFR
PART 1010 § 1010.1; § 1010.4; § 1010.5
PART 1040 § 1040.10 (a), (b) (13) § 1040.11 (c)

FDA – CDRH Laser Product Classes

CLASS I

- Low levels of radiation - no biological damage.

  Example - CD Player

CLASS II

- Eye damage after direct, long-term viewing.

  Example - Grocery Store Scanner

CLASS III a.

- Capable of ocular injury in a short exposure.

  Example - Land Surveyor's Transit

FDA – CDRH Laser Product Classes, cont.

CLASS III b.

- Potential to injure human tissue (eye or skin), direct beam or reflection.

CLASS IV

- Injury by direct or reflected beam, scattered or diffused.

Variance

The Food and Drug Aministration, Center for Devices and Radiological Health (CDRH), regulates the manufacture of *laser products* but does not regulate the use of laser products. A ground-based outdoor laser light demonstration is *considered to be a laser product* and, if the irradiance energy level is greater then 5 miliwatts per square centimeter, the demonstration requires a variance to Title 21, Code of Federal Regulations, Section 1040.11 c. The variance (issued by the CDRH) requires the laser user to notify the FAA of the proposed laser operation and resolve any objections that the FAA may have. If FAA objections remain, the variance is invalid.

FAA Responsibilities

The Administrator of the FAA is responsible under Title 49 U.S.C. to:

- **….ENSURE THE SAFETY OF AIRCRAFT AND THE EFFICENT USE OF THE AIRSPACE….**

Title 49 Transportation, Subtitle 1 DOT, § **106 (g) (A), Subtitle VII, Part A, Subpart 1, § 40103 (b) (1)**

Why Notify the FAA?

TITLE 49 UNITED STATES CODE,

§46504. <u>Interference with flight crew members and attendendants</u>

This section sets forth fines and penalties for interfering with a aircrew members performing their duties.

How to Notify the FAA

- **Use FAA Form 7140-1, Notice of Proposed Outdoor Laser Operation(s).**

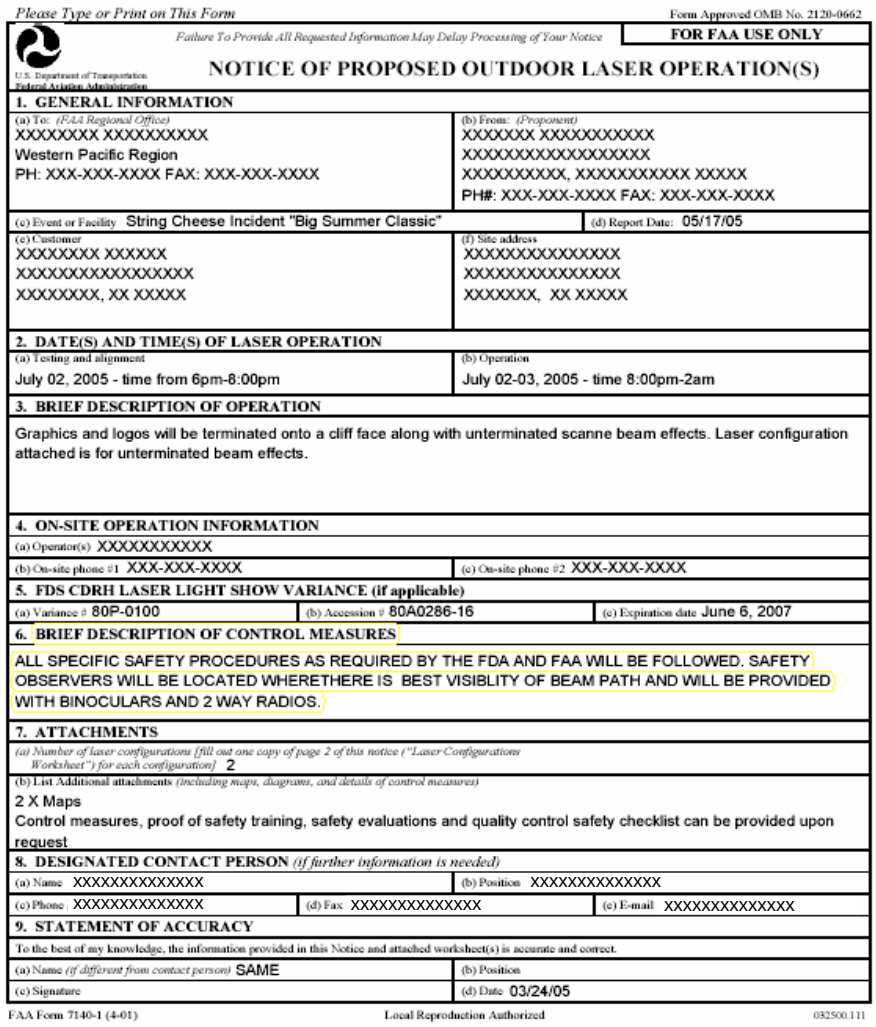
  http://forms.faa.gov/forms/faa7140-1.pdf

  And in FAA AC 70-1, Outdoor Laser Operations:

http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/a79d573e9ff2aaaa86256f9d00583fe0/$FILE/AC70-1.pdf

- **This is a 2-page form. The first page asks for general information. The second page is a Laser Configuration Worksheet that should be completed for each individual laser.**

FAA Form 7140-1, Notice of Outdoor Laser Operation(s), Example



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Failure To Provide All Requested Information May Delay Processing of Your Notice — **FOR FAA USE ONLY**

U.S. Department of Transportation
Federal Aviation Administration

NOTICE OF PROPOSED OUTDOOR LASER OPERATION(S)

1. GENERAL INFORMATION

(a) To: *(FAA Regional Office)*	(b) From: *(Proponent)*
XXXXXXXX XXXXXXXXXX Western Pacific Region PH: XXX-XXX-XXXX FAX: XXX-XXX-XXXX	XXXXXXX XXXXXXXXXX XXXXXXXXXXXXXXXXX XXXXXXXXX, XXXXXXXXXX XXXXX PH#: XXX-XXX-XXXX FAX: XXX-XXX-XXXX
(c) Event or Facility: String Cheese Incident "Big Summer Classic"	(d) Report Date: 05/17/05
(e) Customer XXXXXXXX XXXXXX XXXXXXXXXXXXXXXX XXXXXXX, XX XXXXX	(f) Site address XXXXXXXXXXXXXX XXXXXXXXXXXXXX XXXXXXX, XX XXXXX

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

(a) Testing and alignment	(b) Operation
July 02, 2005 - time from 6pm-8:00pm	July 02-03, 2005 - time 8:00pm-2am

3. BRIEF DESCRIPTION OF OPERATION

Graphics and logos will be terminated onto a cliff face along with unterminated scanne beam effects. Laser configuration attached is for unterminated beam effects.

4. ON-SITE OPERATION INFORMATION

(a) Operator(s): XXXXXXXXXX

(b) On-site phone #1: XXX-XXX-XXXX	(c) On-site phone #2: XXX-XXX-XXXX

5. FDS CDRH LASER LIGHT SHOW VARIANCE (if applicable)

(a) Variance #: 80P-0100	(b) Accession #: 80A0286-16	(c) Expiration date: June 6, 2007

6. BRIEF DESCRIPTION OF CONTROL MEASURES

ALL SPECIFIC SAFETY PROCEDURES AS REQUIRED BY THE FDA AND FAA WILL BE FOLLOWED. SAFETY OBSERVERS WILL BE LOCATED WHERETHERE IS BEST VISIBLITY OF BEAM PATH AND WILL BE PROVIDED WITH BINOCULARS AND 2 WAY RADIOS.

7. ATTACHMENTS

(a) Number of laser configurations [fill out one copy of page 2 of this notice ("Laser Configurations Worksheet") for each configuration]: 2

(b) List Additional attachments *(including maps, diagrams, and details of control measures)*

2 X Maps
Control measures, proof of safety training, safety evaluations and quality control safety checklist can be provided upon request

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

(a) Name: XXXXXXXXXXXXX	(b) Position: XXXXXXXXXXXXX	
(c) Phone: XXXXXXXXXXXXX	(d) Fax: XXXXXXXXXXXXX	(e) E-mail: XXXXXXXXXXXXX

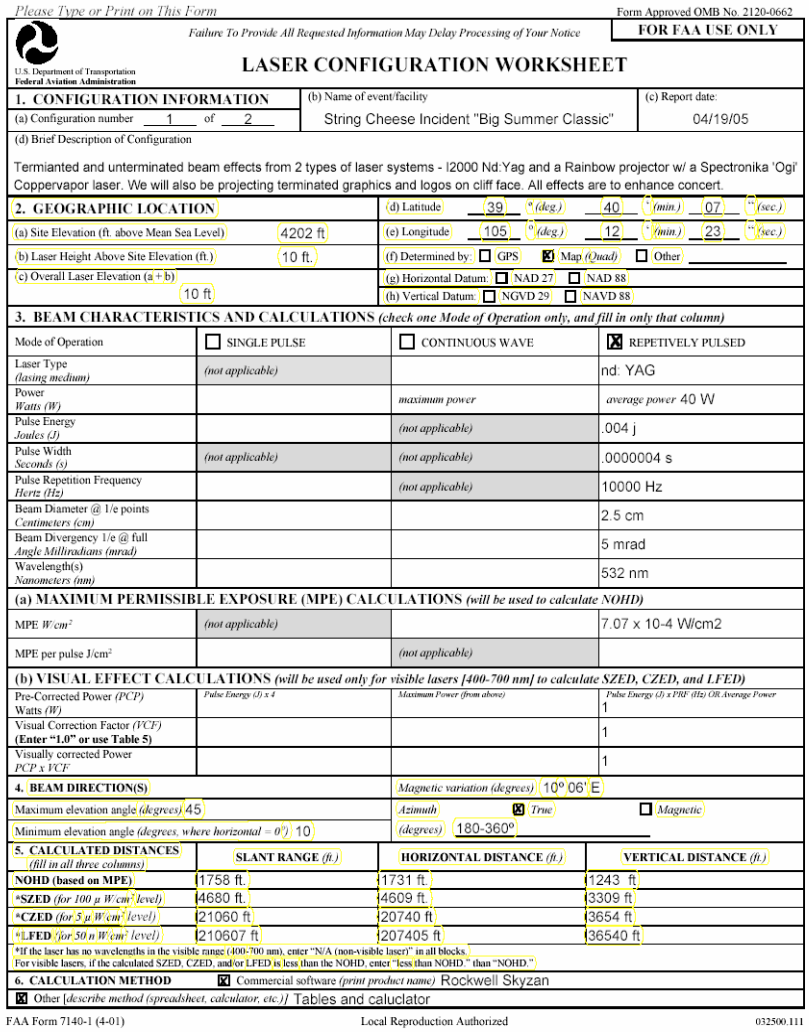
9. STATEMENT OF ACCURACY

To the best of my knowledge, the information provided in this Notice and attached worksheet(s) is accurate and correct.

(a) Name *(if different from contact person)*: SAME	(b) Position
(c) Signature	(d) Date: 03/24/05

FAA Form 7140-1 (4-01) — Local Reproduction Authorized — 082500.111

FAA Form 7140-1, Laser Configuration Worksheet, Example



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Federal Aviation Administration

LASER CONFIGURATION WORKSHEET

1. CONFIGURATION INFORMATION	(b) Name of event/facility	(c) Report date:
(a) Configuration number 1 of 2	String Cheese Incident "Big Summer Classic"	04/19/05

(d) Brief Description of Configuration

Termianted and unterminated beam effects from 2 types of laser systems - I2000 Nd:Yag and a Rainbow projector w/ a Spectronika 'Ogi' Coppervapor laser. We will also be projecting terminated graphics and logos on cliff face. All effects are to enhance concert.

2. GEOGRAPHIC LOCATION	
(a) Site Elevation (ft. above Mean Sea Level) 4202 ft	(d) Latitude 39 °(deg.) 40 '(min.) 07 "(sec.)
(b) Laser Height Above Site Elevation (ft.) 10 ft.	(e) Longitude 105 °(deg.) 12 '(min.) 23 "(sec.)
(c) Overall Laser Elevation (a + b) 10 ft	(f) Determined by: ☐ GPS ☒ Map (Quad) ☐ Other
	(g) Horizontal Datum: ☐ NAD 27 ☐ NAD 88
	(h) 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	☒ REPETIVELY PULSED
Laser Type *(lasing medium)*	*(not applicable)*		nd: YAG
Power *Watts (W)*		*maximum power*	*average power* 40 W
Pulse Energy *Joules (J)*		*(not applicable)*	.004 j
Pulse Width *Seconds (s)*	*(not applicable)*	*(not applicable)*	.0000004 s
Pulse Repetition Frequency *Hertz (Hz)*		*(not applicable)*	10000 Hz
Beam Diameter @ 1/e points *Centimeters (cm)*			2.5 cm
Beam Divergency 1/e @ full *Angle Milliradians (mrad)*			5 mrad
Wavelength(s) *Nanometers (nm)*			532 nm
(a) MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS *(will be used to calculate NOHD)*			
MPE W/cm^2	*(not applicable)*		7.07 x 10-4 W/cm2
MPE per pulse J/cm^2		*(not applicable)*	
(b) VISUAL EFFECT CALCULATIONS *(will be used only for visible lasers [400-700 nm] to calculate SZED, CZED, and LFED)*			
Pre-Corrected Power *(PCP)* Watts *(W)*	*Pulse Energy (J) x 4*	*Maximum Power (from above)*	*Pulse Energy (J) x PRF (Hz) OR Average Power* 1
Visual Correction Factor *(VCF)* **(Enter "1.0" or use Table 5)**			1
Visually corrected Power *PCP x VCF*			1

4. BEAM DIRECTION(S)	
Maximum elevation angle *(degrees)* 45	*Magnetic variation (degrees)* 10° 06' E
Minimum elevation angle *(degrees, where horizontal = 0°)* 10	*Azimuth* ☒ *True* ☐ *Magnetic* *(degrees)* 180-360°

5. CALCULATED DISTANCES *(fill in all three columns)*	**SLANT RANGE** *(ft.)*	**HORIZONTAL DISTANCE** *(ft.)*	**VERTICAL DISTANCE** *(ft.)*
NOHD (based on MPE)	1758 ft.	1731 ft.	1243 ft
***SZED** *(for 100 μ W/cm² level)*	4680 ft.	4609 ft.	3309 ft
***CZED** *(for 5 μ W/cm² level)*	21060 ft	20740 ft	3654 ft
***LFED** *(for 50 n W/cm² level)*	210607 ft	207405 ft	36540 ft

*If the laser has no wavelengths in the visible range (400-700 nm), 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." than "NOHD."

6. CALCULATION METHOD	☒ Commercial software *(print product name)* Rockwell Skyzan
☒ Other *[describe method (spreadsheet, calculator, etc.)]* Tables and caluclator	

FAA Form 7140-1 (4-01) Local Reproduction Authorized 032500.111

FAA Form 7140-1, Laser Configuration Worksheet, Items 2, 4 & 5, Examples

2. GEOGRAPHIC LOCATION		(d) Latitude 39 ° (deg.) 40 ' (min.) 07 " (sec.)
(a) Site Elevation (ft. above Mean Sea Level)	4202 ft	(e) Longitude 105 ° (deg.) 12 ' (min.) 23 " (sec.)
(b) Laser Height Above Site Elevation (ft.)	10 ft.	(f) Determined by: ☐ GPS ☒ Map (Quad) ☐ Other
(c) Overall Laser Elevation (a + b) 10 ft		(g) Horizontal Datum: ☐ NAD 27 ☐ NAD 88
		(h) Vertical Datum: ☐ NGVD 29 ☐ NAVD 88

4. BEAM DIRECTION(S)		Magnetic variation (degrees) 10° 06' E	
Maximum elevation angle (degrees) 45		Azimuth ☒ True ☐ Magnetic	
Minimum elevation angle (degrees, where horizontal = 0°) 10		(degrees) 180-360°	
5. CALCULATED DISTANCES *(fill in all three columns)*	**SLANT RANGE** *(ft.)*	**HORIZONTAL DISTANCE** *(ft.)*	**VERTICAL DISTANCE** *(ft.)*
NOHD (based on MPE)	1758 ft.	1731 ft.	1243 ft
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*If the laser has no wavelengths in the visible range (400-700 nm), 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." than "NOHD."

Where to Send FAA Form 7140-1

Federal Aviation Administration
Western Service Center
System Support Group, AJO-2W2
1601 Lind Ave SW
Renton, WA 98057-3356

<u>AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, WA and WY, (also Guam)</u>

Entertainment Lasers

Rick Roberts (lead)	**425-917-6728**
Larry Tonish (alternate)	**310-725-6539**

Scientific Lasers

Larry Tonish (lead)	**310-725-6539**
Rick Roberts (alternate)	**425-917-6728**

Where to Send FAA Form 7140-1, cont.

Federal Aviation Administration
Central Service Center
System Support Group, AJO-2C2
2601 Meacham Blvd
Fort Worth, TX 76137

AR, IA, IL, IN, KS, LA, TX, MI, MN, MO, ND, NE, NM, OH, OK, SD, and WI

Roger Trevino	**(lead)**	**817-222-5595**
Angel Cases	**(alternate)**	**817-222-5508**

Where to Send FAA Form 7140-1, cont.

Federal Aviation Administration
Eastern Service Center
System Support Group, AJO-2E2
P. O. Box 20636
Atlanta, GA 30320-0631

CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, and WV

Rich Horrocks (lead)	**404-305-5619**
Patricia Graham (alternate)	**404-305-5594**

AL, FL, GA, KY, MS, NC, SC, TN, (also Puerto Rico and Virgin Islands.)

Pete Acevedo (lead)	**404-305-5598**
Patricia Graham (alternate)	**404-305-5594**

Where to Send FAA Form 7140-1, cont.

For airborne lasers involving multiple FAA service areas, send the notice FAA Headquarters :

Federal Aviation Administration
System Operations, Airspace and Rules, AJR-33
800 Independence Avenue, SW
Washington, DC 20591

If you are not sure where to send it, call
Steve Rohring, 202-267-9231

When to Notify the FAA

Laser light shows/demonstrations –30 days in advance

The FDA requires the operators of laser light demonstrations (greater than 5mW/cm^2) to contact the FAA and resolve any objection that the FAA may have.

The FAA uses established procedures to evaluate proposed laser light shows. The evaluation normally takes 30 days or less to complete.

When to Notify the FAA, cont.

Scientific and research lasers - at least 90 in advance

While there no specific regulations requiring operators of scientific/research lasers to contact the FAA, most do because federal regulations prohibit the interference with aircrew members performing their duties.

The FAA evaluation of outdoor scientific/research laser operations is more complex than laser light shows and may require a Safety Risk Management Document. This evaluation typically takes 90 days or longer to complete.

FAA Process

The FAA's Air Traffic Organization (ATO)

- Receives FAA Form 7140-1, Notice of Proposed Outdoor Laser Operation(s)
- Evaluates proposals in accordance FAA Order 7400.2, Procedures for Handling Airspace Matters, and
- Issues letters of objection or no objection.

The FAA's Regional Flight Standards Divisions

- Conduct a Safety Analysis to determine any potential effect that a proposed outdoor laser operation would have on flight crews and flight operations.

Laser Terms

Temporary Adverse Visual Effects

Distraction, Startle, Glare, Flashblindness, Afterimage

Potential for Physiologic Eye or Skin Damage

Maximum Permissible Exposure (MPE)

Nominal Ocular Hazard Distance (NOHD)

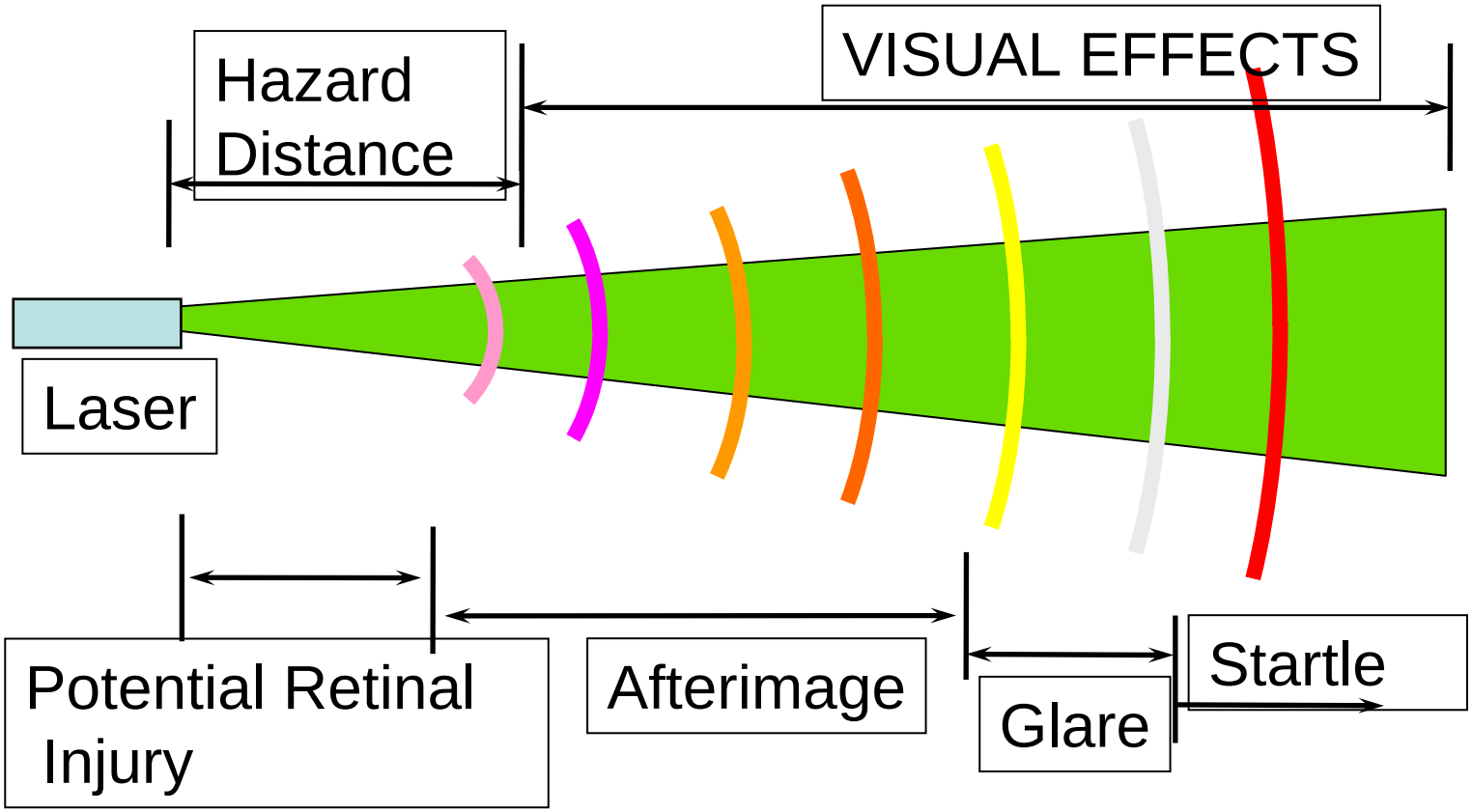
Irradiance Energy Levels

miliwatts per square centimeter (mW/cm^2)

microwatts per square centimeter ($\mu W/cm^2$)

nanowatts per square centimeter (nW/cm^2)

Laser Hazards vs. Distance



From “Commercial Laser Pointers and Night Flying – Don’t Be Startled,” presentation, by D.H. Sliney, US Army Center for Health Promotion and Preventative Medicine, Laser/Optical Radiation Hazards Program (DOHS/25), Laser Eye Protection, p. 28.

Measurements, MPE & NOHD

Maximum Permissible Exposure (MPE)
The level of laser radiation to which a person may be exposed **without hazardous effect or adverse biological change in the eye or skin**. This value is used in the calculation of Nominal Ocular Hazard Distance (NOHD).

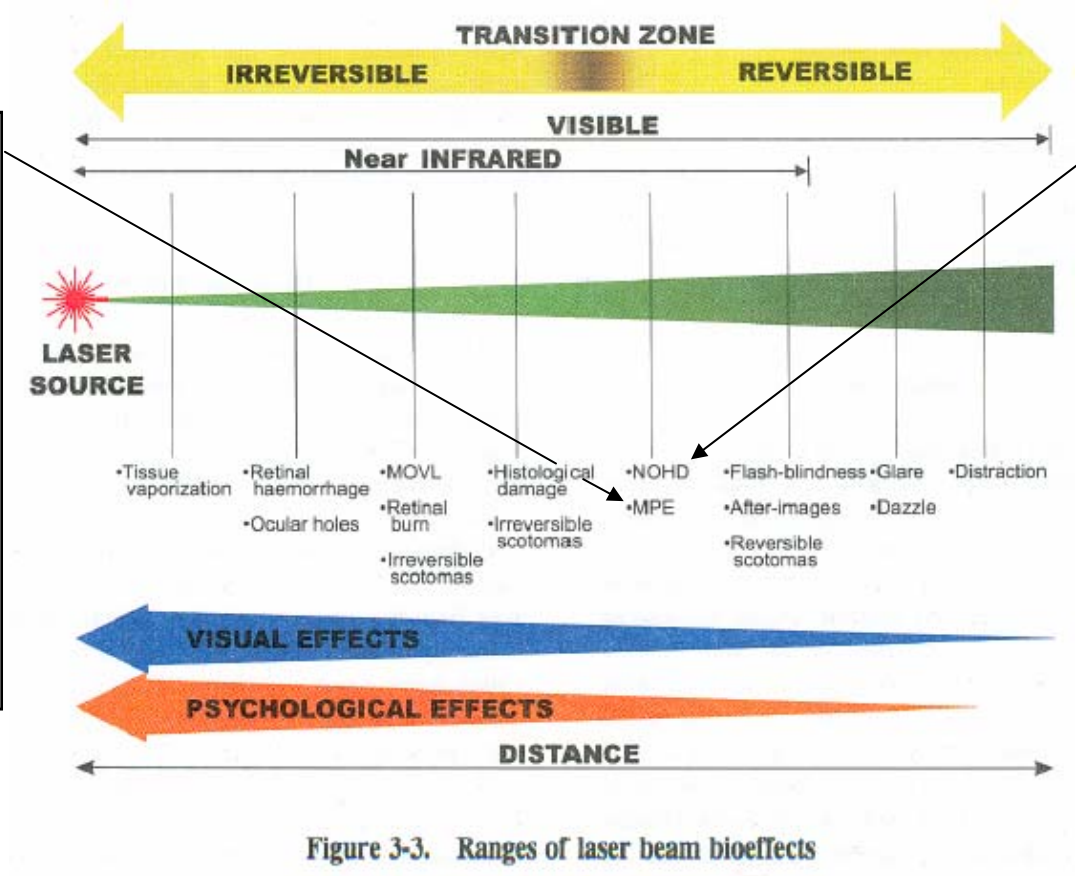


Figure 3-3. Ranges of laser beam bioeffects

Nominal Ocular Hazard Distance (NOHD)
The maximum distance from the laser system beyond which the laser beam irradiance **does not exceed the MPE for that laser**.

The beam is an eye hazard from the laser source to this distance.

Temporary Adverse Visual Effects

Effects on Unaided Vision

- Startle
- Glare/Dazzle
- Afterimage/Flashblindness

With Night Vision Goggles

- Flare or blooming of screen

EVS/HUD - TBD

Temporary Adverse Visual Effects, cont.

Startle – Refers to an interruption of a critical task due to the unexpected appearance of a bright light, such as a laser beam.

Glare/Dazzle – A bright light that makes it difficult to see, such as, oncoming headlights or a momentary laser pointer exposure. These visual effects last only as long as the light is actually present.

Afterimage/Flashblindness – A shadow image left in the visual field after the source of bright light has been removed. This is similar to the effect produced by the flashbulbs, and can occur at exposure levels below those that cause eye injury.

Flight Zones/Distances

Flight Zones

- **Laser Free Zone (LFZ)**
- **Critical Flight Zone (CFZ)**
- **Sensitive Flight Zone (SFZ)**
- **Normal Flight Zone (NFZ)**

Calculated Laser Beam Distances

- **Laser Free Exposure Distance (LFED)**
- **Critical Zone Exposure Distance (CZED)**
- **Sensitive Zone Exposure Distance (SZED)**
- **Nominal Ocular Hazard Distance (NOHD)**

Calculated Laser Beam Distances

There are four laser beam distances that are important in evaluating the safety of ground-based outdoor laser operations.

1. **Nominal Ocular Hazard Distance (NOHD) - The beam is an eye hazard (is above the MPE), from the laser source to this distance.**
2. **Sensitive Zone Exposure Distance (SZED) - The beam is bright enough to cause temporary vision impairment, from the source to this distance. Beyond this distance, the beam is 100μW/cm^2 or less.**
3. **Critical Zone Exposure Distance (CZED) - The beam is bright enough to cause a distraction interfering with critical task performance, from the source to this distance. Beyond this distance, the beam is 5 μW/cm^2 or less.**
4. **"Laser-Free" Exposure Distance (LFED) - The beam is dim enough that it is not expected to cause a distraction. Beyond this distance, the beam is 50nW/cm^2.**

The laser beam distances are calculated by the laser proponent and reported on the Configuration Worksheet, FAA Form 7140-1.

Airspace Flight Zones, cont.

Laser Free Zone:

Surface to 2,000' above airport elevation

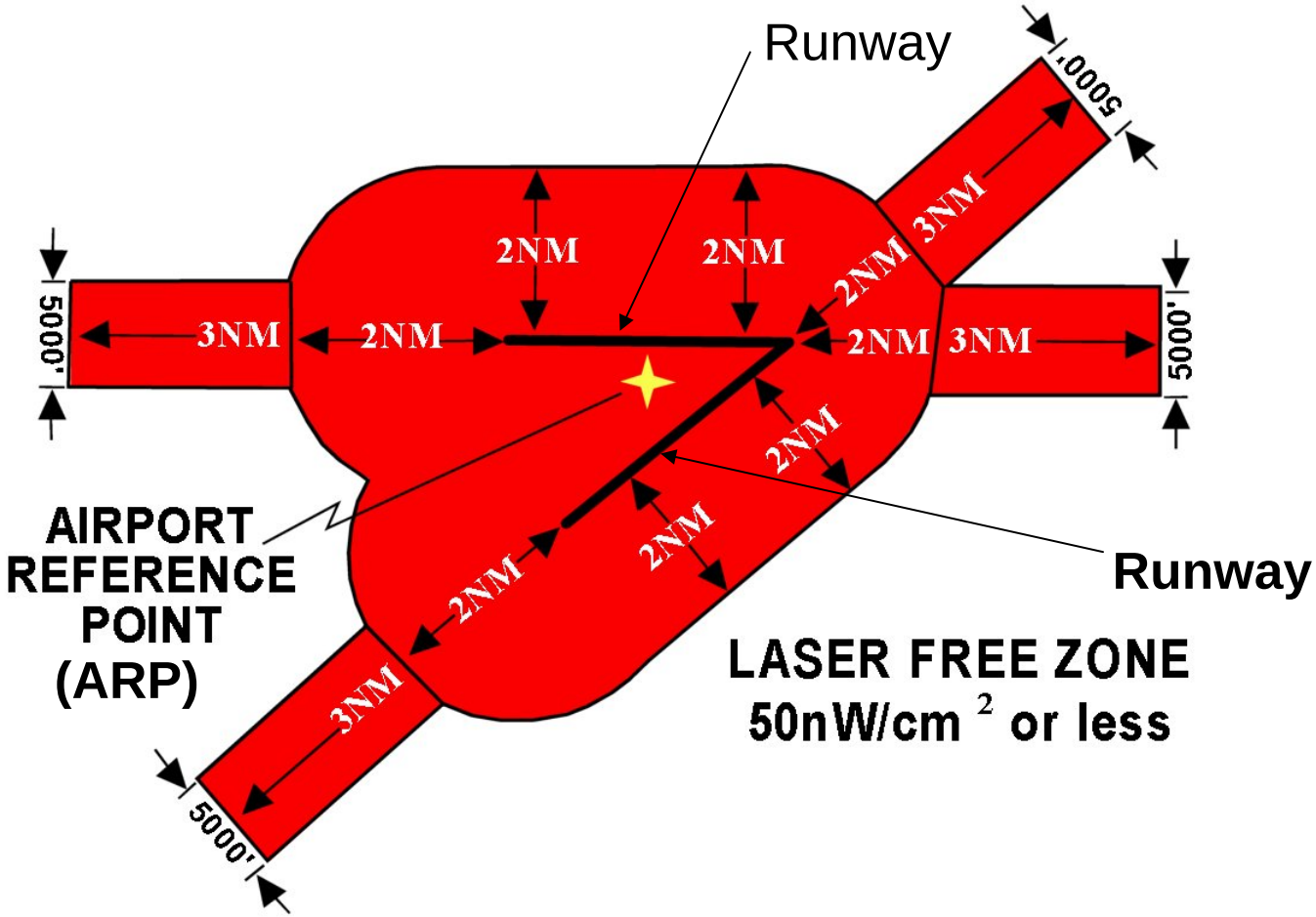
2 Nm from runway ends & centerline

3 Nm extension 5,000’ wide, 2,500’ along either side of extended runway centerline

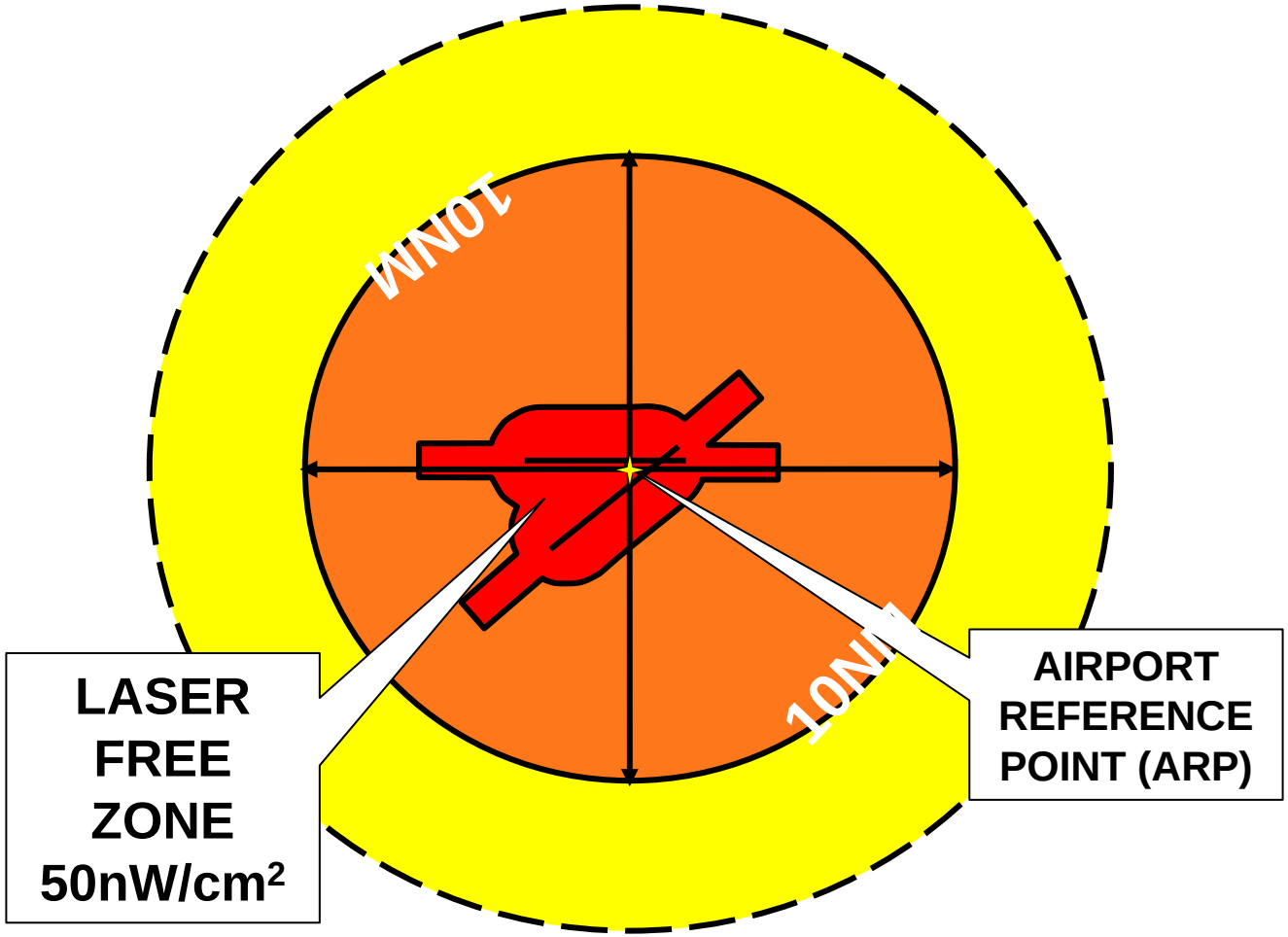
Irradiance not to exceed 50 nW/cm²

Airspace Flight Zones, cont.

Laser Free Zone



Airspace Flight Zones, cont.
Laser Free Zone



Airspace Flight Zones, cont.

Critical Flight Zone:

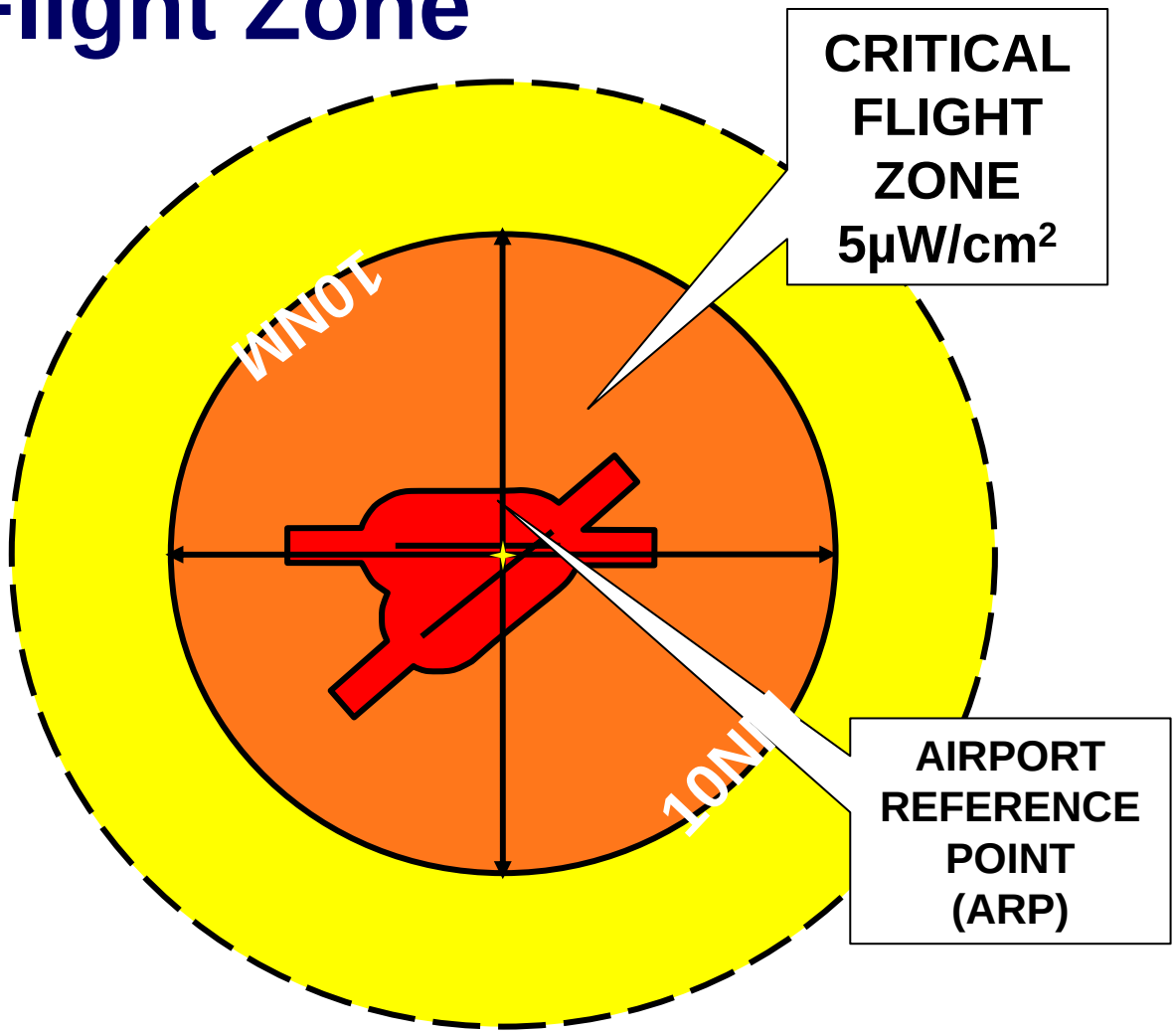
Surface to 10,000’ above airport elevation

10 NM radius from the airport reference point (ARP)

Irradiance not to exceed 5 μW/cm²

Airspace Flight Zones, cont.

Critical Flight Zone



Airspace Flight Zones, cont.

Sensitive Flight Zone:

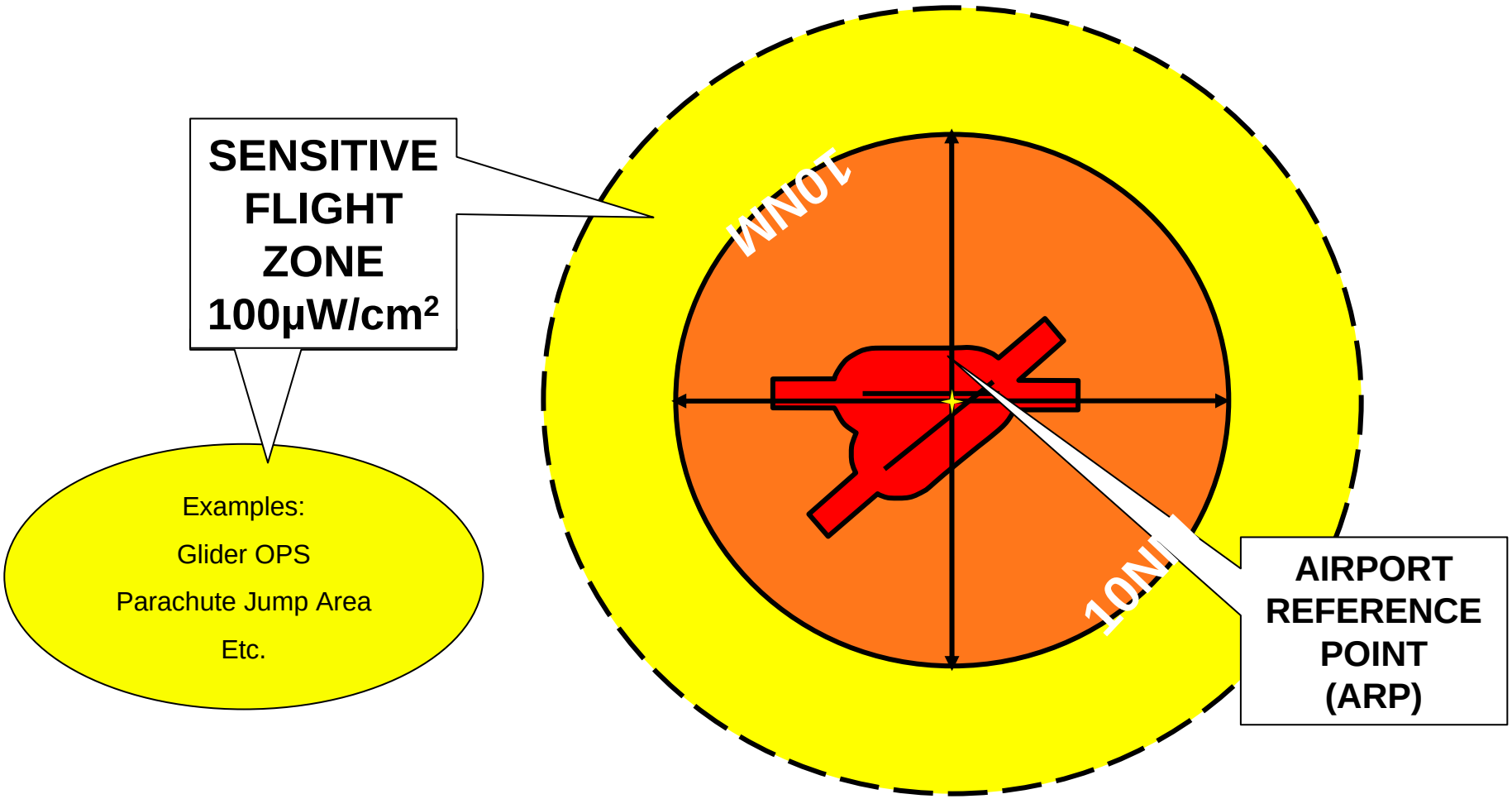
May be designated for know aircraft operations anywhere within the Normal Flight Zone but outside of a Critical Flight Zone

Not necessarily associated with an airport

Location(s) and dimensions are determined by local FAA Flight Standards offices

Irradiance not to exceed 100μW/CM²

Airspace Flight Zones, cont.
Sensitive Flight Zone



Airspace Flight Zones, cont.

Normal Flight Zone:

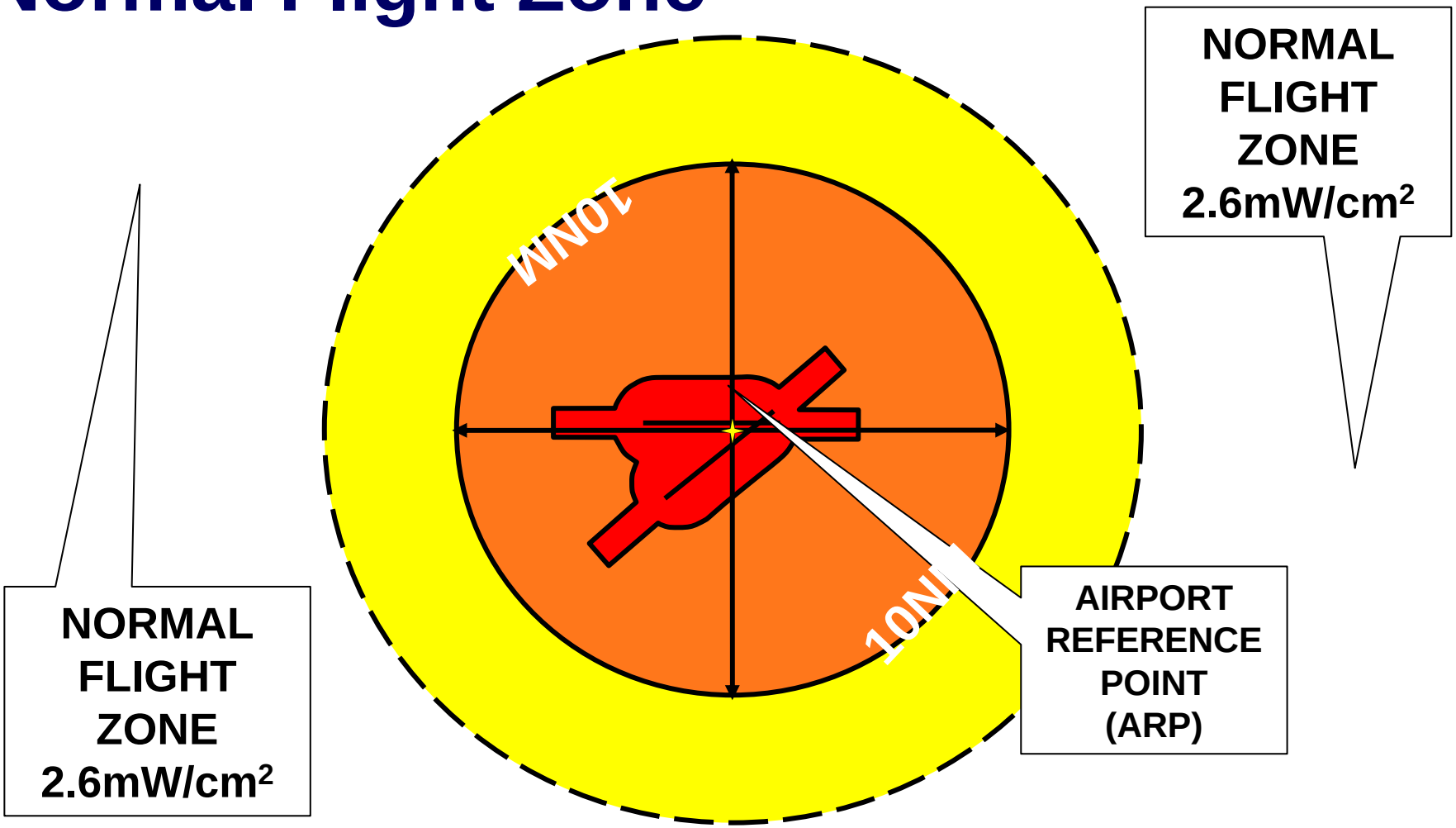
Anywhere in navigable airspace that is not a LFZ, CFZ or SFZ

A NFZ will normally surround other flight zones

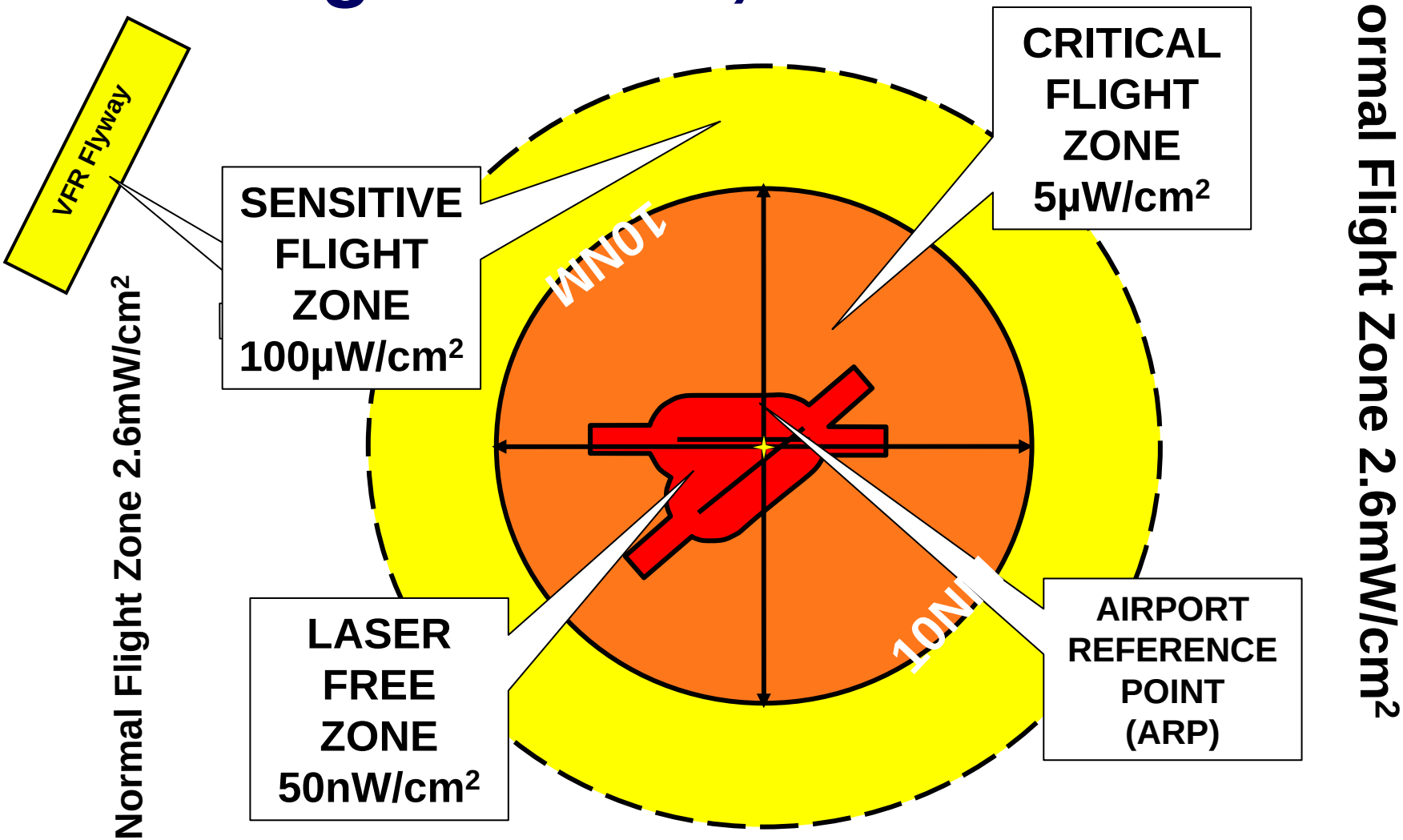
Irradiance not to exceed 2.6 mW/cm^2

Airspace Flight Zones, cont.

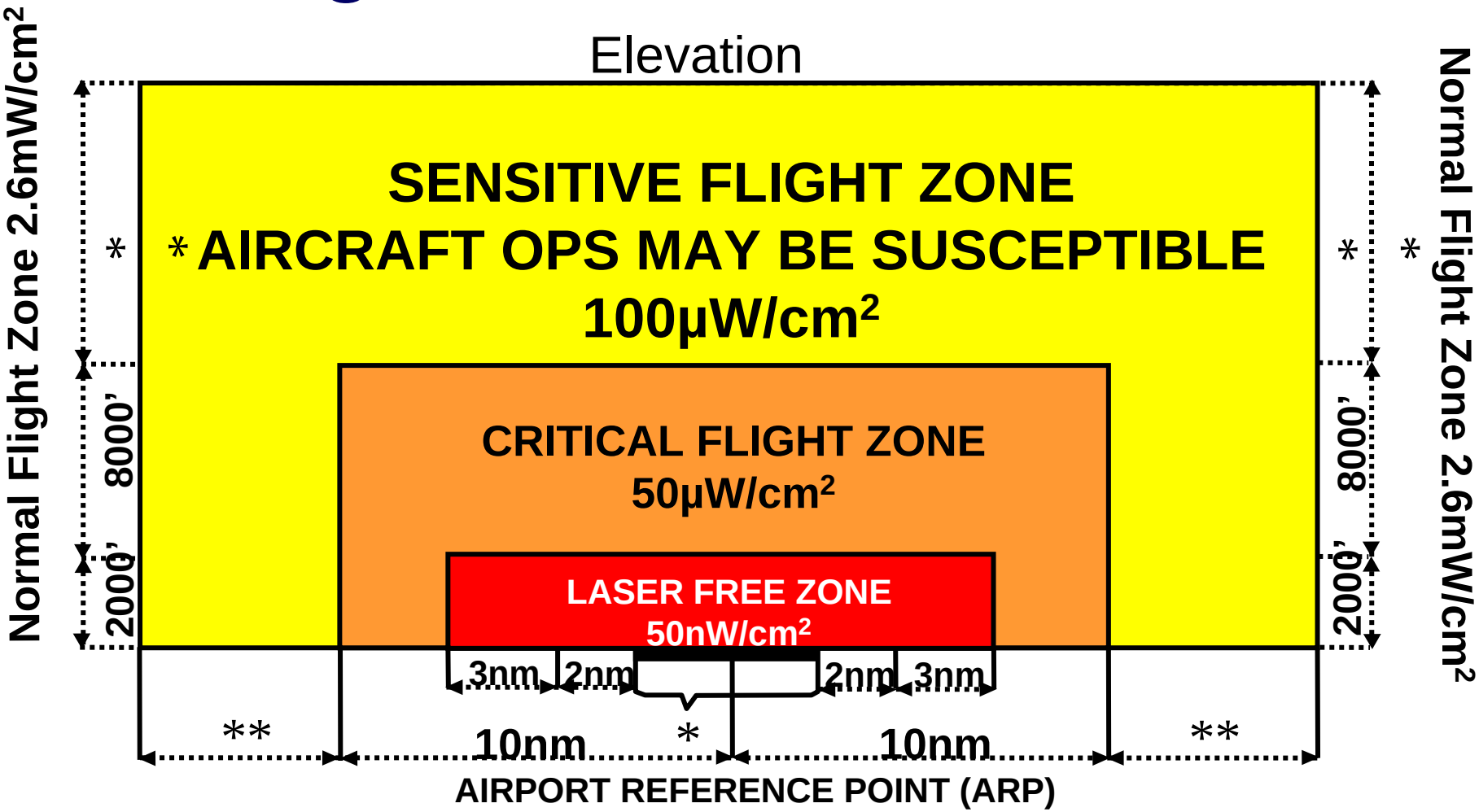
Normal Flight Zone



All 4 Flight Zones, Plan View



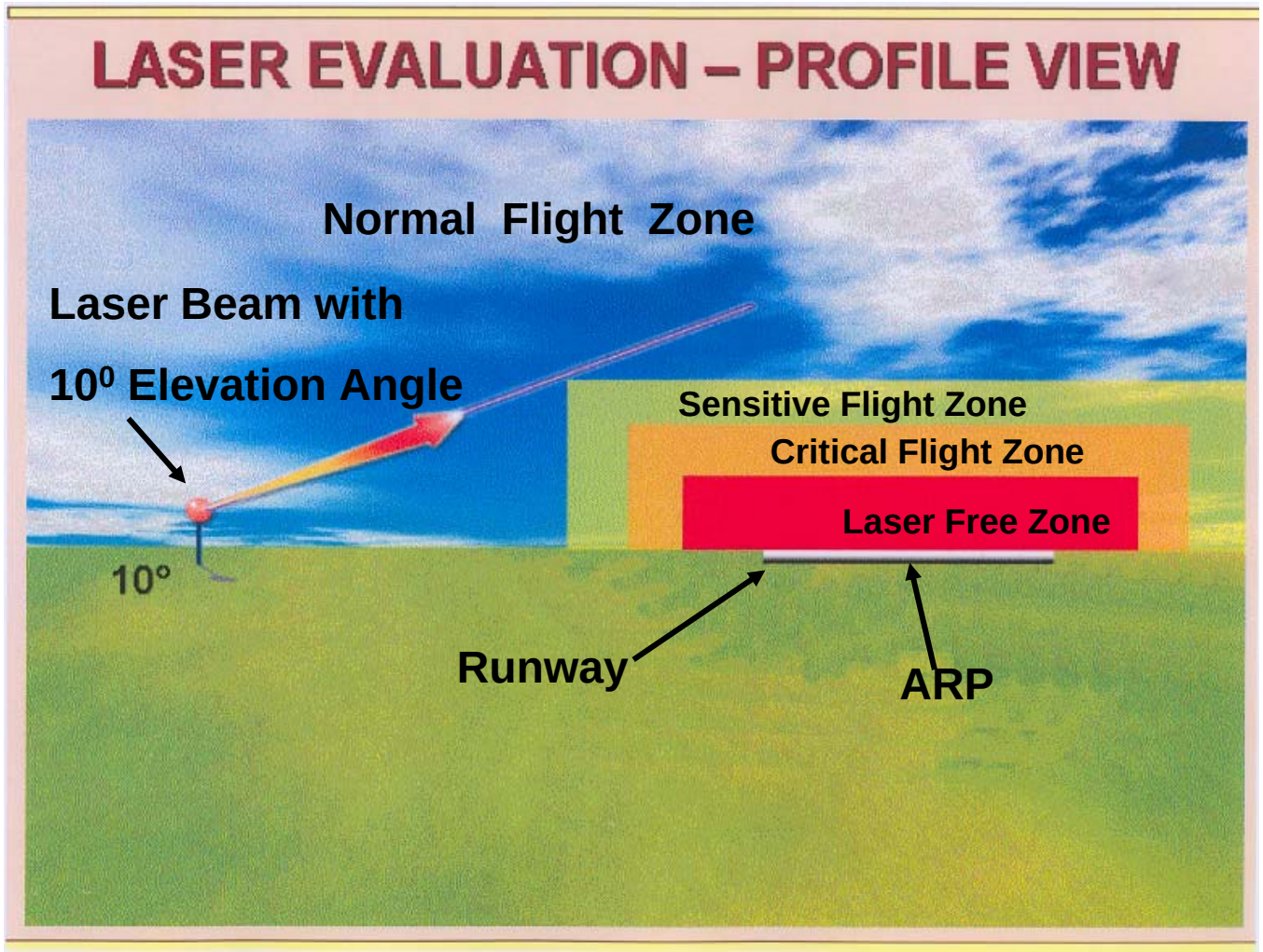
All 4 Flight Zones, Profile View



** Runway length varies per airport. AGL is based on published airport elevation.*

*** To be determined by local FAA evaluation and/or local airport operations.*

Flight Zone Evaluation



Mitigating Potential Laser Hazards

Physical, procedural, and automated mitigating <u>control measures</u> that *may* be acceptable to the FAA include:

- Safety observers
- Limits for beam divergence and/or power
- Beam stops, termination, and/or beam direction controls

Automated systems that detect aircraft and shutter or terminate the beam may be used to *augment* the above control measures.

Control Measures

Safety Observers

One or multiple safety observers may be used to turn off or shutter the laser when aircraft are observed that may encroach on the affected area.

Safety observers are normally effective for observing aircraft with in 3 miles.

Control Measures, cont.

Other Control Measures

If the NOHD exceeds 3 miles, additional control measures (e.g. bore-sighted radar) may be required and may require extensive safety analysis.

To expedite the FAA's analysis, provide detailed safety data documenting how the control measure will ensure aviation safety.

The FAA will evaluated each proposal on a case-by case basis and may ask for additional information

Control Measures, cont.

At a minimum, the following information would be helpful for evaluating the use of bore-sighted radar as a control measure:

- Type of radar used
- Dimensions of radar coverage area
- Documentation of rate of detection for detecting all types of aircraft (including gliders and lighter than air aircraft, etc.)
- Documentation of how far from the laser beam aircraft of various speeds and at various altitudes (including high-speed, low flying military aircraft) are detected.
- Documentation of how quickly the beam is terminated once an aircraft is detected. This should demonstrate that the beam will be terminated before any aircraft enter the beam.
- System maintenance procedures
- System reliability/redundancy
- System failure rate

FAA Letter of Determination

The FAA does not approve or disapprove outdoor laser operations.

The FAA may issue a letter of object or a letter of no objection in response to a Notice of Proposed Outdoor Laser Operation(s).

If the FAA objects and the objections are not resolved, a CDRH variance (for a laser light show/demonstration) is not valid.

FAA Letter of Determination, cont.

A letter of non-objection normally includes:

- A list of provisions, conditions, and limitations
- A reminder that any deviation from the proposal will require further evaluation
- A reminder that the laser proponent must comply with any state or local requirement
- NOTAM requirements
- AT facility contact information

Notices to Airmen (NOTAMS)

NOTAMS are part of the FAA's safety net to protect pilots from the potential adverse and/or hazardous effects of outdoor laser operations.

A NOTAM informs pilots about a known laser operation. This is especially important for visible lasers that may be seen by a pilot flying in the vicinity of the laser operation.

What NASA Can Do To Facilitate an Timely FAA Laser Evaluation

Early notification to the FAA a key to receiving a timely response from the FAA.

For scientific/research lasers, notify the FAA at least 90 days before you need a response from the FAA.

Include a detailed analysis clearly showing how NASA proposes to ensure aviation safety.

What NASA Can Do To Facilitate a Timely FAA Laser Evaluation, cont.

Submit FAA Form 7140-1, Notice of Proposed Outdoor Laser Operation(s) with all applicable sections completed. Some sections of the form are not applicable to airborne laser operations. Submit additional information on attachment.

Fully describe the proposed operation including specific details on control measures that you intend to use ensure aviation safety.

Round Table Breakout Session