

UNCLASSIFIED



# STANDARD CENTRALIZED PREDICTIVE AVOIDANCE AND CAPABILITY VALIDATION PLAN

Change 2

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A handwritten signature in black ink, appearing to read 'John W. Giles', is written over a horizontal line.

John W. Giles  
Col, USAF  
JSpOC Director

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## SUMMARY OF CHANGES

Initial approval	<i>Standard Centralized Predictive Avoidance and Capability Validation Plan for Laser Clearinghouse Support to Lasers and Standard Centralized Predictive Avoidance and Capability Validation Plan for Space Control Center Support to Lasers</i> , both dated 14 April 2005 and signed by Joint Functional Component Command-Space and Global Strike/J35.
Change 1	Consolidates Laser Clearinghouse and Space Control Center standardized plans into one document with common systems and procedures for both organizations. Modifies document to reflect the LCH “Spiral 3” Deconfliction System that was fielded in 2006. Updates organizational names and locations as necessary.
Change 2	Replaced J95 with Unified Space Vault and replaced JSpOC SSA Ops with Combat Operations Division (COD) Space Battle Duty Technician. Updated LCH and COD contact information. Updated Interface Control Document to version LP 14-1. Added information about Space-track.org. Updated verbiage to clarify 30 day lookout requirement.

# 1 INTRODUCTION

## **Purpose & Scope.**

This predictive avoidance plan defines a standard approach to the laser predictive avoidance (P/A) process. It is applicable for any laser system receiving centralized predictive avoidance (CP/A) support from the Unified Space Vault Division (USV) Laser Clearinghouse (LCH) or Combat Operations Division (COD) Space Battle Duty Technician (SBDT), both divisions within the Joint Space Operations Center (JSpOC).

This plan will be tailored to the extent necessary for each laser in a system-specific appendix. This document describes the responsibilities of the LCH, the SBDT and the laser owner to work together to provide safe and responsible laser activities as required by Department of Defense (DOD) Instruction (DODI) 3100.11.<sup>1</sup> This document identifies the systems, processes, interactions, and schedules to be followed so that an end-to-end P/A capability will be available to support the laser program.

## **Background.**

DOD policy requires that all DOD laser activities be conducted in a safe and responsible manner that protects space systems, their effectiveness, and humans in space. DODI 3100.11 mandates that all DOD laser activities be coordinated with the Joint Functional Component Command for Space (JFCC SPACE) for predictive avoidance with U.S., friendly, and other space operations. Strategic Command Instruction 534-12<sup>2</sup> was published to implement this policy and prescribe procedures regarding illumination of satellites by lasers.

## **Plan Maintenance.**

This plan will be periodically updated as necessary to reflect new or evolving policies and procedures. Substantive (non-administrative) changes to the plan will be fully coordinated among all stakeholder organizations affected by the change.

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<sup>1</sup> DOD Instruction 3100.11, "Illumination of Objects in Space by Lasers", 31 March 2000.

<sup>2</sup> Strategic Command Instruction 534-12, *Laser Deconfliction Process*, 25 July 2007.

## 2 GENERAL DESCRIPTION OF SYSTEMS

### Laser System Description.

Appendix A to this plan contains a description of the laser program, the objectives of the laser firings, laser parameters, P/A requirements, details of typical scenarios, and schedules. This appendix includes a system-specific description of the scenarios used in laser activities, to include scenario goals, geometries, the laser engagement process, and safety procedures.

### Laser Clearinghouse and Space Battle Duty Technician Overview.

The JSpOC as part of JFCC SPACE is responsible for the laser Predictive Avoidance mission in accordance with DOD Instruction 3100.11 and U.S. Strategic Command Instruction 534-12. Specific LCH responsibilities are further assigned to the JSpOC's Unified Space Vault (USV), in which the LCH is established. The JSpOC is located at Vandenberg Air Force Base in California.

Air Force Space Command's 614th Air and Space Operations Center (AOC) provides manning, training, and equipment to the JSpOC which assist the LCH by providing satellite data, predictive avoidance support, and timely notification of space events, such as satellite launches and maneuvers. Upon evaluation of the laser and support needed, the LCH may task the Space Battle Duty Technician to provide predictive avoidance to selected laser programs. The SBDT is a 24/7 position on the JSpOC operations floor. The SBDT position falls within the Combat Operations Division of the JSpOC.

The LCH performs the following functions: (1) reviews all proposed laser illuminations above the horizon or in space, (2) provides predictive avoidance and safe laser operating parameters, (3) coordinates with satellite owner/operators and mission partners, and (4) when notified, reports all laser firings conducted outside authorized parameters.

The LCH uses the Space Deconfliction System (DECON) to perform analysis for the predictive avoidance process. This system generates protect lists, computes open firing windows, analyzes satellite susceptibility to lasers, and conducts post-mission analysis of laser activity. The SBDT also has a DECON System that performs the same functions as the LCH system and can be used as a system back-up for LCH.

### 3 LASER PREDICTIVE AVOIDANCE PLANNING PROCESS

The laser Predictive Avoidance planning process consists of six steps:

*Step 1: Registration of the laser.*

*Step 2: Evaluation of the laser's potential to harm satellites (waiver assessment).*

*Step 3: Analysis of alternative P/A approaches.*

*Step 4: Planning implementation of the P/A approach.*

*Step 5: P/A capability validation.*

*Step 6: Authorization of the laser activity.*

In order to use Predictive Avoidance, the first three steps above **must be** completed. At this point in the planning process (Step 1), the laser owner has provided the LCH with the technical parameters concerning their laser's fluence or irradiance. In Step 2, the laser has been assessed in a waiver determination process to have the potential to inadvertently affect satellites, and P/A is required. Finally, the centralized predictive avoidance (CP/A) approach was selected in Step 3 where the LCH or **SBDT** will calculate safe or "open" windows for laser firings for all protected satellites. The laser operator will not be responsible to calculate any open windows.

The fourth step is *Predictive Avoidance Planning*. Section 4 of this document describes the predictive avoidance tasks and actions to be accomplished **by the LCH, SBDT, and the Laser Owner.**

The fifth step is *Capability Validation*. Section 5 of this document (P/A Capability Validation) defines the means by which the predictive avoidance process will be tested and analyzed.

Finally, Commander, JFCC SPACE or his designee (such as **the JSpOC Director**) will issue authorization for the laser activity employing Centralized P/A. Final Authorization for lasers employing a Hybrid or Decentralized P/A approach, in which the laser system has responsibility to calculate windows, is currently reserved for Commander, JFCC SPACE.

#### 4 PROCEDURES FOR CENTRALIZED PREDICTIVE AVOIDANCE

The following sections describe standardized procedures for CP/A planning, pre-Activity activities, real-time operations, and post-Activity actions.

##### **Predictive Avoidance Planning.**

The Laser Owner must comply with the following calendar and Interface Exchange Requirements (IERs) for P/A planning. The IERs are described in more detail in Section 6.

Schedule	Action
Quarterly	Contact the LCH to update the projection of laser firings in the Laser Test Master Schedule to cover the next twelve months. Submit two weeks prior to the end of each quarter. (IER #1)
30 days prior to laser firing	Provide the LCH the dates and times for laser firings and scenarios. Coordinate with the LCH on predictive avoidance runs to be performed, method of transmission of safe firing windows, frequency and timing of support plus points of contact (phone, fax and e-mail). The LCH sends out a spreadsheet format for the 30 day lookout and is expected back to LCH by the 15 <sup>th</sup> of the current month for the next months' activity.
No later than 3 days prior to start of laser activity	Provide the LCH with any updates to the 30 day notice. The laser owner will transmit a P/A request message to the LCH identifying the date and time of the Activity, the laser to be used, the laser location, and the targets to be illuminated (IER #2). The possible formats needed to specify the laser locations and targets/pointing directions are found in the Interface Control Document (ICD) to the LCH Space Deconfliction System.

As part of P/A planning, the LCH maintains and updates the Master Protect List (MPL) of satellites. The MPL includes all satellites that are potentially susceptible to laser emissions.

In very rare instances, a subset of the MPL, called a Unique Protect List (UPL), may be created for a laser program. The UPL consists of satellites that may potentially be harmed if illuminated by a specific laser. Alternately, the Space Deconfliction System may be used to apply information satellite susceptibility to lasers when the open firing windows are computed. The Air Force Research Laboratory (AFRL) Satellite Assessment Center (SatAC) provides a database of satellite susceptibility information to the LCH for use in the Space Deconfliction System. SatAC's support to the predictive planning process will be in accordance with established agreements.<sup>3</sup>

Table 1 summarizes the tasks performed during Predictive Avoidance Planning. Details of IERs may be found in Section 6.

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<sup>3</sup> Memorandum of Agreement between JFCC SPACE and AFRL Satellite Assessment Center for Satellite Susceptibility Analysis, 9 August 2012.

**Table 1 - Predictive Avoidance Planning Tasks.**

<b>Task</b>	<b>OPR</b>	<b>Description</b>	<b>Implementation</b>
1.1	Laser Owner	Determine dates and times <b>to be requested</b> ; identify lasers to be used and scenario.	Laser owner's internal planning procedures. Submit Laser Test Master Schedule inputs quarterly and update per IER #1 in Table 5. Coordinate with LCH 30 days prior to confirm support requirements <b>via the LCH 30 day lookout spreadsheet (See paragraph 4).</b>
1.2	Laser Owner	Identify target or laser firing geometry; define target trajectory and uncertainties.	The targets will be identified by satellite identification numbers, stars, planets, or boxes/points in space or other means. Valid satellite targets must be on the Lasing Approval List maintained by the LCH or the laser owner must provide letters of permission from the satellite owner.
1.3	Laser Owner	Provide P/A Request Message (PRM) to the LCH.	The <b>PRM</b> includes data generated in Tasks 1.1-1.2 and conforms to formats specified in the LCH Space Deconfliction System ICD. PRMs <b>should be transferred via the space-track.org website, unless otherwise coordinated with LCH for alternate means.</b> See IER #2 in Table 5.
1.4	LCH	Maintain MPL.	LCH updates the MPL based on current satellite activity such as new launches and satellite decays.



## Pre-Activity Predictive Avoidance Activities.

The Laser Owner/Operator will post PRMs in their respective PRM folder on space-track.org. LCH can utilize other methods for coordination for PRMs (i.e. higher classification), however space-track.org is the preferred method of coordination.

The LCH or SBDT will use the Space Deconfliction System to compute open windows to determine when the laser activity may be conducted safely. The open windows will be based on the most current General Perturbation (GP) element sets or Special Perturbation (SP) vectors in the database. P/A processing may use the MPL or the laser-specific UPL.

The open windows will be provided on a schedule established in the Predictive Avoidance Planning step above. The LCH requires approximately 24 hours to generate the open windows. The results are sent in the P/A Approval Message (PAM); IER #3 described in Section 6. The laser owner will determine if the open windows are sufficient to achieve laser activity objectives. If not, the laser owner may request assistance from the LCH in determining if there is a modification to the scenario that would improve the open firing times.

For PAMs that are posted to the space-track.org website, to access the site, laser owner/operators must request access through the space-track.org homepage for approval by the space-track.org admin team. Questions about space-track.org access can be addressed by emailing [admin@space-track.org](mailto:admin@space-track.org). Table 2 summarizes the tasks performed during pre-Activity predictive avoidance activities.

*Table 2 - Pre-Activity Predictive Avoidance Tasks.*

Task	OPR	Description	Implementation
2.1	LCH or SBDT	Compute open windows based on PRM.	The LCH or SBDT will double-check the laser site location for correctness, paying specific attention to potential +/- and E/W Longitude errors. Open windows will be calculated using the Space Deconfliction System. The MPL will be used as the satellite protect list with Deconfliction Susceptibility Sub-Routine. GP element sets will be used for ephemeris. A default keep-out-cone half angle of 2.5 degrees will be used along with AFSPC-approved auto-coning capability unless analysis of laser system parameters justifies a smaller value.
2.2	LCH or SBDT	Transmit PAM.	The PAM containing the safe firing windows will be downloaded from the Space Deconfliction System, reviewed for security considerations, and posted to the space-track.org website or agreed upon method. See IER #3 in Table 5 of the <i>Standard Plan</i> . The PAM will conform to the ICD
2.3	Laser Owner	Determine if open windows are sufficient to support laser activity objectives.	The open windows will be compared with laser activity objectives to determine the adequacy of firing opportunities. If inadequate, dialogue with the LCH will be initiated to identify alternatives.

## **Real-Time Laser Operations.**

The laser operator will conduct the laser activity within the open firing windows provided in the P/A Approval Message. Laser firings must be performed within the laser and scenario parameters defined in Task 1.3. The open firing windows provided in Task 2.2 will be used by the laser system to restrict laser firings as described in Appendix A.

At T-1 hour for each day of a laser activity, the laser operator will contact the LCH or **SBDT** notifying them of the laser status and that laser firings are about to begin. This activity also verifies communications between the laser site and the LCH or **SBDT**. (See IER #4 in Table 5 for details.)

At T-0 and during the laser firings, the laser system will record all information needed for post-firing reports. During the course of the laser firing, if a satellite maneuvers or if a satellite is launched, the LCH or **SBDT** will notify the laser operator as soon as possible, and the laser firing will be stopped until further analysis is accomplished. The LCH or **SBDT** will provide the laser operator with revised open firing windows, if necessary.

Within 15 minutes of completion of laser firings, the laser operator will send a verbal Quick Look Report to the LCH or **SBDT**. See IER #6 in Table 5 for details. In the event of a laser firing outside authorized parameters (LOAP), the laser operator will verbally provide a LOAP Notification to the LCH within 15 minutes of the event, and provide a follow-up written report within 12 hours. See IERs #7 and 8 in Table 5.

Table 3 contains the detailed description of the tasks that will be performed during real-time laser operations.

**Table 3 - Real-Time Laser Operations Tasks.**

<b>Task</b>	<b>OPR</b>	<b>Description</b>	<b>Implementation</b>
3.1	Laser Operator	Disseminate PAM for operator use.	Open firing windows must be available to system operators.
3.2	Laser Operator	Communication check and Laser Status Report.	One hour prior to beginning the laser firing, the laser operator will contact the LCH or <b>SBDT</b> . The laser operator will verify communication systems are available, relay the status of the laser, and notify that the laser firing is about to begin. The laser operator will also inquire if any space events are in progress. See IER #4 in Table 5.
3.3	LCH or SBDT	Space Event Notification.	When a space event occurs, the laser activity may be halted until clearance from the LCH or SBDT is received. Updated satellite ephemeris will be used to calculate new open windows and transmit them to the laser operator if necessary. See IER #5 in Table 5.
3.4	Laser Operator	Perform laser system processing of open windows to ensure a safe firing.	See Appendix A.
3.5	Laser Operator	Monitor laser beam and target position during engagement.	See Appendix A.
3.6	Laser Operator	Abort/terminate laser firing if laser exceeds P/A spatial or temporal parameters.	See Appendix A.
3.7	Laser Operator	Record laser firing data for post analysis.	See Appendix A.
3.8	Laser Operator	Monitor status during engagement.	See Appendix A.
3.9	Laser Operator	Quick Look Report.	Verbal report from the laser operator to the LCH or <b>SBDT</b> within 15minutes of completion of a laser activity. See IER #6 in Table 5.
3.10	Laser Operator	LOAP Notification.	In the event of a laser firing outside authorized parameters, the laser operator must verbally notify the LCH or <b>SBDT</b> within 15 minutes. See IER #7 in Table 5.

### **Space Event Notification.**

In the timeframe (generally 24 hours) between the laser operator's receipt of the PAM and the laser firing, a satellite on the MPL may maneuver or a new satellite may be launched. Every effort will be made to prevent these events from interfering with the laser firings; however, the LCH must retain its authority to delay or cancel **activity** if it deems necessary to protect satellites. In the case where a new or maneuvered satellite may be affected by a laser firing, the LCH or **SBDT** may direct a halt to the test, and/or generate and forward to the laser operator updated P/A open windows that incorporate the new/maneuvered satellite. (See IER #5 in Table 5.)

**Post Activity Assessments and Reporting.**

If a laser operator sends notification of a LOAP, the laser operator must submit additional details to the LCH within 12 hours in the LOAP Report. (See IER #8 in Table 5 for details.)

The laser firing data recorded by the system in Task 3.7 above is used in the Laser Activity Summary Report (LASR). The report must be submitted 24 hours after a LOAP (Task 3.10 above). For routine laser firings, the laser operator must archive the data for one year in case LCH requests data for post activity analysis. A Laser Activity Summary Report is only required if requested within that time by the LCH. See IER #9 in Table 5.

*Table 4 – Post-Activity Assessments and Reporting Tasks.*

<b>Task</b>	<b>OPR</b>	<b>Description</b>	<b>Implementation</b>
4.1	Laser Operator	Download post activity analysis data.	Transfer data recorded during the laser activity (Task 3.7) for post activity reports, as required. Archive the data for one year. See Appendix A.
4.2	Laser Operator	Send LOAP Report to LCH. (if required)	Within 12 hours after a LOAP Notification is sent. See IER #8 in Table 5.
4.3	Laser Operator	Compile post activity analysis data and send LASR to LCH (if required).	Within 24 hours after a LOAP Notification or if requested by LCH within one year. (IER #9 in Table 5)

## 5 INTEROPERABILITY AND COMMUNICATIONS INFRASTRUCTURE

Communications connectivity will be established between the laser operator and the LCH or **SBDT**. The communications infrastructure will include voice, fax, and data transmissions. The laser operator will support unclassified communications at a minimum. Classified communications can also be supported if required by the laser system's security classification guide. Required voice communications capabilities include **two** unclassified voice lines. Required data communications capabilities include **two** unclassified e-mails.

### **LCH contact information:**

Position: Duty Officer

Address: JFCC SPACE/**JSpOC/USV/DE/LCH**  
747 Nebraska Avenue, Room B209  
Vandenberg AFB, CA 93437

Unclassified Phone: (805) **606-1282**, DSN **276-xxxx**

Secure Phone: (805) 606-1075, DSN 276-xxxx

Unclassified Fax: (805) 606-1610

Secure Fax: (805) 606-3799

E-mail: [\*\*JSpOCLCH@us.af.mil\*\*](mailto:JSpOCLCH@us.af.mil)

SIPRnet: [\*\*usaf.vandenberg.afspc.mbx.jspoc-lch@mail.smil.mil\*\*](mailto:usaf.vandenberg.afspc.mbx.jspoc-lch@mail.smil.mil)

### **SBDT contact information:**

Position: Duty Officer

Address: JFCC SPACE/**JSpOC/COD/SBDT**  
Building 8410  
Vandenberg AFB, CA 93437

Unclassified Phone: (805) 605-6546, DSN 275-xxxx

Secure Phone: (805) 605-3569, DSN 275-xxxx

**Unclassified Fax (COD Division office): (805) 605-3464**

**Secure Fax (JSpOC floor): (805) 605-3509**

E-mail: [\*\*JSpOCSSAOps@us.af.mil\*\*](mailto:JSpOCSSAOps@us.af.mil) (subject line include Attn: **SBDT**)

SIPRNet: [\*\*usaf.vandenberg.afspc.mbx.jspoc-ssa-ops@mail.smil.mil\*\*](mailto:usaf.vandenberg.afspc.mbx.jspoc-ssa-ops@mail.smil.mil) (subject line include Attn: **SBDT**)

Appendix A **of the CPA and PRM requests** will list current contact information specific to each laser program.

## 6 INFORMATION EXCHANGE REQUIREMENTS

The Information Exchange Requirements in Table 5 have been established to support the predictive avoidance procedures discussed above. Administrative information exchanges are not included. The table shows the information exchanged, the format and content, the originator and recipient, and the means of communication. The *LCH Reports Handbook*<sup>4</sup> defines the voice and text message formats and content. The *Space Deconfliction System Interface Control Document*<sup>5</sup> specifies the format and content of the data messages.

**Table 5 - Information Exchange Requirements.**

#	Information	Content	Format	Source	Recipient	Media	Time Frame
1	Laser Test Master Schedule	Per Handbook Section 3.4	Text	Laser Owner	LCH	E-mail	Submit two weeks prior to end of each Quarter
2	30 days prior to laser firing	Per Handbook Section 3.5	Text	Laser Owner	LCH	E-mail	LCH spreadsheet format for the 30 day lookout. Due back to LCH by the 15 <sup>th</sup> of the current month for the next months' activity.
3	P/A Request Message	Per ICD Section 4.2.1.1	Text	Laser Owner	LCH or SBDT	Web site	NLT 3 days prior to laser activity
4	P/A Approval Message	Per ICD, Section 4.3.1.1	Text	LCH or SBDT	Laser Owner	Web site	24 hours prior to laser firing
5	Laser Status Report	Per Handbook Section 2.2	Voice	Laser Owner	LCH or SBDT	Phone	One hour prior to beginning of firing
6	Space Event Notification	Per Handbook Section 2.5	Voice	LCH or SBDT	Laser Owner	Phone	As required
7	Quick Look Report	Per Handbook Section 2.3	Voice	Laser Owner	LCH or SBDT	Phone	Within 15 minutes of completion of laser firings for the day
8	LOAP Notification	Per Handbook Section 2.4	Voice	Laser Owner	LCH or SBDT	Phone	Within 15 minutes of determining a laser firing outside authorized parameters occurred
9	LOAP Report	Per Handbook Section 3.2	Text	Laser Owner	LCH	Fax or e-mail	Within 12 hours after LOAP Notification (IER #7)

<sup>4</sup> *Laser Clearinghouse Reports Handbook, Change 4, 1 November 2014.*

<sup>5</sup> *Interface Control Document for the USSTRATCOM JFCC SPACE Space Deconfliction System, B002-SPACE-DECON-LP 14-1-ICD-01, 30 May 2014.*

#	Information	Content	Format	Source	Recipient	Media	Time Frame
10	Laser Activity Summary Report	Per ICD Section 4.2.1.3.	Text	Laser Owner	LCH	Mail, fax or e-mail	Within 24 hours of LOAP Notification (IER #7); also archive data for 1 year and provide upon LCH request

## 7 PREDICTIVE AVOIDANCE CAPABILITY VALIDATION PROCESS

The purpose of P/A capability validation is to ensure the technical parameters of the laser system are well understood, processes and procedures are in place, personnel are trained on equipment and procedures, and communications mechanisms are established.

System validation must be documented by the laser owner in the form of test reports or analyses and provided to the LCH as inputs to the validation process. Previously documented tests or analyses are acceptable. The LCH will analyze the data to verify that the default keep-out-cone accounts for all laser system and satellite errors, or whether a smaller cone size is more appropriate.

If the laser system employs an automated capability to ensure the laser is operated within approved azimuth/elevation boundaries and open time windows, the system must be sufficiently tested to assure proper operations. The laser owner must also certify to the JSpOC that these capabilities have been satisfactorily tested per Appendix C.

Re-testing or additional analysis is required whenever a relevant configuration item is modified. Relevant configuration items can include, but are not limited to: laser components; computer hardware and software; telescope mounting, tracking, and optical components; and other system configuration items such that modifications to those items would affect predictive avoidance performance and processes to the extent that they would change system data previously submitted to the LCH.

The laser operator must develop written procedures that outline the responsibilities of personnel participating in the laser activity. In addition, the laser operator will certify that all personnel are sufficiently trained on these procedures per Appendix C.

Finally, an end-to-end P/A demonstration will be conducted to ensure procedures and communications links between the laser operator and the LCH are sufficient to perform all P/A functions (See Appendix B).

Validation tests and analyses must be completed and reports submitted to the LCH per the schedule in Table 6. The LCH will compile the validation results provided by the laser owner and submit a coordinated recommendation to the Commander, JFCC SPACE (or designee such as the JSpOC Director) for final authorization of the laser activity.



## 8 PREDICTIVE AVOIDANCE CAPABILITY VALIDATION CRITERIA

The criteria listed below must be satisfied to validate P/A capabilities for the laser activity. The anticipated completion dates will be identified in Appendix A. These criteria may be validated through incremental testing. In the event of system modifications to predictive avoidance capabilities, the system will be re-tested to ensure these criteria remain valid.

*Table 6 - Validation Criteria*

#	Validation Criteria	Validation Documentation	OPR
1	LCH predictive avoidance capabilities identified in Section 4 have been satisfactorily tested.	LCH software test reports and numerical validation reports for most recent version of Space Deconfliction System.	LCH
2	Laser predictive avoidance capabilities identified in this plan have been satisfactorily tested.	Laser system and software test reports.	Laser Owner
3	Verification of laser system parameters (including laser positional uncertainty, laser beam divergence, boresight errors and laser system failure modes) affecting the cone size for open window computation.	Relevant test reports and analyses.	Laser Owner
4	P/A procedures have been developed, documented, and verified; and trained personnel are available.	Statement of Certification of P/A Capabilities due prior to the end to end demonstration. See Appendix C of the <i>Standard Plan</i> for sample.	Laser Operator
5	DOD Compliance Statement whether the laser activity requires SECDEF approval and meets requirements of DODI 3100.11.	Statement of Compliance with DODI 3100.11. Due prior to the end to end demonstration if a DOD program. See Appendix D for sample.	Laser Owner
6	Interfaces, interoperability and procedures between the LCH and the laser operator including information exchange requirements have been verified.	End-to-end demonstration of P/A capabilities report. See Appendix B for the demo script. Criteria 1-5 (5 only if a DOD program) must be completed prior to end-to end demonstration.	LCH and Laser Operator

## 9 PREDICTIVE AVOIDANCE RESPONSIBILITIES

### Joint Functional Component Command for Space.

- 1) Develop, in coordination with stakeholders, this standard centralized predictive avoidance and capability validation plan.
- 2) Ensure organize, train, and equip requirements that allow the LCH to implement this plan are coordinated with Air Force Space Command.<sup>6</sup>
- 3) Advocate for LCH capabilities.
- 4) Provide final approval for the laser firing based on predictive avoidance capability validation results.

### Laser Clearinghouse (JSpOC/USV).

- 1) Operate the LCH Space Deconfliction System to provide the support required for laser firings.
- 2) Coordinate with affected agencies to ensure appropriate satellite protection methods are used.
- 3) Develop, in coordination with laser owners, laser-specific appendices to this Plan.
- 4) Approve and sign the laser specific appendix to this Standard P/A plan.
- 5) Review and analyze the predictive avoidance capability validation results.
- 6) Participate in P/A capability validation testing.
- 7) Receive satellite authorization letters from the laser owner to update the Lasing Approval List in support of the laser program.
- 8) Perform LCH steps in the predictive avoidance process specified in Section 4.
- 9) Inform JFCC SPACE/J3 of any new or revised laser-specific appendices to this plan.
- 10) Report unauthorized laser firings identified by the laser operator to the USSTRATCOM Global Operations Center (GOC), in coordination with the JSpOC Senior Space Duty Officer.
- 11) Support laser programs in necessary efforts to mitigate their risks of inadvertently illuminating unauthorized satellites. Should a laser site fire outside of Predictive Avoidance measures, collect and track the site's remedial actions to prevent future occurrences.

### Space Battle Duty Technician (JSpOC/COD) as tasked by LCH.

- 1) Operate the approved Space Deconfliction System to provide the support required for laser firings when tasked by the LCH.
- 2) Perform **SBDT** steps in the predictive avoidance process specified in Section 4.
- 3) Report unauthorized laser firings identified by the laser operator to the LCH.

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<sup>6</sup> U.S. Space Command Laser Clearinghouse Implementation Plan, 19 December 2000

**Laser Owner/Operator.**

- 1) Participate in the development and coordination of the laser-specific appendix to this Plan.
- 2) Approve and sign the laser specific appendix to this Standard CP/A Plan.
- 3) Participate in P/A capability validation by providing technical information and test results and certification statements to the LCH and by participating in the end-to-end demonstration.
- 4) Provide laser test plans and procedures, and schedules to LCH at least 30 days prior to the planned start date.
- 5) Provide target satellite identification numbers and Permission letters (if target not listed in the Lasing Approval List) to the LCH.
- 6) Notify LCH of any changes to the system that would affect P/A validation and authorization.
- 7) Incorporate P/A capabilities into the laser system operational concepts and requirements documents.

**Air Force Research Laboratory/Satellite Assessment Center.**

- 1) Provide satellite susceptibility data as per the Memorandum of Agreement with JFCC SPACE.
- 2) Review laser technical parameters, as submitted by LCH, for their suitability for use with susceptibility data (“laser normalization” process).

## **APPENDIX A - LASER SPECIFIC PREDICTIVE AVOIDANCE INFORMATION**

Appendix A is a laser-specific document that includes a description of the laser program system, typical scenarios for laser activities, details of the laser safety system, unclassified laser parameters, predictive avoidance procedures and any unique requirements not addressed in this Standard Plan, a schedule of laser activities, and points of contact. Appendix A will be signed by the JFCC SPACE Directed Energy Branch Chief and the laser owner responsible official (O-5/GS-14 or equivalent level).

Final Authorization for the LCH to provide the laser owner/operator with predictive avoidance support in accordance with the P/A Plan occurs after signature Appendix A to this Standard P/A plan. This authorization is normally documented by JFCC SPACE in a memorandum signed at an authorization-level specified in USSTRATCOM Instruction 534-12, *Laser Predictive Avoidance Process*.

## APPENDIX B - DESCRIPTION OF END-TO-END DEMONSTRATION PROCEDURES

### B-1. End to End Demonstrations.

As part of the capability validation process, the laser operator and the LCH will conduct an end-to-end demonstration to evaluate all predictive avoidance capabilities required in this plan including the Information Exchange Requirements identified in Table 5 of this document. **Table 6 validation criteria 1-5 (5 only if DOD a program) must be completed prior to the end-to-end demonstration.** The generic script for this demonstration is listed below. The end-to-end demonstration will be used to verify that the integrated system of hardware, software, procedures, personnel, development of open windows for laser operations, and communications adequately perform centralized P/A and ensure safe and responsible laser use.

### B-2. Predictive Avoidance Planning Script.

Activity	OPR	Recipient	Timeframe	Actions / Information Required
PRM (IER #2)	Laser Operator	LCH	3 to 30 days prior to laser firing	Data per ICD, including: Laser Activity Schedule - Laser Type/Description/Laser Location - Target - Pointing Parameters - Time/Duration - Point of Contact (POC)
Update MPL	LCH	N/A	Upon receipt of new information	- Update protect lists based on satellite launches and decays

### B-3. Pre-Activity Predictive Avoidance Activities Script.

Activity	OPR	Recipient	Timeframe	Actions / Information Required
PAM (IER #3)	LCH	Laser Operator	Schedule per specific agreement in Appendix A.	Data per ICD, including: - Open windows will list times (to the second) approved for conducting laser firings within parameters requested

Note: The *Timeframe* may be adjusted or compressed for test/exercise purposes.

### B-4. Real Time Predictive Avoidance Script.

Activity	OPR	Recipient	Timeframe	Information Required
Input Open Window times	Laser Operator	N/A	Upon receipt of PAM	- Input Open Window times

<b>Activity</b>	<b>OPR</b>	<b>Recipient</b>	<b>Timeframe</b>	<b>Information Required</b>
Laser Status Report (IER #4)	Laser Operator	LCH	T-1 hour	<ul style="list-style-type: none"> <li>- Communications check</li> <li>- Notify LCH of laser status and start time of laser activities</li> </ul>
Space Event Notification (IER #5)	LCH	Laser Operator	Occurs between the open window generation & completion of demonstration	<ul style="list-style-type: none"> <li>- If a new launch or maneuver of a satellite on the MPL impacts the laser demonstration, LCH may halt the demonstration, or generate revised open windows for the laser</li> </ul>
Quick Look Report (IER #6)	Laser Operator	LCH	Within 15 minutes of completion of laser firings	<ul style="list-style-type: none"> <li>- Notify LCH of stop time of final laser activities and if within approved parameters</li> </ul>
LOAP Notification (IER #7)	Laser Operator	LCH	Within 15 minutes of incident	Data per LCH Reports Handbook, including: <ul style="list-style-type: none"> <li>- Time of laser activity</li> <li>- Reason for Incident Report</li> <li>- Laser aim position (Azimuth/Elevation)</li> <li>- Target and location</li> <li>- Laser used</li> <li>- Output power of laser</li> </ul>

**B-5. Post-Activity Activities Script.**

<b>Activity</b>	<b>OPR</b>	<b>Recipient</b>	<b>Timeframe</b>	<b>Actions / Information Required</b>
LOAP Report (IER #8)	Laser Operator	LCH	Within 12 hours after determination of a laser incident	Data per LCH Reports Handbook, including: <ul style="list-style-type: none"> <li>- Time of laser firings</li> <li>- Assessment of how far outside authorized parameters firings were</li> <li>- Laser location (latitude/longitude/elevation)</li> <li>- Target</li> <li>- Target location</li> <li>- Laser used</li> <li>- Laser output power</li> <li>- Laser system or demonstration conditions contributing to incident</li> <li>- Point Of Contact</li> </ul>
LOAP Report	LCH	STRAT-COM Global Ops Center	Upon receipt of LOAP Report	<ul style="list-style-type: none"> <li>- Forward detailed description and supporting details after coordinating with JSpOC Senior Space Duty Officer</li> </ul>
Laser Activity Summary Report (IER #9)	Laser Owner	LCH	Within 7 days of completion of laser activity period	Data per ICD, including: <ul style="list-style-type: none"> <li>- Time of laser firings</li> <li>- Assessment of firings being within parameters</li> </ul>

## APPENDIX C - STATEMENT OF CERTIFICATION OF P/A CAPABILITIES

From: [insert Laser Owner/Operator name/organization]

To: **Laser Clearinghouse**

**JSpOC/USV**

747 Nebraska Avenue

Vandenberg AFB, CA 93437

Subject: Statement of Certification of Predictive Avoidance Capabilities for the [insert laser name]

References:

- a. Standard Centralized Predictive Avoidance and Capability Validation Plan for Laser Clearinghouse (LCH) Support to Lasers (insert date of most current document).
- b. [insert laser name] Appendix A to the Standard Centralized Predictive Avoidance and Capability Validation Plan (insert date of most current document).
- c. Laser Clearinghouse Reports Handbook (insert date of most current document).
- d. Deconfliction System Interface Control Document (insert date of most current document).
- e. Statement of Certification of Laser Predictive Avoidance Capabilities [insert laser name] (insert date of most current document).
- f. If applicable: [insert laser name] Deconfliction System/Software Test Report (insert date of most current document).

1. We certify that all predictive avoidance (P/A) capabilities required of the [insert laser name] in the referenced plans are in place and have been satisfactorily verified through testing and analysis.

2. We also certify all personnel who will participate in predictive avoidance operations are fully trained and available, and will comply with the P/A processes documented in the references.

3. In addition, we certify all the [insert laser name] P/A operational procedures required to implement the referenced plans have been developed, evaluated, reviewed, and approved.

//Signed//

[Laser Owner/Operator Responsible Official  
(O-5/GS-15 or equivalent level)]

## APPENDIX D - DODI COMPLIANCE STATEMENT

From: [insert Laser Owner / Operator name / organization]

To: Laser Clearinghouse  
JSpOC/USV  
747 Nebraska Avenue  
Vandenberg AFB, CA 93437

Subject: Statement of Certification for Compliance with DOD Instruction 3100.11

References:

- a. DOD Instruction 3100.11, Illumination of Objects in Space by Lasers, 31 March 2000.
- b. Standard Centralized Predictive Avoidance and Capability Validation Plan (insert date of most current document).
- c. [insert laser name] Appendix A to the Standard Centralized Predictive Avoidance and Capability Validation Plan (insert date of most current document).

In accordance with the Reference (a) Instruction, we certify that Secretary of Defense approval of the [insert laser name] tests/missions described in reference (b) and (c) are not required. None of the criteria in Reference (a) Section 4.4 apply. Also, Secretary Defense approval is not required per Reference (a) Section 4.5.

We further certify that these laser firings do not raise any issues of DOD compliance with arms control agreements (Reference (a), Section 6.1.5).

//Signed//

[Laser Owner/Operator Responsible Official  
(O-5/GS-15 or equivalent level)]



## APPENDIX E - ACRONYMS AND GLOSSARY

Term	Definition
AFB	Air Force Base
AFRL	Air Force Research Laboratory
AFSPC	Air Force Space Command
AOC	Aerospace Operations Center
CP/A	Centralized Predictive Avoidance. A means of predictive avoidance where the Laser Clearinghouse provides safe operating (“open”) windows to the laser owner / operator.
<b>COD</b>	<b>Combat Operations Division</b>
Deconfliction	Actions taken to ensure that planned activities do not inadvertently affect other satellites or their mission effectiveness.
DOD	Department of Defense
DODI	Department of Defense Instruction
DOD Laser Activity	Any DOD-sponsored laser research, development, developmental test, operational test, evaluation, or exercise in which a laser is fired to, in, through, or from space, or aimed above the horizon with the potential to inadvertently or adversely affect satellites or humans in space.
GP	General Perturbation
ICD	Interface Control Document
IER	Information Exchange Requirement
Illumination	The emission of energy from a laser directed at a target. (Reference: DODI 3100.11, Enclosure 1)
IER	Interface Exchange Requirement
JFCC SPACE	Joint Functional Component Command for Space
JSpOC	Joint Space Operations Center
LCH	Laser Clearinghouse
LO/O	Laser Owner Operator
MOA	Memorandum of Agreement
MPL	Master Protect List
Open Windows	Times at which it is safe for lasers to fire if no conflict exists with satellites on the Master/Unique Protect List.
P/A	Predictive Avoidance: A deconfliction process that involves the analytical and geometrical method used to: (1) ensure that laser illuminations do not impact upon the safe and effective operation of a satellite, (2) determine if a specific satellite may be inadvertently illuminated, and (3) make informed decisions on the safety of laser activities to, in, through, or from space, or aimed above the horizon.
POC	Point of Contact

Term	Definition
SatAC	Satellite Assessment Center. A function of the Air Force Research Laboratory's Directed Energy Directorate.
SI	U.S. Strategic Command Instruction
SIPRNet	Secure Internet Protocol Router Network
SP	Special Perturbation
<b>SBDT</b>	<b>Space Battle Duty Technician</b>
SSDO	Senior Space Duty Officer (at JSpOC)
USSTRATCOM GOC	United States Strategic Command Global Operations Center
USV	Unified Space Vault