



Goddard Procedural Requirements (GPR)

DIRECTIVE NO. GPR 1860.2D **APPROVED BY Signature:** Original Signed By
EFFECTIVE DATE: November 30, 2017 **NAME:** Richard D. Barney
EXPIRATION DATE: November 30, 2022 **TITLE:** Director, Safety and Mission Assurance

COMPLIANCE IS MANDATORY

Responsible Office: 360/Safety Division

Title: Laser Radiation Protection

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Preface

P.1 PURPOSE

This directive describes the Goddard Space Flight Center (GSFC) Radiation Protection Program (RPP) for Laser Radiation, which contains guidance on administrative and procedural requirements essential to the safe use of LASER (Light Amplification by the Stimulated Emission of Radiation) radiation. Other types of radiation are addressed in other documents

P.2 APPLICABILITY

- a. This directive is applicable to all GSFC personnel, facilities, and activities, including all permanent and temporary sites. This directive shall also apply to all GSFC tenant organizations, contractors (including offsite contractor facility locations identified in a GSFC contract), grantees, clubs and other persons operating on GSFC property as required by law and as directed by contractual, grant, and agreement documents.
- b. In this directive, all document citations are assumed to be the latest version unless otherwise noted.
- c. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms “may” or “can” denote discretionary privilege or permission; “should” denotes a good practice and is recommended but not required; “will” denotes expected outcome; and “are/is” denotes descriptive material.

P.3 AUTHORITY

NPR [1800.1D](#), NASA Occupational Health Program Procedures

P.4 APPLICABLE DOCUMENTS AND FORMS

- a. American National Standard Safe Use of Lasers (American National Standards Institute (ANSI) Z136.1).
- b. American National Standard Safe Use of Lasers Outdoors (ANSI Z136.6).
- c. American National Standard Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and Light-Emitting Diode (LED) Sources (ANSI Z136.2).
- d. [GSFC Form 23-6L](#), Goddard Space Flight Center Request for Non-Ionizing Radiation Safety Committee Action – Laser Radiation Source Approval.
- e. [GSFC Form 23-28L](#), Laser Radiation Source Questionnaire.

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- f. [GSFC Form 23-35LU](#), Laser Radiation Source – Personnel Approval.
- g. [GSFC Form 23-75](#), Environmental Checklist, R&D Projects
- h. [GSFC Form 23-59](#), Initiator’s Acquisition Checklist
- i. [FAA Form 7140-1](#), Notice of Proposed Outdoor LASER Operation(s) and Configuration Worksheet

P.5 CANCELLATION

GPR 1860.2C, Laser Radiation Protection

P.6 SAFETY

Safety requirements and numerous safety-related procedures are identified throughout this directive. Specific requirements applicable to procedures resulting from this GPR are described where appropriate.

P.7 TRAINING

Users and custodians shall be appropriately trained in the safe use of lasers (see Appendix C, Table 1 and Table 2). Documentation of training and certification for the use of Laser systems rated below a Class 3B level is the responsibility of the appropriate management organization.

P.8 RECORDS

Record Title	Record Custodian	Retention
Inspection and Inventories of Class 3B and 4 and Outdoor lasers	Radiation Protection Office (RPO) keeps original; custodians maintain a copy	*NRRS 8/23.5 Cutoff annually. Destroy with concurrence of Center or NASA counsel's office 75 years after cutoff or when no longer needed, whichever is later.
GSFC Form 23-6L (Approved)	RPO keeps original; custodians maintain a copy	*NRRS 8/23.5
GSFC Form 23-35LU (Approved)	RPO keeps original; users maintain a copy	*NRRS 1/130 Records are kept for 2 years. If employee does not wish to be renewed for the position at the end of 2-year period, the record is removed and placed in an inactive file. Records are retained at GSFC until destroyed. Destroy when 75 Years old.
GSFC Form 23-28L	RPO	*NRRS 8/23.5

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Record Title	Record Custodian	Retention
FAA Form 7140-1	RPO maintains a copy; original sent to the FAA	*NRRS 8/23.5

**[NRRS 1441.1 – NASA Records Retention Schedules](#)*

P.9 MEASUREMENT/VERIFICATION

Metrics will include the number of employees injured by lasers and the number of laser incidents. This data will be reported quarterly to the NIRSC.

PROCEDURES

In this document, a requirement is identified by “shall,” a good practice by “should,” permission by “may” or “can,” expectation by “will,” and descriptive material by “is.”

1.0 ROLES AND RESPONSIBILITIES

1.1 Non-ionizing Radiation Safety Committee (NIRSC)

The NIRSC is responsible for the development of non-ionizing radiation policies and procedures regarding the safe use of these types of radiation in locations where GSFC operates. The NIRSC will consist of representatives identified by their directorates as having varying areas of expertise, including a representative from Wallops Flight Facility. NIRSC shall:

- a. Meet at least quarterly, and as often as necessary to accomplish its responsibilities;
- b. Ensure that non-ionizing radiation sources used at GSFC or under GSFC programs are managed so as to minimize the health and safety risks to Government and contractor employees and the public;
- c. Ensure that GSFC and other Federal regulations, professional standards, and sound health physics practices are met;
- d. Approve Class 3B and Class 4 laser and all Outdoor Laser operations and, if necessary, prescribe conditions and requirements to minimize radiation hazards by reviewing the Laser Safety Plans submitted with a GSFC Form 23-6L;
- e. Approve the qualifications of personnel as responsible users and custodians of laser radiation producing devices by reviewing their completed GSFC Form 23-35LU;
- f. Approve safe operating procedures; and
- g. Suspend any approval not in compliance with GSFC’s Radiation Protection Program.

1.2 Safety Division

The Safety Division is responsible for oversight of safety programs at GSFC and will support all GSFC organizations in matters involving non-ionizing radiation, including the NIRSC. The Chief, Safety Division shall ensure a qualified individual is assigned as the Radiation Safety Officer (RSO) and that there are adequate contractual personnel available to support the RPP.

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1.3 Radiation Safety Officer (RSO)

The RSO is a Civil Service employee who has administrative responsibility for the Center's RPP and is supported by the Radiation Protection Program Support Staff (RPPSS), which includes the Laser Safety Officer. The RSO shall:

- a. Ensure maintenance of records associated with all Laser sources and/or devices reviewed and maintained by the RPPSS;
- b. Provide notification to the NASA Senior Environmental Health Officer (SEHO) regarding any unintended personnel laser exposure; and
- c. Coordinate all matters regarding outdoor laser safety coordination with other agencies with the SEHO.

1.4 Laser Safety Officer (LSO)

The LSO can be either a Contract or Civil Service employee who is a member of the RPPSS and works directly with the RSO. The LSO shall:

- a. Survey by inspection, at least annually, all areas where lasers are used and stored;
- b. Audit laser source records and evaluate use programs to assure compliance with NIRSC requirements;
- c. Maintain appropriate records of inspections and evaluations;
- d. Have the authority to suspend, restrict or terminate the operation of a laser or laser system if it is deemed to pose an imminent threat to personnel safety;
- e. Provide consultation on Class 3B and Class 4 and Outdoor Laser operations as requested;
- f. Review Laser Safety Operating Procedures, alignment procedures, and any other procedures as may be required for personnel safety;
- g. Review all laser devices (regardless of Laser Class) to determine class and RPP requirements;
- h. Review all Class 3B and Class 4 laser installations prior to startup of operations and after each approved alteration, and conduct periodic surveys and evaluations;
- j. Provide a report to the RSO regarding an unintended personnel laser exposure or any objection to propagation of any laser beam by any organization within one hour of notification;
- k. Develop and maintain an inventory of all laser that have been evaluated by the RPPSS; and
- l. Obtain Federal Aviation Administration (FAA) forms for outdoor laser use from the Laser Custodian.

1.5 Radiation Protection Program Support Staff (RPPSS)

This RPPSS is made up of personnel provided through a service support contract with qualified health physics personnel positioned at the Greenbelt Radiation Protection Office (RPO) and safety personnel positioned and GSFC sites like Wallops Flight Facility and White Sands Complex. These staff members accomplish many requirements associated with the RPP (i.e. radiation surveys, inspections) and support the RSO to ensure that all uses of Laser sources and devices are done in a safe fashion and meets all federal, state, NASA and local regulations.

The staff is responsible for:

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- a. Review all applications for use of Laser devices and sources, including location, and procedures;
- b. Recommend approval or disapproval (to the LSO and NIRSC) of applications for the use of Laser sources and devices;
- c. Suspend any activity they determine to be a threat to health or property; and
- d. Investigate overexposures, accidents, and other deviations from approved radiation safety practice, and implementing corrective actions as necessary.

1.6 Management

GSFC line management has primary responsibility for the physical safety of personnel working under their jurisdiction and for designating users and custodians of sources of laser radiation. The line manager shall:

- a. Ensure that laser sources are used only by individuals approved by GSFC's NIRSC and that all procedures and requirements are met;
- b. Ensure that hazard warning signs required by this directive are procured and posted by the user organization under the guidance of the LSO; and
- c. Ensure that laser custodians and users have adequate education, training, and experience for the responsibilities of a custodian or user.

1.7 Supervisors

Supervisors are responsible for employees and projects. Supervisors shall ensure that all facilities and equipment are properly maintained and that employees, where appropriate, are trained and knowledgeable in the proper use of lasers.

1.8 Laser Custodian

The laser custodian, who can be a Contractor or a Civil Servant, is not an administrative person but an active user who has the responsibility to ensure that all laser systems or devices that fall under them are used in a safe manner and meet the requirements of this directive. The Laser Custodian shall:

- a. Be authorized by the NIRSC as an Approved User of Class 3B and Class 4 or Outdoor laser sources;
- b. Be accountable for sources of lasers under his/her control;
- c. Ensure the proper use and storage of all sources of laser radiation under his/her custodianship;
- d. Post written safeguards on or near the laser control panel or at the entrance to the laser controlled area;
- e. Classify all lasers according to their greatest normally accessible level of radiation and in accordance with the ANSI Z136.1 (latest edition), i.e., Class 1, 1M, 2, 2M, 3R, 3B, or 4;
- f. Write Safe Operating Procedures;
- g. Submit all forms for laser use and approval to the LSO at a minimum of 2 weeks prior to need or expiration date of current approved authorization(s); and
- h. Submit immediate reports to the LSO if any departure from laser procedures has occurred (eye or skin exposures greater than the Maximum Permissible Exposure (MPE) limit, any injuries from laser

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support equipment, and/or any uncontrolled outdoor radiation of a laser beam). See Appendix D for report format required.

1.9 Approved Users

Approved Users are individuals that have received approval from the NIRSC to use Class 3B and Class 4 or Outdoor Laser systems or devices. Approved Users shall:

- a. Obtain certification from the line management responsible for the operations;
- b. Submit a GSFC Form 23-35LU to the RPPSS as stated in section 2.1.

1.10 Ancillary Personnel

Ancillary personnel involved in non-ionizing radiation activities shall:

- a. Know and follow GSFC radiological safety requirements, environmental statutes, and operations-specific policies and procedures; and
- b. Report immediately all unsafe conditions or operations to their supervisor, Facilities Operations Manager, and/or RPPSS.

1.11 Contractor-Operated Facilities

Contractors operating at contractor-operated facilities but in conjunction with GSFC programs shall be required to develop a plan to address the hazards of working with laser radiation sources in accordance with ANSI Z136.1 and ANSI Z136.6 as identified in their contracts.

1.12 Environmental Planning and Impact Assessment for Laser Projects

Environmental planning provides a process to identify environmental impacts, issues, and requirements associated with a project and to incorporate them into project planning and decision making. Environmental planning shall be integrated early into the planning process for proposed GSFC laser projects and activities. This facilitates compliance with National Environmental Policy Act (NEPA) and other environmental laws, minimizes impacts to the environment, and avoids cost and schedule impacts to the project.

GSFC uses the NEPA process as a framework for balanced and integrated environmental planning. NEPA is Federal legislation that establishes our national environmental policy. This law requires Federal agencies to consider the environmental impacts of actions in their planning and decision-making processes. While NEPA does not apply abroad, EO 12114 does, and requires Federal agencies to also consider the environmental impacts of their actions outside the United States. GSFC implements NEPA and EO 12114 in accordance with the procedures and guidelines of NPR 8580.1 and GPR 8500.1: *Environmental Planning and Impact Assessment*.

The Principle Investigator, Project Manager or the Branch Head shall contact the Code 250 NEPA Program Manager who will direct them to fill out Form 23-75: Environmental Checklist, R&D Projects. Additional planning and coordination between the project Codes, LSO and the Code 250 Environmental

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Team will be required to ensure the appropriate documentation is completed and approved prior to project commencement.

It is imperative that projects allow enough time to complete the GSFC Forms used in review of your experiments. This shall include any experiment requiring the use of any class of laser or laser system used outdoors.

2.0 LASER RADIATION OPERATIONS APPROVAL REQUIREMENTS

This section defines the requirements for obtaining NIRSC approval of users, custodians, devices, and operators involved with laser radiation sources. Approval procedures and methods are established to assure that work with sources of laser radiation is performed with due regard for personnel safety.

2.1 Obtaining Authorization to be an Approved User and/or Custodian of Laser Sources or Devices

The procedure for obtaining authorization is as follows (*NOTE: Proposed users shall only be allowed to work for up to 30 days under the supervision of a currently Approved User until formal NIRSC approval has been granted*). The proposed individual will:

- a. Complete a GSFC Form 23-35LU, listing his/her training and experience working with laser sources and/or devices, listing the laser sources and/or devices he/she will be using, and listing the name(s) of the Custodian(s) for whom he/she will be working; and
- b. Submit the form to his/her appropriate manager/supervisor for concurrence. If satisfied with the request, the manager/supervisor will forward the request to the RPPSS for NIRSC approval. The RPPSS will review the request to ensure that the individual has the education, training, and experience necessary as described in Appendix C;

The NIRSC shall approve or disapprove the request and the RPPSS must notify the individual by providing a copy of the approved or disapproved GSFC Form 23-35LU. Interim approval for a request may be granted by the RSO between NIRSC meetings and then finalized at the next NIRSC meeting.

Triennial refresher training is required to maintain User Approval and expiration dates are maintained by the RPO. Personnel who fail to complete this triennial training by their Laser User Approval expiration date will receive a Termination Letter from the RPO which prevents them from using any Class 3B or 4 Laser inside any Facility or any Class of Laser outdoors.

Civil service and contract employees are allowed to be either an approved user or custodian of Laser sources or devices. GSFC civil servants, contractors and other personnel operating offsite under GSFC authorization are subject to all provisions of Goddard's RPP, but are also responsible for ensuring all local regulations are being met.

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2.2 Personnel training requirements

Personnel completing a GSFC Form 23-35LU are required to list the Laser radiation safety training they have received. Additional specific training may be required of each individual based on the characteristics of the Laser source or device they are seeking authorization to use. Personnel will receive Hands On Training by the Custodian.

2.3 Personnel experience requirements

Experience in working with Laser sources or devices is crucial. A person shall have previous experience in operating Laser sources or devices. Experience for this requirement can include that obtained from universities, former employment, and work supervised by a custodian.

This experience will be documented on the individual's GSFC Form 23-35LU.

2.3.1 Supervision of inexperienced Laser radiation workers

Completing Laser radiation safety training does not ensure that inexperienced workers are competent to use Laser sources or devices without supervision. Inexperienced personnel needing to use Laser sources or devices will submit a GSFC Form 23-35LU. Block #5 shall be marked YES for "direct supervision during all operations." The custodian will ensure that inexperienced workers are directly supervised during Laser use until such time that the custodian is comfortable that the worker can handle Lasers safely and competently. Once the custodian is comfortable with this worker's experience a request should be submitted by the custodian in writing to the RPPSS to have the original GSFC Form 23-35LU modified to change Block #5 to NO. This request will include the dates that the worker was supervised.

2.4 Obtaining Approval for Laser Operations

Requests for laser operations shall be received by the LSO at least 2 weeks prior to the work date for adequate processing. Complicated systems, procedures, flight projects, or extremely hazardous operations will take longer to acquire final approval. These systems should be coordinated with the LSO in the early planning stages to assure that there is no impact to mission schedule.

Request for approval to use laser sources or devices are initialed by submitting a GSFC Form 23-28L to the RPPSS who will conduct a hazard evaluation and based on the classification of the Laser and where it will be used a GSFC Form 23-6L and Laser Safety Plan may be required. The GSFC Form 23-6L is used to submit a Laser Safety plan which describes the who/what/where/why of using the source.

The procedure for obtaining authorization for laser operations is as follows:

- a. For new laser sources; the originator will prepare a GSFC Form 23-28L describing the source involved and identifying their nominal output. For established laser source, the originator will list the assigned Docket Number(s) in the appropriate section of the GSFC Form 23-6L;
- b. The originator will prepare the GSFC Form 23-6L describing the intended use of the source along with a Laser Safety Plan. The Laser Safety Plan will address (at minimum) the following items: Potential Hazards, Controls to be Used, Operating and Emergency Procedures, Training, Approval, Alignment Procedures, Listing of Authorized Users, Listing of Approved Laser that will be used, Type of Safety Observer that will be used if conducting outdoor laser operation, and a diagram of

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laser lab area. All operations shall be in compliance with GSFC and other applicable regulations. The originator submits the above forms to the RPPSS for NIRSC approval;

- c. When the LSO receives the request, he/she will perform a review to determine the adequacy of the equipment, facilities, and location of the particular use of the laser source. Operating procedures must be discussed and evaluated. On the basis of the evaluation, the LSO may impose additional conditions to ensure safe operation and limits established for Critical Zone Exposure, Sensitive Zone Exposure, and Laser Free/High Intensity Light/Flight Zone are not exceeded.
- d. The NIRSC shall approve or disapprove the request for the laser operation, and the RPPSS must notify the originator by providing a copy of the approved or disapproved GSFC Form 23-6L. The NIRSC may also impose additional requirements; and
- e. The procedures approved in the request become the conditions under which the Custodian and his/her personnel are approved to use the laser system. Any subsequent change in procedure shall be reviewed and approved in writing by the NIRSC prior to instituting the change.

NOTE: Approvals for operations are only valid for a maximum of 3 years. Operations who fail to recertify by the Laser Use Approval expiration date will receive a Termination Letter which prevents this operation from using the Lasers at the locations described in the Laser Safety Plan.

2.5 Inspection and inventory requirements

Facility/site location inspections shall be performed annually by the RPPSS to ensure compliance with the approved GSFC Form 23-6R. Source inventory will be completed (at a minimum) annually by the RPPSS and source inventory, in the same manner, will be required to be verified by the custodian annually. The possible loss of any source should be immediately reported to the RSO.

2.6 Obtaining Approval to Purchase Laser Sources or Devices

The individual requesting the laser source or device shall be an Approved User. Prior to the purchase of a Class 3B or Class 4 laser the requesting individual will complete a GSFC Form 23-28L and submit it to their appropriate manager/supervisor for concurrence. If satisfied with the request, the manager/supervisor forwards the request to the RPPSS. The RPPSS will review the form to see what additional requirements are to be met prior to purchase. The RPPSS will direct the requesting individual to purchase the item(s) after this review by email correspondence. The initiator will also submit a GSFC Form 23-59 to the Safety Team in the Safety Division office on this request.

If the new laser is added to an existing NIRSC approved GSFC Form 23-6L the custodian will send an updated Appendix 2 to the RPPSS.

NOTE: Class 3B laser pointers are not permitted for use at GSFC or its supported facilities.

Users of fiber optics communications systems will follow guidance provided in ANSI Z136.2. Since these systems may contain Class 3B or Class 4 lasers, custodians of open-ended optical fibers and LEDs containing Class 3B or 4 lasers shall seek approval by the NIRSC through the LSO.

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2.7 Eye Exams

- a. Previous versions of NPR 1800.1 and ANSI Z136.1 required that personnel that would be working with Class 3B or Class 4 Laser systems and/or devices must have a baseline eye exam prior to starting work with them. Changes found in NPR 1800.1D allow for each NASA Center to define the policy on baseline eye exams which was removed as a requirement in ANZI Z136.1 -2014. GSFC's policy for baseline eye exams established by GSFC's NIRSC is that they are no longer required.
- b. Eye exams should be administered after any suspected exposure.
- c. Baseline and termination eye exams can be made available but are not required to be an Approved User of Lasers.

3.0 OUTDOOR LASER OPERATIONS

- a. All aviation protective systems determinations shall be supported by qualitative and quantitative safety/hazard analysis. Unless otherwise noted, all ANSI Z136.6 requirements are incorporated by reference as requirements, and will take precedence over any less rigorous requirement in this document. Proposed protective systems must be submitted to the NIRSC for approval (GSFC Form 23-6L). All supporting documentation will be included. It should be noted that ALL classes of lasers, i.e., 1, 1M, 2, 2M, 3R, 3B, and 4, used outdoors must be approved by the NIRSC since even Class 1 laser systems may present a hazard to aircraft operators.
- b. Laser systems directed towards outer space (which might disrupt orbiting satellites) and funded by the Department of Defense shall have an approval from the Laser Clearing House (LCH), Joint Functional Component Command for Space (JFCC SPACE) on file with the NIRSC. Contact the LSO for Coordination with the JFCC SPACE. See ANSI Z136.6 for information on which outdoor laser systems require approval from the Laser Clearing House. Information sheets for submission to the Laser Clearing House are available from the LSO.
- c. Federal Aviation Administration (FAA) coordination is required for all operations that will transmit laser energy through navigable air space controlled by the FAA. Coordination with the FAA shall be accomplished by submitting an FAA Form 7140-1 to the RPPSS. The person submitting the FAA Form 7140-1 must do so at least 60 days in advance of the expected date of operation. This will include any operation requiring a letter of determination from the FAA for their flight approval.
- d. Laser Safety Review Board (LSRB): Documentation stated in the NASA HQs LSRB By-Laws must be submitted by the project to the RSO at least 30 days in advance of the expected date of operation. RSO will enter these documents into the LSRB's Community of Practice website and work with the LSRB to obtain a "Letter of Concurrence" or work with the project to address concerns addressed in a LSRB "Letter of Notification". Projects will not be authorized to operate until they are granted a "Letter of Concurrence".
- e. Special Requirements: If any Federal, state or local Government agency objects to outdoor propagation of a laser beam, the following operational and notification requirements shall be followed:
 - a. Immediately provide a report to the LSO.

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- b. The LSO will, in turn, notify the Chairman of the NIRSC and a telephone notification shall be made to the NASA Senior Environmental Health Officer (SEHO). In no case can this notification exceed 2 hours from the time the objection is raised. A written report (email or fax) will be prepared as a follow-up to the telephone notification. If the NASA SEHO is unavailable, notification must be to the Office of the Chief Health and Medical Officer.
- c. An objection to the use of a specific outdoor laser by the FAA of the U.S. Military shall be honored until the NASA SEHO, in conjunction with other NASA organizations, reviews the complaint and authorizes continuation of operations.

4.0 OFFSITE LASER OPERATIONS

Offsite operations at locations not belonging to GSFC will be subject to the requirements and regulations of the use site. Approval of offsite operations may take an extended time. Offsite laser operations project managers shall appoint a site laser safety officer for the project. On most projects this would ball to the Project Safety Manager, but could be assigned to someone else. This individual will have the authority and the experience to ensure that safe operations are conducted and local regulations met.

5.0 LASER RADIATION PROTECTION REQUIREMENTS

- a. Requirements for control of hazards presented by lasers are located in section 4 of ANSI Z136.1 and are incorporated by reference. The application of control measures for the individual laser classes is shown in table 10 in section 8 of the aforementioned ANSI publication. Alternate control measures may be approved by the NIRSC. Adequate justification for alternate control measures shall accompany the NIRSC request for approval.
- b. Protective eyewear will be relied upon only after all engineering efforts to eliminate the hazard have been attempted. Eye protection for laser hazards will be reviewed and approved by the LSO. ANSI Z136.1 should be consulted when identifying and selecting laser eye protective equipment.
- c. Associated Hazards (Non-Beam Hazard) – This aspect of laser technology is seldom encountered outside of the research and engineering laboratory and is associated with high-power lasers almost exclusively. Non-beam hazards may include electrical, laser generated air contaminants, collateral and plasma radiation, fire, explosions, compressed gas, laser dyes, mechanical, noise, hazardous wastes, confined space, and ergonomics hazards. When these hazards are present, other requirements not addressed by this GPR are likely to apply. ANSI Z136.1 provides requirements and guidance related to these hazards.

6.0 CAUTION SIGNS, SYMBOLS, LABELS, AND POSTING

- a. Except as otherwise authorized by the LSO, signs, symbols, and labels shall use the design and colors described in ANSI Z136.1;
- b. In addition to the contents of signs, symbols, and labels prescribed by this section, a user may provide on or near such signs, symbols, and labels any additional information that may be appropriate in aiding individuals to minimize exposure to laser radiation or any associated hazards;
- c. Laser warning signs and labels shall be posted as required and in accordance with ANSI Z136.1; and
- d. Standard operating procedures for Class 3B and Class 4 lasers approved by the NIRSC and submitted with GSFC Form 23-6L shall be posted on or near the laser control panel or at the entrance to laser facility.

Appendix A – Definitions

- A.1 Approved User** – A person designated by management who is approved by the NIRSC to use Class 3B or Class 4 and outdoor sources of laser radiation or approved by management for sources below Class 3B for indoor usage.
- A.2 Aviation protection requirements** – Requirements to all outdoor laser systems that have a nominal ocular hazard distance (NOHD) greater than 500 feet above sea level (ASL) or have levels in the visible spectrum in excess of those permitted in Laser Free/High Intensity Light/Flight Zone (LF/HIL/FZ) as defined in FAA Order 7400.2 (series), Part 6, Miscellaneous Procedures, Chapter 29, Outdoor Laser Operations.
- A.3 Critical Zone Exposure** – 5 microW/cm^2 ; will not produce significant visual impairment.
- A.4 Custodian** – An approved laser user who has been designated by the appropriate management (section head or higher) and approved by the NIRSC to assume the responsibility of accountability for sources of hazardous laser radiation.
- A.5 Laser Free/High Intensity Light/Flight Zone** – Effective 50 nW/cm^2 ; indistinguishable from background ambient light.
- A.6 Laser Safety Plan** – A Plan written to protect personnel from exposure of the eye and skin to hazardous levels of laser radiation and to other hazards associated with the operation of laser devices during operation and maintenance. The plan will address (at minimum) the following items: Potential Hazards, Controls to be Used, Operating and Emergency Procedures, Training, Alignment Procedures, Listing of Authorized Users, Listing of Approved Laser that will be used, Type of Safety Observer that will be used if conducting outdoor laser operation, and a diagram of laser lab area.
- A.7 Maximum Permissible Exposure (MPE)** – The level of Laser radiation to which an unprotected person may be exposed without adverse biological changes in the eye or skin.
- A.6 Navigable Air Space** – Is defined as any height greater than 500 feet above sea level (ASL).
- A.8 Nominal Ocular Hazard Distance (NOHD)** – The distance along the axis of the laser beam beyond which the appropriate maximum permissible exposure per ANSI Z136.1 is not exceeded.
- A.9 Outdoor laser operations** – All uses of lasers in operations that involve the laser illumination of any area that is not enclosed by a physical structure. Outdoor laser operations include fixed ground-based systems, mobile ground-based systems, lasers fired through structure openings into outdoor areas, and flight systems (aircraft, balloons, and rocket payloads).
- A.10 Safety Observer** – May be any trained person or an individual using any mechanical/optical device approved by the Radiation Protection Office.
- A.11 Safe Operating Procedures** – A local-level procedure document describing safeguards for laser use. Written safeguards are posted on or near the laser control panel or at the entrance to the laser-controlled area. Class 1, 1M, 2, 2M and 3R systems as defined in ANSI Z136.1 are excluded from this requirement unless they are used in navigable airspace.
- A.12 Sensitive Zone Exposure** – 100 microW/cm^2 ; will begin to produce afterimage or flash-blindness effects.

Appendix B – Acronyms

ANSI	American National Standards Institute
FAA	Federal Aviation Administration
GPR	Goddard Procedural Requirements
GSFC	Goddard Space Flight Center
JFCC	Joint Functional Component Command for Space
LASER	Light Amplification by the Stimulated Emission of Radiation
LED	Light-Emitting Diode
LSO	Laser Safety Officer
LSRB	Laser Safety Review Board
MPE	Maximum Permissible Exposure
NEPA	National Environmental Policy Act
NIRSC	Non-ionizing Radiation Safety Committee
NPR	NASA Procedural Requirements
NRRS	NASA Records Retention Schedules
RPO	Radiation Protection Office
RPP	Radiation Protection Program
RPPSS	Radiation Protection Program Support Staff
RSO	Radiation Safety Officer
SEHO	Senior Environmental Health Officer

Appendix C – Training Requirements

Users and custodians shall be appropriately trained in the safe use of lasers (see Table 1 and Table 2). The following are training objectives:

Table 1 Laser User Training and Experience Requirements			
Laser Class	Training	Experience*	Approval Authority
1, 1M	None	None	Management
2, 2M, 3R	<ul style="list-style-type: none"> • Basic understanding of laser principles and hazards; • Understanding of manufacturers’ warnings, hazards, and use instructions 	Hands-On Instruction	Management
3B	<ul style="list-style-type: none"> • Basic understanding of laser principles and hazards; • Understanding of manufacturers’ warnings, hazards, and use instructions; • Understanding of the requirements of this GPR; • Know user responsibilities and basic GSFC laser use approval procedures; • Understand principles and properties of laser light; • Understand laser exposure bio-effects; • Recognize hazards and understand hazard controls for laser radiation; • Understand exposure control methods (engineering vs. administrative); • Understand the NIRSC-imposed requirements; • Know basic procedures and methods of handling laser approvals; • Know responsibilities of users and custodians; • Know the inspection and survey requirements 	8 Hours of documented Hands-On-Training	NIRSC
4	<ul style="list-style-type: none"> • Same training as a Class 3B Laser User 	40 Hours of documented Hands-On-Training	NIRSC

* Other requirements may be substituted for experience as determined appropriate by the NIRSC.

Table 2 Laser Custodian Training and Experience Requirements			
Laser Class	Course	Experience*	Approval Authority
3B	<ul style="list-style-type: none"> • Basic understanding of laser principles and hazards; • Understanding of manufacturers' warnings, hazards, and use instructions; • Understanding of the requirements of this GPR; • Know user responsibilities and basic GSFC laser use approval procedures; • Understand principles and properties of laser light; • Understand laser exposure bio-effects; • Recognize hazards and understand hazard controls for laser radiation; • Understand exposure control methods (engineering vs. administrative); • Understand the NIRSC-imposed requirements; • Know basic procedures and methods of handling laser approvals; • Know responsibilities of users and custodians; • Know the inspection and survey requirements 	8 Hours of documented Hands-On Training	NIRSC
4	<ul style="list-style-type: none"> • Same training as a Class 3B Laser Custodian 	40 Hours of documented Hands-On-Training	NIRSC
Outdoor Laser Operations	<ul style="list-style-type: none"> • Same training as a Class 3B Laser Custodian • Gain in-depth knowledge of laser safety, including non-damaging visual effects, emission calculations, and engineering controls required for their safe operation; • Understand specific operating procedures and safety requirements of the laser installation. 	8 Hours of documented Hands-On-Training in addition to the Class 4 requirements	NIRSC

* Other requirements may be substituted for experience as determined appropriate by the NIRSC.

Appendix D – Accident or Incident Reporting Requirements

Supervisors shall ensure that all individuals, including outside service technicians, understand and follow all controls and procedures as specified by the Center LSO or NIRSC. Mishaps are to be reported in accordance with [GPR 8621.4](#) *GSFC Mishap Preparedness and Contingency Plan*. Supervisors or lead experimenters should not intentionally depart from established safety procedures. The laser operators should keep the supervisor or lead experimenter fully informed of any unintended departure from established safety procedures and of any request to perform unsafe tasks.

All departures from established laser procedures shall be reported to the LSO and/or the NIRSC immediately. This includes all laser eye or skin exposures (greater than the MPE), any injuries from laser support equipment, and any uncontrolled outdoor radiation of a laser beam. Information required in the report includes:

- The nature of the accidental radiation occurrence;
- The location at which the accidental radiation occurred;
- The manufacturer, type and model number of the electronic product or products involved and the GSFC Form 23-28L Docket Number if assigned, reference ANSI Z136.6;
- The circumstances surrounding the accidental radiation occurrence, including causes;
- The number of persons involved, adversely affected, or exposed during the accidental radiation occurrence, the nature and magnitude of their exposure and/or injuries and the names of the persons involved;
- The actions, if any, which may have been taken to control, correct or eliminate the causes and to prevent reoccurrence; and
- Any other pertinent information with respect to the accidental radiation occurrence.

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EFFECTIVE DATE: November 30, 2017
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CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	06/29/04	Initial Release.
A	01/26/05	<p>Modified to clarify all requirements in accordance with NASA Rules Review Committee recommendations.</p> <p>P.4 added references i, j, and k.</p> <p>P. 9 changed “harmful employee exposures” to “employees injured by lasers”</p> <p>P. 10 added definitions for custodian, user, and Safe Operating Procedure.</p> <p>1.1 Moved “Safe Operating Procedure” to P.10</p> <p>Reorganized Section 1 Roles and Responsibilities, from alphabetical listing to a top-down hierarchy.</p> <p>1. RSC, added the Laser Safety Subcommittee to the RSC.</p> <p>2.a Classification of lasers, moved to custodian responsibility</p> <p>2.c Laser Radiation Source approval moved to 1.0 RSC and 1.0 Custodian to better define the process.</p> <p>2.d Laser Radiation Source Personnel Approval moved to 1.0 RSC and 1.0 Custodian to better define the process.</p> <p>2.e User Certification moved to 1.0 User section</p> <p>3.0 Training Requirements moved to Appendix A</p> <p>4.0 Baseline and Termination Eye Examinations moved to 1.0 User</p> <p>5.a deleted</p> <p>5.b moved to 1.0 LSO</p> <p>Section 6 renumbered Section 3</p> <p>Section 8 renumbered Section 4</p> <p>Section 9 renumbered Section 5</p> <p>Section 10 renumbered Section 6</p> <p>Added Appendix B, Mishap reporting requirements</p>

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B	04/02/10	<p>Administratively revised to update the Responsible Office Code, Organization Title and organization name within the document.</p> <p>Administratively extended for 1 year from original expiration date.</p>
C	09/26/11	<p>Table of Contents was added with each section numbered.</p> <p>References: Removed FAA internal documents that have no authority over GSFC operations</p> <p>Added GSFC Form 23-75 Environmental Checklist</p> <p>P.8 Updated Records custodian information to clarify the custodian</p> <p>Section 1: Established the Non-ionizing Radiation Safety Committee (NIRSC) and clarified their roles and responsibilities</p> <p>Section 1: Approved Users – updated the eye examination requirements</p> <p>Section 1: Environmental Planning and Impact Assessment for Laser Projects – added this section to identify requirements to coordinate with the Medical & Environmental Management Division, Code 250</p> <p>Section 2: Updated information on the process to get approval for users and uses of lasers on GSFC</p> <p>Section 3: Outdoor Laser Operations – clarified coordination requirements with organizations outside GSFC (i.e. the FAA or Space Command)</p> <p>Appendix C – Training: Clarified training requirements and responsibilities.</p>
D	11/30/17	<p>Revisions to the document were made to bring it current with current organization structure and procedures.</p>

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