



## Goddard Procedural Requirements (GPR)

<b>DIRECTIVE NO.</b>	<u>GPR 8834.1</u>	<b>APPROVED BY Signature:</b>	<u><i>Original Signed by</i> <i>D. Perkins for</i></u>
<b>EFFECTIVE DATE:</b>	<u>August 8, 2006</u>	<b>NAME:</b>	<u>Edward J. Weiler</u>
<b>EXPIRATION DATE:</b>	<u>August 8, 2011</u>	<b>TITLE:</b>	<u>Director</u>

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### COMPLIANCE IS MANDATORY

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**Responsible Office:** 540/Mechanical Systems Division

**Title:** Lifting Operations Requirements

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## PREFACE

### P.1 PURPOSE

The purpose of this GPR is to define the process, requirements, and responsibilities for conducting safe lifting operations at Goddard Space Flight Center (GSFC) and at applicable contractor sites.

### P.2 APPLICABILITY

- a. This directive is applicable to all operations associated with Lifting Devices and Equipment (LDE), including rented or leased LDE, at Greenbelt, Wallops Flight Facility (WFF), and other areas under GSFC cognizance unless specifically excluded by this directive. It also applies to institutional lifts, manual lifts, and lifts under privatization agreements.
- b. When invoked as a contractual requirement, this directive is applicable to lifting operations at contractor installations supporting GSFC activities.
- c. Lifting operations under privatization clauses shall be subjected to the provisions of this directive to the extent provided by the contract, and the requirements shall be clearly specified therein.
- d. The responsible Contracting Officer and the Project Manager shall apply selected requirements of this directive to any contractor, tenant, or customer if non-NASA lifting operations place NASA personnel, facilities, or equipment at risk.
- e. Tenants and their contract personnel operating in facilities exclusively used for non-NASA operations and controlled by the tenant under a Center-level agreement are excluded from this directive.
- f. This directive does not apply to contractor lifting operations on-site using contractor-provided LDE which are exclusively associated with facility or equipment repair, maintenance, modification, installation, removal, or construction activities. If there is risk to NASA personnel, facilities, or equipment, organizations procuring this type of support shall require the contractor to submit a Safety Plan that describes the lifting operations and procedures, the OSHA standards to be followed,

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and other special analyses or safeguards needed. The approved Safety Plan shall be a part of the contract.

### **P.3 AUTHORITY**

NASA-STD-8719.9, Standard for Lifting Devices and Equipment

### **P.4 REFERENCES**

- a. OSHA 1910.135(a)(1), Head Protection
- b. [NPR 8715.3](#), NASA Safety Manual
- c. [GPR 1410.2](#), Configuration Management
- d. [GPR 5330.1](#), Product Processing, Inspection and Test
- e. [GPR 5340.2](#), Control of Nonconformances
- f. [GPR 8621.1](#), Reporting of Mishaps and Close Calls
- g. [GPR 8719.1](#), Certification and Recertification of Lifting Devices and Equipment
- h. GSFC WM-001, Workmanship Manual for Electrostatic Discharge (ESD) Control
- i. Department of Health and Human Services (DHHS) / National Institute for Occupational Safety and Health (NIOSH) Publication No. 94-110, Applications Manual for the Revised NIOSH Lifting Equation

### **P.5 CANCELLATION**

None

### **P.6 SAFETY**

Safety requirements are described throughout this GPR, as appropriate.

### **P.7 TRAINING**

Supervisors shall ensure that:

- a. Personnel involved in manual lifts are trained or briefed on proper lifting techniques;
- b. All individuals designated to participate in a lifting operation are qualified to perform their role safely and effectively, based on training, prior experience, and physical ability to do the operation. This includes designated observers, safety representatives, LDE operators, communicators, and all other participants; and
- c. LDE Operators are trained and qualified/certified in accordance with GPR 8719.1 for the type of lifting operations required, and that training and certifications are current.

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## P.8 RECORDS

Record Title	Record Custodian	Retention
Critical Lift Procedure(s) and completed checklists	Project Office	* NRRS 8/103: <u>Temporary</u> . Destroy/delete between 5 and 30 years after program/project termination.
Stress/Stability Analyses	Project Office	* NRRS 8/103
Other User documents (e.g., technical interface information, analyses, problem records, and other relevant lift-specific information)	Project Office	* NRRS 8/103

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

Contractors generating records as required by this procedure shall retain the records and turn them over to NASA as specified in the contract.

## P.9 METRICS

Deficiencies, incidents, or mishaps related to lifting operations, excluding the LDE, shall be documented in accordance with GPR 5340.2 and/or GPR 8621.1. Records shall be analyzed by the applicable safety office semiannually for trends and continual improvement.

## P.10 DEFINITIONS

Most of the terms used in this directive are defined in NPR 8715.3, NASA-STD-8719.9, and GPR 8719.1. Those that are unique or essential to this directive are listed below.

- a. Certified – An individual who has documented evidence that he/she has completed required training, and has specific knowledge or proficiency in a skill has been demonstrated, documented, and approved by an accepted authority. Certification expires after a specified time period and must be renewed to remain current. Certification, in the context of this GPR, requires approval by the RECERT Manager.
- b. Critical Hardware – Hardware whose loss would have serious programmatic or institutional impact, and that has been identified by the installation, directorate, or project as being critical.
- c. Critical Lift Coordinator (CLC) – An individual who is assigned to direct and give instructions to the crane operator during critical crane operations due to specific project requirements, and who has obtained the necessary training and is certified by the RECERT Manager. The CLC is an optional position, used only when a project desires to have its own lifting “expert.” The role of the CLC shall be specified in the Critical Lift Procedure.

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- d. Critical Lift Procedure – A specific step-by-step procedure to be followed by the lift team to perform a Critical Lift operation. The procedure also defines the roles and responsibilities of all lift team members, and pertinent items to be verified prior to the lift. See Section 3.3.
- e. Customer – A non-NASA, government or private sector entity or organization that owns, sponsors, or otherwise champions a project brought onto GSFC property by a current NASA contractor exercising a contractual provision permitting such an arrangement for the purposes of utilizing NASA facilities and/or test equipment on a lease or rental basis.
- f. Flight Hardware – Hardware designed and fabricated for ultimate use in a vehicle intended to fly.
- g. Hazardous Operating Procedures (HOPs) – detailed, documented procedures listing step-by-step functions or tasks to be performed on a system or equipment to ensure safe and efficient operations. HOPs may address such topics as special precautions, start and stop times or conditions, necessary sequences of steps, approving official(s) etc.
- h. Institutional Lift – A lift performed as part of the day-to-day operations of the Center, such as lifting a section of pipe or moving a pallet of office supplies. It is not a manual lift, although a manual lift may be included as part of an institutional lift. NOTE: an Institutional Lift can also be classified as “critical,” depending on the hardware involved.
- i. LDE Operator Certification – The documented status of LDE operators validating that they are trained and qualified in accordance with NASA-STD-8719.9 and GPR 8719.1, and certified by the RECERT Manager at Greenbelt or the Deputy RECERT Manager at Wallops.
- j. Lift Categories – the category of lifting operations determines the number and qualifications of personnel involved, documentation requirements, and safety requirements. The following categories of lifts are addressed:
  - (1) Critical Lift – A lift where failure/loss of control could result in loss of life, loss of or damage to critical hardware, or a lift involving special high-dollar items such as program-critical flight hardware, one-of-a-kind articles, or major facility components whose loss would have serious programmatic or institutional impact. Operations involving the lifting of personnel with a crane, lifting of loads over personnel, lifting of pressurized containers, or lifting of containers of hazardous materials shall always be defined as critical lifts (See NASA-STD-8719.9). Operations with special personnel and equipment safety concerns beyond normal lifting hazards may also be designated as critical.
  - (2) Non-Critical Lift – A lift involving routine lifting operations governed by standard industry rules and practices except as supplemented with unique NASA testing, operations, maintenance, inspection, and personnel licensing requirements contained in NASA-STD-8719.9 and this directive.

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- k. Lifting Devices and Equipment (LDE) – The collective term that includes both Lifting Devices and Lifting Equipment. Lifting Devices are machines such as overhead and gantry cranes (including top running, monorail, underhung, and jib cranes), mobile cranes, derricks, gantries, hoists, winches, special hoist-supported personnel lifting devices, hydra-sets, mobile aerial platforms, powered industrial trucks, and jacks. Lifting Equipment includes the slings and sling assemblies, strongbacks, shackles, load-measuring devices, and hardware components used to attach the load(s) to the lifting device(s).
- l. Manual Lift – A lift where a person lifts, holds, and/or moves an item.
- m. Mechanical Lift – A lift that employs the use of equipment (e.g., crane, chain fall, fork lift, etc.) to raise, lower, or move loads.
- n. Person in Charge (PIC) – The individual in charge of the operation. It may be the I&T Manager, Lead Engineer, LDE Operator, the Rigger, the CLC, or other individual as designated in the critical lift or other applicable procedure.
- o. Personal Protective Equipment – safety equipment such as hard hats, goggles, steel-toed shoes, etc.
- p. Pre-lift Briefing – A briefing of involved personnel held prior to the commencement of a critical lift or other designated lift.
- q. RECERT – an established GSFC process that provides certification and recertification expertise, management, and oversight for lifting devices and equipment at GSFC or by GSFC contractors (see P.2). The RECERT manager has overall responsibility for RECERT functions. The processes of certification/recertification of LDE and operators are described in GPR 8719.1.
- r. Rigger – An individual who selects and attaches lifting equipment to an item to be lifted. At GSFC, a rigger is a certified LDE operator.
- s. Safety Representative – An individual who is selected to make judgments concerning personnel, equipment, or systems safety. The safety representative shall be qualified on the basis of a certificate, professional standing, and/or demonstrated competence in the types of lifts he/she takes part in. The Safety Representative shall be selected by mutual agreement of the Lifting Service Provider (LSP) and User, who together determine the necessary qualifications for the assigned task.
- t. Tenant – A non-NASA entity or organization that has obtained GSFC’s permission to reside on Center. The entity or organization has total control of, and responsibility for, its own operations and activities within the agreed-upon boundaries, as long as NASA personnel or property are not put at risk.

## P.11 ACRONYMS

CG	Center of Gravity
CLC	Critical Lift Coordinator

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DHHS	Department of Health and Human Services
EED	Electro-Explosive Device
ESD	Electrostatic Discharge
FOM	Facility Operations Manager
GSFC	Goddard Space Flight Center
HOP	Hazardous Operating Procedures
LDE	Lifting Devices and Equipment
LSP	Lifting Service Provider
NIOSH	National Institute for Occupational Safety and Health
PPE	Personal Protective Equipment
PIC	Person In Charge
QA	Quality Assurance
RECERT	Recertification Program
WFF	Wallops Flight Facility
WOA	Work Order Authorization

## 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.”

This directive establishes GSFC requirements for lifting operations. It complements NASA-STD-8719.9 to ensure the safety of all personnel and equipment involved in lifting operations at all levels of complexity.

For use at a contractor’s facility, the requirements of this directive may be tailored and reissued as a project document and controlled in accordance with GPR 1410.2, and invoked in the applicable contract(s).

### 1.0 RESPONSIBILITIES

**1.1 Lifting Service Provider** (LSP) is the organization that provides a lifting service to a user, and is usually the owner/operator of the facility where the lift service is performed. The LSP may provide their own LDE and/or operators, or task supporting organizations or contractors to provide LDE and/or operators. The LSP shall be responsible for the following:

- a. Ensuring that LDE operators and supporting personnel are properly designated, authorized, trained, and certified (see GPR 8719.1) at the time lifting operations are performed;
- b. Ensuring that lift procedures and checklists, when needed (see Section 3.1), are available and understood for lifting operations;
- c. Ensuring that deficient LDE or other lifting equipment that is removed from service is locked-out or tagged out-of-service, and that RECERT is promptly notified;
- d. Coordinating outages for load testing and inspections of lifting devices with RECERT to minimize conflicts with ongoing operations;

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- e. Supporting Lifting Service Users in determining whether their lifting operation(s) is critical or non-critical;
- f. Providing lifting devices and/or lifting equipment, when requested by the Lifting Services User, appropriate for the lifting operation, i.e., certified for critical (and non-critical) lifts, or certified for non-critical lifts only;
- g. Notifying the Facility Operations Manager (FOM) of any operations that may have unusual hazards or safety implications (see 1.10); and
- h. Safe conduct of all lifting operations.

For **Critical Lifts**, the LSP shall also:

- i. Provide expert advice and assistance on lifting operations;
- j. Support the User in developing the Critical Lift Procedure(s) for User equipment;
- k. Ensure that all required LDE and associated tools are available, in correct operating condition, and certified as required;
- l. Review and verify lift and critical lift procedures with the User prior to the lift operation; and
- m. Certify, to the User, that all above requirements have been met prior to the lift operation.

## **1.2 Lifting Service User**

Lifting Service Users (hereinafter referred to as “User”) are ultimately responsible for their hardware, and therefore have key responsibilities in lifting operations. Users shall coordinate closely with the LSP for the conduct of lifting operations that affect their hardware.

Many Users are flight projects that use special lifting devices or fixtures and require specialized engineering support. They may provide their own lifting equipment and/or operators, or task supporting organizations or contractors to provide equipment and/or operators.

Users shall be responsible for the following, for all lifting operations of their hardware:

- a. Determining the category of lifts for their hardware, i.e., critical or non-critical, so that compliance requirements for lifting operations can be established. In making this determination, input shall be obtained from the LSP, the applicable safety organization(s), and facility personnel (if appropriate);
- b. Developing or ensuring availability of lifting procedures and HOPs that ensure the safety of their personnel and hardware (see Section 3.1);
- c. Designating a Person In Charge with the responsibilities described in 1.4 below;
- d. Developing and approving Critical Lift Procedure(s) prior to beginning lift operations, and concurring with changes during the lift;
- e. Verifying that the LSP’s LDE and operators have current certifications as required by GPR 8719.1 for the type of lifting operations required;
- f. Ensuring that all applicable safety analyses or assessments are completed and are sufficient per the requirements of NASA-STD-8719.9, and that lift points are above the established Center of Gravity (CG);
- g. Providing engineering support as needed by the LSP for User hardware;
- h. Providing for appropriate Safety Representative support as described in Section 1.5;



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- i. Providing Work Order Authorization(s) (WOAs) as required by GPR 5330.1;
- j. Notifying the FOM of any operations that may have unusual hazards or safety implications (see 1.10);
- k. Stopping lifting operations in the event of an actual or reported failure or unsafe condition;
- l. Providing concurrence to resume operations once failures or unsafe conditions are corrected; and
- m. Safe conduct of all lifting operations.

### **1.3 Program and Project Managers shall:**

- a. Determine the applicability of NASA-STD-8719.9 and this procedure to off-site contractors, and ensure that sufficient requirements are invoked in the contracts; and
- b. Ensure their projects support all lifting operations as described herein.

**1.4 Person In Charge (PIC)** shall take overall responsibility for the conduct of the lifting operation. He/she shall be from the User organization or the LSP, and may be an I&T Manager, Lead Engineer, LDE Operator, the Rigger, a Critical Lift Coordinator (CLC), or any other individual selected and specified in the critical lift or other applicable procedure. The PIC shall:

- a. Ensure that all involved parties meet the lift requirements;
- b. Ensure that all tools and equipment are adequate for the lift requirements;
- c. For any critical lift, or for any lift determined by the LSP or User to need a pre-lift briefing and walk-through, conduct a pre-lift briefing/walk-through with all required participants. See Section 2.3.
- d. Manage the lifting operation.
- e. Ensure that adequate communications and direction are available, particularly for the LDE operator(s).

### **1.5 Safety Representative(s)**

The qualified safety representative(s) shall be responsible for the following:

- a. Maintaining qualification in terms of competence, experience, training, etc.
- b. Verifying that all applicable safety analyses or assessments are completed in accordance with requirements of NASA-STD-8719.9;
- c. Advising all personnel involved in the lifting operations of any additional hazard(s) and appropriate methods of hazard control prior to and throughout the entire lifting operation;
- d. Verifying that Incident/Mishap Reports are initiated and submitted in accordance with this document and the requirements of GPR 8621.1;
- e. Providing input to the User in the designation of lifting operations as critical or non-critical;
- f. Reviewing and approving all critical lift procedures, HOPs, and WOAs pertaining to critical lifting operations;
- g. Ensuring appropriate hazard controls have been addressed in the HOPs and/or WOAs;
- h. Ensuring that the lifting operation adheres to this directive and all applicable NASA, OSHA, and processing facility safety regulations (where appropriate);

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- i. Providing concurrence to proceed with a hazardous lifting operation and, upon completion, concurrence to open the controlled area and resume normal operations; and
- j. Reviewing and concurring with project-initiated safety variance requests (see GPR 8719.1) prior to submittal to the RECERT Manager.

**1.6 Lift Team Members shall:**

- a. Participate in Pre-Lift Briefings as described in Section 2.3,
- b. Understand their roles and the roles of other lift team members for a given operation;
- c. Ensure that they fully understand all applicable procedures and safety requirements; and
- d. Wear the appropriate Personal Protective Equipment (PPE).

**1.7 Safety and Environmental Division at Greenbelt and the Safety Office at Wallops shall:**

- a. Provide oversight for Center industrial or institutional lifting operations for compliance with GSFC, NASA, and OSHA requirements;
- b. Monitor compliance of institutional lifting operations and operators to the requirements herein; and
- c. Monitor compliance to institutional safety requirements.

**1.8 RECERT Manager shall, in addition to the responsibilities described in GPR 8719.1, be responsible for:**

- a. All RECERT functions described herein; and
- b. Reviewing and concurring with safety variance requests prior to the originator's submittal to the Goddard Safety Council and Center Director for approval.

**1.9 Deputy RECERT Manager. The Deputy RECERT Manager shall serve as the RECERT Manager's alternate and represent the RECERT Manager at WFF for day-to-day operations.**

**1.10 Building Facility Operations Manager (FOM). FOMs are responsible for notifying building occupants of potential safety hazards in and around facilities under their cognizance. When notified by the LSP or User of a lifting operation with unusual hazards or safety implications (i.e., potential to affect occupants beyond the immediate lift area), he/she shall review the proposed lifting operations and concur prior to commencing the lifting operation(s).**

**1.11 Certified Critical Lift Coordinator (CLC). CLCs shall be responsible for:**

- a. Maintaining current certification as required by GPR 8719.1;
- b. Coordinating the preparation and execution of the lift(s) with the PIC; and
- c. When indicated in the Critical Lift Procedure, directing and commanding the lifting operation for their organization's hardware.

**1.12 All Personnel. Every individual involved in or observing a lifting operation shall be responsible for calling a stop to the lifting operation in the event of a failure or unsafe condition.**

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## 2.0 REQUIREMENTS

### 2.1 General Requirements for All Lifting Operations

#### 2.1.1 Suspended load operations

Suspended load operations, as defined in NASA-STD-8719.9, are discouraged at GSFC. However, if a suspended load operation must be conducted, the operation shall be in compliance with NASA-STD-8719.9. Prior to any suspended load operation, the operation shall be documented and coordinated through the RECERT Manager, and the RECERT Manager shall, in turn, consult with NASA HQ Office of Safety and Mission Assurance for guidance and concurrence.

#### 2.1.2 Prior to any lifting operation:

- a. The LDE operator shall:
  - (1) Perform the required daily inspection on all LDE in accordance with NASA-STD-8719.9, manufacturers recommendations, and GSFC procedures;
  - (2) Ensure appropriate PPE (e.g., hard hats, eye protection, etc.) are available; and
  - (3) Verify the load's weight and the location of the CG.
- b. The PIC shall:
  - (3) Ensure that all LDE are certified as described in GPR 8719.1 for the category of lift to be performed;
  - (4) Ensure that all operators and riggers involved in the lift are certified for the category of lift to be performed;
  - (5) Analyze the lift for all unmitigated hazards including lift stability.

#### 2.1.3 General operating requirements

- a. Refer to the appropriate Chapter of NASA-STD-8719.9 for the operational requirements for the type of lifting devices and/or equipment being used and follow those requirements.
- b. For other lifting or handling equipment not covered by NASA-STD-8719.9, consult and follow the equipment manufacturers' recommendations with documented concurrence from the applicable safety representative.

#### 2.1.4 Loads Containing Components Sensitive to Electrostatic Discharge (ESD)

The User shall be responsible for ESD protection of the load. The User shall address and coordinate ESD protection with the LSP to ensure that the ESD requirements of the load are fully understood and protective measures are taken. If special handling requirements are needed to ensure ESD protection, they shall be addressed in documented procedures (see Section 3.1). Procedures shall address and comply with the requirements of NASA-STD-8719.9 and GSFC WM-001.

#### 2.1.5 Loads Containing Explosives or Electro-Explosive Devices (EED's)

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A lifting operation involving loads containing explosives or EEDs shall be classified as critical unless a documented risk assessment is performed that indicates otherwise and is concurred to by responsible user management and the applicable safety representative. If it is indicated as non-critical, it shall be classified as hazardous.

Hazardous lifting operations shall be conducted in accordance with the requirements of sections 4.4 and 6.9 of NPR 8715.3. The requirements of 2.1.3 above shall also apply.

#### 2.1.6 Use of Hard Hats

In accordance with OSHA 1910.135(a)(1), hard hats shall be worn when working in areas where there is a potential for injury to the head from falling objects. However, the use of hard hats introduces the risk of damage to the load from contact with a hard hat. The PIC shall examine each situation and ensure steps are taken to mitigate the risk.

## 2.2 Special Requirements for Critical Lifts

The requirements for critical lifts detailed in NASA-STD 8719.9 shall be followed in their entirety. Appendix A of this directive is a sample checklist for critical lifts. The following specific requirements shall also apply, whether the critical lift is project equipment or otherwise:

- a. Prior to any critical lifting operations, the PIC shall ensure that the lifting equipment is certified per GPR 8719.1 for critical lifts;
- b. Prior to any critical lifting operations, the PIC shall verify the weight and CG location to ensure that the payload maintains stability during the lift;
- c. Prior to any critical lifting operations, the PIC shall ensure that the Critical Lift Procedures are complete and approved as described in Section 3 herein;
- d. Prior to any critical lifting operations, the PIC shall ensure that a pre-lift briefing (see Section 2.3) is held with the lift team, the User's designated representatives, Safety Representatives, and others as appropriate to review the planned lifting operation;
- e. For critical lifts, a single person (NASA or contractor) shall be designated as responsible for the safety of the operation. This shall be the Safety Representative described in Section 1.5;
- f. A Critical Lift shall not commence unless all team members required by the Critical Lift Procedure are present, on station, and have received the pre-lift briefing;
- g. Videotaping of Critical Lifts is encouraged and shall be the User's responsibility;
- h. Certified Critical Lift Coordinators (CLCs) shall be responsible for directing and giving commands to the LDE Operator during a lifting operation if so designated in the Critical Lift Procedure;
  - (1) If the CLC is in charge of the lifting operation, he/she shall instruct all personnel involved in the proper preparation, lifting, and final positioning to be achieved, as part of the pre-lift briefing.
  - (2) Coordination for directing the lifting operation shall be delineated in the Critical Lift Procedure and emphasized in the pre-lift briefing.

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- (3) Any transfer of responsibility for directing the lifting operation (e.g., from CLC to the rigger/crane operator and vice versa) shall be identified in the Critical Lift Procedure and emphasized in the pre-lift briefing.
- (4) A CLC shall not perform rigging activities or hands-on operation of lifting devices.

### 2.3 Requirements for a Pre-Lift Briefing

A pre-lift briefing shall be performed whenever more than one person is involved in the activity, whenever a lift is considered critical, or whenever the PIC, a Safety Representative, or a supervisor in the LSP or User organizations requests one. In these cases, the briefing shall be conducted, regardless of familiarization/experience of those performing the task/operation. The pre-lift briefing is generally useful for all but the most routine operations, and is primarily aimed at ensuring the safety and coordination of the personnel and equipment involved.

2.3.1 The pre-lift briefing shall be conducted prior to beginning lifting operations, and shall involve all personnel having a role in the operation. When Lift Team members arrive after the lift has begun, such as when a shift change occurs, the PIC shall brief the incoming personnel sufficiently to ensure that they fully understand their roles, the task(s) to be performed, and all relevant elements of the pre-lift briefing.

2.3.2 The PIC normally conducts the pre-lift briefing, although he/she may delegate this responsibility.

2.3.3 Before the Pre-Lift Briefing, the PIC shall:

- a. Check weather forecast and/or storm code panel (if applicable) for adverse conditions that could potentially affect the Lift;
- b. Check LDE for proper criticality category and certification; and
- c. Check LDE log book(s) to ensure that there are no outstanding deficiencies.
- d. Ensure that any required lift procedures and WOAs have been approved and signed off with all required signatures;
- e. Verify that any required lift stability analyses, HOPs, stress analyses, etc. are completed and available;
- f. Ensure that the CG and total weight of the load to be lifted are known and documented; and
- g. Ensure that all 2-way radios to be used during lifting operations are fully charged and functioning properly, and verify that the operation of the radios does not produce radio interference with other equipment in the vicinity.

2.3.4 The Pre-Lift Briefing shall include, as a minimum, the following:

- a. Ensure that all Lift Team members are present;
- b. Ensure that all Lift Team members understand their roles and responsibilities;
- c. Perform a step-by-step review of the lifting operation;
- d. Explain the hardware to be lifted, associated Ground Support Equipment, configuration of lifting equipment, and associated hazards;
- e. Ensure that all Lift Team members understand the PPE requirements and are prepared to meet them;
- f. Review any applicable safety requirements or procedures; and

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g. Emphasize that safety is the primary consideration during the lift.

## 2.4 Institutional Lifts

Institutional lifts are those types of lifts performed frequently and repetitively, often on a daily basis, and normally involve activities such as construction or maintenance, handling of shop materials, and other routine activities involved in the normal operation of the Center. In general, the LDE consists of cranes, fork lifts, powered pallet jacks, and other material-handling equipment.

Supervisors shall ensure that LDE operators performing institutional lifts are trained in the safe operation of the LDE in use, and certified or otherwise qualified as defined in GPR 8719.1. Supervisors shall also ensure that any special procedures necessary to protect personnel or high-value equipment are available.

If an institutional lift is determined to be a Critical Lift, Section 2.2 shall apply.

## 2.5 Manual Lifts

This section applies to those cases where one or more individuals manually supports or moves a load, with or without LDE. Manual lifts may range in complexity from handling a light-weight item of equipment to supporting an item of space flight hardware while LDE is repositioned. Operations as simple as helping someone move an item of office equipment are considered manual lifts.

2.5.1 The following safe lifting and handling load limits shall apply for each manual critical lift:

- a. 35 lbs of manageable shape and size for one person;
- b. 75 lbs of manageable shape and size for two people;
- c. 100 lbs of manageable shape and size for three people;
- d. No manual lift shall be performed for a load exceeding 100 lbs unless written concurrence from a qualified safety representative has been obtained; and
- e. All lifts shall be within limits of comfortable balance and control.

Supervisors shall determine and document weight limits for manual non-critical lifts. In making this determination, supervisors shall consider the guidelines of DHHS (NIOSH) Publication No. 94-110, Applications Manual for the Revised NIOSH Lifting Equation.

2.5.2 The following rules shall apply whenever performing a manual lift. These rules may be tailored based on the situation, but shall not compromise personnel or equipment safety or permit undue risk.

- a. Plan and walk through the entire lift prior to commencing the lifting operation;
- b. Visually inspect the area to identify any tripping hazards and remove them, if possible, prior to starting. If a trip hazard cannot be moved prior to starting, a spotter shall be used to guide the individual(s) performing the lift when approaching the hazard;
- c. Clear work area and translation path of personnel not involved in the lifting operation;



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- d. Pick up the load correctly to avoid injury. Minimize unnecessary bending, twisting, and lifting above the shoulders;
- e. Make use of mechanical devices such as portable carts or dollies whenever possible. Inspect carts and dollies for any damage before use, and verify the device has a suitable load rating for the item to be moved;
- f. Ensure that the item being lifted can be handled manually without injury to personnel or damage to the hardware and/or facility;
- g. Ensure that a firm grip can be maintained from the beginning to the end of the lift;
- h. Ensure that the load destination is clear of obstacles and provides a stable base to support the load;
- i. When in doubt, STOP! Contact the appropriate safety representative or safety organization.

2.5.3 If a manual lift is considered complex, and high-value equipment and/or safety are at risk, a procedure and/or WOA shall be written and followed as required in Section 3.0. If the manual lift is considered a Critical Lift, Quality Assurance (QA) witnessing is required, but Safety witnessing is not. Manual lifts of small, light-weight critical items, such as circuit board panels, do not require QA or Safety witnessing.

2.5.4 Manual lifts of small, light-weight critical items, such as circuit board panels, do not require all the safeguards described above. Other requirements may be determined by the supervisor or project manager. In such cases, supervisors or project managers shall be responsible to ensure that there is no compromise of safety to the personnel or equipment.

### 3. DOCUMENTED PROCEDURES

#### 3.1 When are they needed?

Documented procedures shall be prepared, when required, for lifting operations as defined below. Procedures shall not rely on personnel to stabilize or support any portion of a load that exceeds the manual lift limits in 2.5.1, even in conjunction with LDE.

- a. Work Order Authorizations shall be processed and approved for project lifts as defined in GPR 5330.1.
- b. Procedures for routine, non-critical lifts shall be available and may be generic and non-lift-specific. The requirement may be satisfied by adherence to overall standards, generic lifting procedures, standard operating procedures, and/or original equipment manufacturer's operating instructions, augmented by operator training and certification.
- c. Procedures for non-routine, non-critical lifts, such as a lift involving an unusually configured load with an off-center CG, shall require a stress/stability analysis and lift procedure prior to commencement of the lifting operation(s). The PIC shall determine the degree of detail and approvals required. Normally, these procedures may be similar to those described in 3.1.b, with additional detail added for non-routine situations.
- d. HOPs shall be required for all procedures involving unusual hazards. HOPs may be stand-alone or incorporated in the body of other procedures. HOPs shall be in accordance with NPR 8715.3.



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- e. Checklists are very effective, and their use is encouraged. Checklists for key items of LDE can reduce the work involved in producing procedures. A sample checklist for a critical lifting operation is given in Appendix A. A sample checklist for a non-critical lifting operation is given in Appendix B. Other checklists should list detailed steps in the operation.
- f. Institutional lift procedures are usually as described in 3.1.b and 3.1.c. Supervisors shall ensure that adequate procedures are available, and shall produce a lifting procedure and perform a pre-lift briefing for lifts having an unusual level of risk.
- g. Critical Lift Procedures shall be developed for each critical lifting operation, except as provided in 2.5.4.

The following table serves as a guideline for determining need for lift procedures.

<b>Criticality</b>	<b>Type</b>	<b>Description</b>	<b>Lift Procedure Needed?</b>
Non-Critical	Mechanical	Simple or routine	No
Non-Critical	Mechanical	Non-routine or complex	Yes
Non-Critical	Mechanical	Institutional with no risks except those inherent in any lifting operation	No
Non-Critical	Mechanical	Institutional with risks in addition to those inherent in any lifting operation	Yes
Non-Critical	Manual	Simple	No
Non-Critical	Manual	Complex	Yes
Non-Critical	Manual	High dollar	Yes
Non-Critical	Manual	Safety risk	Yes
Critical	All	All (see 3.1.g)	Yes

### 3.2 Non-Critical Lift Procedures

Procedures, when required (see Section 3.1), shall be available for all LDE citing general operating instructions, operator certification or training requirements, equipment certification requirements, and other information needed to ensure safe performance of lifting operations. Procedures may be generic, and may apply to multiple types of lifts for a given facility or LDE. These procedures need not be lift-specific. They should be sufficient to ensure safe handling of lifted and lifting equipment, ensure operator safety, and minimize or eliminate risk (Ref: NASA-STD-8719.9).

### 3.3 Critical Lift Procedures

Critical Lift Procedures are primarily the responsibility of the User, but the LSP shall participate and concur in the procedure before the lifting operation. The procedures shall address the following:

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- a. Description of the lift operation, location, and LDE to be used, including defining the safety keep-out zone for the operation;
- b. Description of the means of communications to be used;
- c. Identification of lift team members, their roles, and responsibilities;
- d. Degree and makeup of safety and mission assurance coverage;
- e. Sequential operational requirements;
- f. HOPs;
- g. Checklists and other required documents;
- h. Emergency and contingency procedures (e.g., fire, power outage, lifting during an electrical storm, under windy conditions for outdoor lifts, etc.);
- i. Special requirements for ESD, EEDs, and explosives;
- j. PPE;
- k. Contamination control requirements;
- l. Checklists of required documentation;
- m. Stability analyses, stress analyses, and any other analyses determined by the LSP or User to be needed before the lift;
- n. Procedures for making and approving changes to the procedure after it has been approved; and
- o. Photo or videotape requirements.

As a minimum, the Critical Lift Procedure shall be reviewed and approved by the LSP, User, Safety Representative, the PIC, and others deemed appropriate.

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## **APPENDIX A SAMPLE CHECKLIST FOR CRITICAL LIFTING OPERATIONS**

1. Ensure that all the Lift Team members are present.
2. Ensure that the Lift Procedure has been approved and signed off for all signature blocks.
3. Ensure that the required Lift Stability Analysis, HOP, Stress Analysis, etc. are completed.
4. Ensure that the CG and total weight of load to be lifted are known and documented.
5. If 2-way radios are to be used during lifting operations, ensure that all units are fully charged and functioning properly, and verify that the operation of the radios does not produce radio interference with other equipment in the vicinity.
6. Ensure that all Team members are wearing appropriate PPE.
7. Check weather forecast and/or storm code panel (if applicable) for adverse conditions that could potentially affect the Lift.
8. Ensure that LDE is certified for critical lifts.
9. Ensure that the LDE Operator is certified for Critical Lifting.
10. Check LDE Log Book to ensure that there are no outstanding deficiencies.
11. Conduct a Pre-Lift Briefing

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## **APPENDIX B SAMPLE CHECKLIST FOR NON-CRITICAL LIFTING OPERATIONS**

1. Determine whether the lift is simple or complex.
  - a. If the lift is simple and routine, the lift may be performed following industrial standards and practices, general guidelines, and operator training.
  - b. If the lift is complex and/or involves an unusual load configuration with an off-center CG, the PIC shall require that a stress/stability analysis and a lift procedure be developed and approved prior to the lifting operations. Also consider the following, as appropriate:
    - (1) Ensure that all Lift Team members are present.
    - (2) Ensure that the Lift Procedure has been approved and signed off for all signature blocks.
    - (3) Ensure that the required stress/stability analysis is completed.
    - (4) Ensure that the CG and total weight of load to be lifted are known and documented
    - (5) If 2-way radios are to be used during lifting operations, ensure that all units are fully charged and functioning properly, and verify that the operation of the radios does not produce radio interference with other equipment in the vicinity.
    - (6) Ensure that all Team members are wearing appropriate PPE.
    - (7) Check weather forecast and/or storm code panel (if applicable) for adverse conditions that could potentially affect the Lift.
2. Check LDE for valid certification.
3. Check LDE Log Book to ensure that there are no outstanding deficiencies.
4. Verify that the LDE operator's certification is valid.

