



# LAUNCH AND RECOVERY SYSTEMS OPERATING PROCEDURE

**TITLE:** SUSPENDED LOAD OPERATIONS ANALYSIS/  
APPROVAL

**No.:** USA004677  
**Rev.:** 5

**POLICYMAKER:** SAFETY, QUALITY, AND MISSION  
ASSURANCE

**Date:** 05/18/2009  
**Page:** 1 of 10

## 1. PURPOSE AND SCOPE

This Operating Procedure (OP) implements the requirements of the NASA Alternate Safety Standard for Suspended Load Operations for the Space Program Operations Contract (SPOC).

## 2. APPLICABILITY

This OP is applicable to United Space Alliance (USA) Kennedy Space Center (KSC), Cape Canaveral Air Force Station (CCAFS), NASA Shuttle Logistics Depot (NSLD), Dryden Flight Research Center (DFRC), and White Sands Test Facility (WSTF) personnel and other USA personnel with Florida duty assignments.

## 3. REQUIREMENTS

*Note: This OP has no USA parent document.*

- a. The approval that allows personnel to perform work beneath a suspended load is to be documented in a Suspended Load Operations Analysis/Approval (SLOAA) package as specified in Kennedy NASA Procedural Requirements (KNPR) 8715.3. The SLOAA package follows the format required by the NASA Alternate Safety Standard for Suspended Load Operations. The NASA Alternate Safety Standard for Suspended Load Operations was approved by the Occupational Safety and Health Administration (OSHA) as an alternative to specific OSHA suspended load requirements.
- b. A SLOAA package is to be compiled for each suspended load operation, to include the Approval Sheet for Suspended Load Operations (reference Appendix A), SLOAA report (reference Appendix B), and any other supporting data.
- c. The last page of the SLOAA package is to be signed by the NASA KSC Safety and Mission Assurance Shuttle Division Chief (SA-B). The first-time use of a crane/hoist that is identified as having a Single Failure Point (SFP) *whose failure would result in dropping the load during* a suspended load operation must be approved by NASA Headquarters Office of Safety and Mission Assurance.
- d. For requests which result from Interim Problem Report (IPR), Problem Report (PR), or Discrepancy Report (DR) dispositions, and if the current SLOAA package covers the suspended load operation, a new SLOAA package is not required. If the operation is not covered by a current SLOAA package, a SLOAA package is to be generated.

## 4. RESPONSIBILITIES

Not applicable

## 5. PROCEDURE

### 5.1 ORGANIZATIONS REQUESTING SLOAA

- a. For normal-time requests:
  1. Prepare SLOAA package consisting of:
    - a) Approval Sheet for Suspended Load Operations
    - b) SLOAA report
  2. Provide the following signatures:
    - a) Requester
    - b) USA and NASA system engineers
  3. Submit the SLOAA package to the appropriate element safety organization for review and evaluation. For SLOAAs that affect:
    - a) Ground *operations*, submit the SLOAA package to Mission Assurance.
    - b) Solid Rocket Booster (SRB) *operations*, submit the SLOAA package to *Mission Assurance's* Operational and System Safety.
    - c) Integrated Logistics (IL), submit the SLOAA package to *USA* Safety and Health Florida.
  4. Maintain the accuracy of SLOAA packages; submit SLOAA package updates through the normal-time request approval process.
- b. For real-time requests:
  1. Prepare SLOAA package consisting of:
    - a) Approval sheet for Suspended Load Operations
    - b) SLOAA report
    - c) Copy of the approved (or proposed) controlling Work Authorization Document (WAD)
  2. Provide the following signatures:
    - a) Requester
    - b) USA and NASA system engineers
    - c) USA and NASA onsite safety representatives
  3. Forward the SLOAA package to the SPOC Safety Console.

### 5.2 MISSION ASSURANCE

- a. For normal-time requests, perform an evaluation of the SLOAA package to ensure its compliance with KNPR 8715.3.
- b. Approve and forward the original SLOAA package to NASA KSC Lifting Devices and Equipment Manager (LDEM) for processing.

- c. Forward a copy of the approved SLOAA package to the requester, USA system engineer, Mission Assurance's Procedures Review, SPOC Safety Console, and onsite safety representative.
- d. Maintain a register and file of SLOAA packages.

### **5.3 OPERATIONAL AND SYSTEM SAFETY**

- a. For normal-time requests, perform an evaluation of the SLOAA package to ensure its compliance with KNPR 8715.3.
- b. Approve and obtain the following signatures:
  - 1. Safety, *Quality*, and *Mission Assurance's (SQ&MA's)* Inspection Manager
  - 2. *SQ&MA* Director
  - 3. NASA Marshall Space Flight Center (MSFC) Resident Office representative
- c. Forward the original SLOAA package to NASA KSC LDEM for processing.
- d. Forward a copy of the approved SLOAA package to the requester and USA system engineer.
- e. Maintain a register and file of SLOAA packages.

### **5.4 USA SAFETY AND HEALTH FLORIDA**

- a. For normal-time requests, perform an evaluation of the SLOAA package to ensure its compliance with KNPR 8715.3.
- b. Approve and forward the original SLOAA package to NASA KSC LDEM for processing.
- c. Forward a copy of the approved SLOAA package to the requester, USA system engineer, and onsite safety representative.
- d. Maintain a register and file of SLOAA packages.

### **5.5 SPOC SAFETY CONSOLE**

- a. For real-time requests, perform an evaluation of the SLOAA package to ensure its compliance with KNPR 8715.3.
- b. Obtain verbal approval from and sign for the following:
  - 1. For SLOAAs that affect *ground operations*:
    - a) USA GO Mission Assurance Manager
    - b) NASA SA-B Division Chief
    - c) NASA KSC LDEM
  - 2. For SLOAAs that affect SRB operations:
    - a) Inspection Manager
    - b) *SQ&MA* Director

- c) NASA MSFC Resident Office representative
  - d) NASA SA-B Division Chief
  - e) NASA KSC LDEM
3. For SLOAAAs that affect IL:
- a) USA Safety and Health Florida Manager
  - b) NASA SA-B Division Chief
  - c) NASA KSC LDEM
- c. Forward a copy of the approved SLOAA package to the requester, element system engineer, *appropriate element safety organization*, and USA and NASA onsite safety representatives.
- d. Forward the original SLOAA package *to the NASA KSC LDEM*.

## 6. DEFINITIONS

**Normal-Time Request.** A suspended load operation request known in advance of the operation.

**Real-Time Request.** A suspended load operation request that is required due to unforeseen circumstances occurring during an operation.

**Suspended Load Operation.** An operation that requires personnel to perform work while beneath a suspended load.

**Suspended Load Operations Analysis/Approval.** An authorization to proceed with a lifting operation where personnel are required to perform work while beneath a suspended load. Used to show analysis and approval to work under a suspended load according to the NASA Alternate Safety Standard for Suspended Load Operations, which is referenced in its entirety in NASA-Standard (STD)-8719.9.

## 7. REFERENCES

Code of Federal Regulation (CFR) Title 29, Labor, Occupational Safety and Health Administration (OSHA) Part 1910, Occupational Safety and Health Standards, Section 179, Overhead and Gantry Cranes, and Section 180, Crawler Locomotive and Truck Cranes

KNPR 8715.3, KSC Safety Practices Procedural Requirements

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

NSTS 22206, Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL)

## 8. FORMS

<u>Form Number</u>	<u>Title</u>	<u>Location</u>
KSC 20-200 NS	Approval Sheet for Suspended Load Operations	KSC Forms
N/A	Nonconformance (used for IPRs, PRs, and DRs)	<i>System generated in iPRACA</i>

*iPRACA = Integrated Problem Reporting and Corrective Action*

**APPENDIX A****APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS  
(KSC 20-200 NS; REV 01/05)**

<b><u>BLOCK</u></b>	<b><u>ENTRY DESCRIPTION</u></b>
SLO-KSC-	Leave blank. (NASA KSC LDEM will provide a control number.)
Title	Provide a brief title of the suspended load task or operation.
Document Number/Title	Document number and title of controlling WAD for the suspended load operation.
Prepared By	Name of requester preparing the form.
Date	Date the requester completed the form.
Required Approval	The appropriate personnel or designee (as outlined in previous sections of this OP) will type or print his/her name and organization and sign and date the form in the appropriate block.

## APPENDIX B FORMAT FOR SLOAA REPORT

### NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL

NUMBER:  
DATE:  
PAGE: \_\_\_\_ OF \_\_\_\_

**OPERATION:** Brief title of the operation being performed.

**SUPPORTING DOCUMENTS:** List of pertinent documents used in the analysis to include the WAD number and title of the controlling work document, System Assurance Analysis (SAA) number and title for the crane/hoist system, and any other attachments.

**GENERAL DESCRIPTION:** Give a thorough description of the operation to be performed and include the number of personnel who will be beneath the suspended load for each task.

**RATIONALE/ANALYSIS:** Address each of the following 15 requirements, which are excerpts from NASA-STD-8719.9 (Safety Standard for Suspended Load Operations section).

- a. All suspended load operations will be approved by the Center/facility NASA Director of Safety based upon a detailed engineering hazard analysis of the operation. The analysis documentation will include the following:
  1. A justification why the operation cannot be conducted without personnel beneath the load. Feasible procedure/design options will be investigated to determine if the work can be accomplished without personnel working under a load suspended from a crane/hoist.
  2. Details of the precautions taken to protect personnel should the load drop. Secondary support systems, i.e., equipment designed to assume support of (catch) the load preventing injury to personnel should the crane/hoist fail, will be evaluated and used whenever feasible. Secondary support systems will be constructed with a minimum safety factor of 2 to yield.
  3. The maximum number of exposed personnel allowed. Steps will be taken to limit the number of personnel working under a load suspended from a crane/hoist. Only those essential personnel absolutely necessary to perform the operation will be allowed to work in the safety-controlled area.
  4. The time of exposure. Steps will be taken to ensure that personnel do not remain under the load any longer than necessary to complete the work.
- b. Each operation will be reviewed on a case-by-case basis.
- c. Only those suspended load operations approved by the Center/facility NASA Director of Safety will be permitted, subject to this standard. A list of approved

suspended load operations will be maintained by NASA Safety and made available to OSHA personnel upon request.

- d. The operational procedures document (e.g., Operations and Maintenance Instruction, Technical Operating Procedure (TOP), WAD, etc.) will be revised to specify the necessary additional requirements identified by the hazard analysis discussed in paragraph a. The procedures will be available on site for inspection during the operation.
- e. During a suspended load operation, if a new procedure not covered by the original analysis is deemed necessary due to unusual or unforeseen circumstances, the NASA Center/facility Safety Office will be consulted and must approve and document the procedure before operations continue. Safety will coordinate with Operations, Engineering, and other organizations as appropriate. If the new procedure is to be performed on a regular basis, a detailed hazard analysis and approval as outlined in paragraph a are required.
- f. The crane/hoist will be designed, tested, inspected, maintained, and operated in accordance with NASA-STD-8719.9.
- g. Each crane/hoist involved in suspended load operations will undergo a Failure Modes and Effects Analysis (FMEA) per NSTS 22206. The FMEA will determine SFPs, assessing all critical mechanical functional components and support systems in the drive trains and critical electrical components.
  - 1. For those cranes/hoists identified as having no SFP whose failure would result in dropping the load, the total weight of the suspended load will not exceed the device's rated load.
  - 2. For those cranes/hoists identified as having an SFP whose failure would result in dropping the load, use of that device for suspended load operations must be approved by NASA Headquarters. Complete documentation on the suspended load operation, including the hazard analysis outlined in paragraph a and the FMEA described above, will be forwarded to NASA Headquarters for evaluation. Approval will be given based upon detailed analysis of the potential hazards and rationale for acceptance. Such cases will never exceed the device's rated load. OSHA will be notified when NASA Headquarters approves using any crane/hoist identified as having an SFP whose failure would result in dropping the load.
- h. Before lifting the load involved in a suspended load operation, the crane/hoist will undergo a visual inspection (without major disassembly) of components instrumental in ensuring that the load will not be dropped (e.g., primary and secondary brake systems, hydraulics, mechanical linkages, and wire rope per NASA-STD-8719.9). Noted discrepancies will be resolved before the operation continues. This pre-lift inspection will be in addition to the inspections required in CFR Title 29, Part 1910.179(j) and 180(d).
- i. A trained and licensed operator (certified per NASA-STD-8719.9) will remain at the crane/hoist controls while personnel are under the load.

- j. Safety-controlled areas will be established with appropriate barriers (rope, cones, etc.). All nonessential personnel will be required to remain behind the barriers.
- k. Prior to the suspended load operation, a meeting with the crane/hoist operator(s), signal person(s), person(s) who will work under the load, and the person responsible for the task will be held to plan and review the approved operational procedures that will be followed, including procedures for entering and leaving the safety-controlled area.
- l. Communications (voice, radio, hard wired, or visual) between the operator(s), signal person(s), and the person(s) working under the load will be maintained. Upon communication loss, operations will stop immediately, personnel will clear the hazardous area, and the load will be safed. Operations will not continue until communications are restored.
- m. Personnel working beneath the suspended load will remain in continuous sight of the operator(s) or the signal person(s). A method of identifying personnel working beneath a suspended load will be identified in the WAD (e.g., orange vest, armband, hazardous operation badge, etc.).
- n. NASA will conduct periodic reviews to ensure the continued safety of the procedures. As a minimum, NASA will annually evaluate the implementation of this OP at each Center with operations on the suspended load list.
- o. A list of approved suspended load operations, list of cranes/hoists used for suspended load operations, and copies of the associated hazard analyses will be provided to the OSHA Office of Federal Agency Programs via NASA Headquarters for distribution to the appropriate regional and area OSHA offices. (NASA Headquarters, in conjunction with OSHA, will develop a format for transmittal of this information.) Quarterly updates to the documentation will be provided as needed.

**APPROVAL:**

**DATE:**

### CHANGE HISTORY

REV	EFFECTIVE DATE	DESCRIPTION
5	05/18/09	Biennial update with process changes at 5.5.c. and d. Removes "originals" from 5.2.d, 5.3.e, and 5.4.d. Clarifies 3.c. Updates organization titles and forms. Adds USA parent document information at Section 3.
4	04/13/07	Annual update. Reflects processing of real-time SLOAAs, current contract name, and deletion of a KSC form and Appendix C.
3	03/22/06	Annual update. Reflects current operations, organization title, and forms.
2	01/31/05	Annual update. Reflects current operations, organization title, and reference document.
1	12/19/03	Annual update. Deletes NASA PH-P4 requirement to perform independent annual inspection of all cranes/hoists involved in suspended load operations and clarifies organizational responsibilities.
Basic	09/25/02	Supersedes SPI SF-522(8)K. Reflects current operations and organization titles and includes applicability to USA Florida.