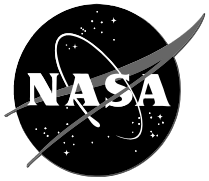
TEST EQUIPMENT DATA PACKAGE REQUIREMENTS AND GUIDELINES NASA JSC REDUCED GRAVITY OFFICE

Aircraft Operations Division

April 2014



National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

Verify that this is the correct version before use.

APPROVAL AUTHORITY

`

Original Signed by

Dominic L. Del Rosso
Lead, Reduced Gravity Program

CHANGE RECORD/LIST OF EFFECTIVE PAGES

Doc. Version	Date	Process Owner/Ext.	Description
Basic	May 2002	J. S. Yaniec/49211	Initial Release.
Basic PCN 1	Feb 2003	J. S. Yaniec/49211	Incorporate Pressure Systems changes.
Basic PCN 2	Mar 2003	J. S. Yaniec/49211	Incorporate Test Equipment Data Package changes.
Basic PCN 3	Mar 2004	J. S. Yaniec/49211	Add general reference link on page 17.
Rev A	Jul 2004	J. S. Yaniec/49211	Major Revision.
Rev B	Feb 2005	J. S. Yaniec/49211	Complete Revision.
Rev B PCN 1	Aug 2005	J. S. Yaniec/49211	Replace reference to AOD Form 70 with JSC-17773 and reference to AOD Form 71 with NS-STO-CH01.
Rev C	Nov 2007	J. S. Yaniec/49211 D. Del Rosso/49113	Major Revision.
Rev C PCN 1	Nov 2008	D. Del Rosso/49113	Replace reference to JPG-1700.1I with JPR-1700.1.
Rev D	Dec 2010	D. Del Rosso/49113	Document updated in support of 2011 Microgravity research flights.
Rev E	Feb 2014	D. Del Rosso/49113	In Section 3.0, add Records information per JPR 1281.5, Document and Data Control. In Section 8.24, Experiment Procedures Documentation, clarify in-flight procedures to be included in the TEDP.
Rev E PCN 1	Apr 2014	D. Del Rosso/49113	In Paragraph 8.17, Hazard Analysis Report Guidelines, replace references to JPR 1700.1, JSC Safety and Health Handbook, Section 2.4, with Section 2.3 to correspond with JPR 1700.1 Revision K, dated November 2013.

TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

1.0 PURPOSE

The Reduced Gravity Program, operated by the National Aeronautics and Space Administration (NASA) Lyndon B. Johnson Space Center (JSC), provides an aircraft flight that simulates the weightless environment of space.

The purpose of this document is to provide a guideline for existing and potential users of the Reduced Gravity Program. This document explains the Test Equipment Data Package (TEDP) and provides information on pre-flight, post-flight, and in-flight test operations.

2.0 SCOPE

This document applies to all users and potential users of the JSC Reduced Gravity Program.

Reference the Aircraft Operations Division (AOD) EDMS (Electronic Data Management System) Library to verify the latest version of this document.

3.0 RECORDS

No records are generated by this document.

4.0 REFERENCES

American National Standards Institute (ANSI) Z-136.1 Safe Use of Lasers

AOD 33897, Experiment Design Requirements and Guidelines

AOD 33899, JSC Reduced Gravity Program User's Guide

AOD 33912, Interface Control Document NASA 932 C-9B

AOD Form 72, C-9B Quick Reference Data Sheet

AOD Form 150, Human Research Master Protocol

AOD Form 151, NASA/JSC Human Research Informed Consent

Interface Control Document Boeing 727-200

NASA Institutional Review Board (IRB)/Committee for the Protection of Human Subjects (CHPS) Website

JSC-20483, JSC Institutional Review Board: Guidelines for Investigators Proposing Human Research for Space Flight and Related Investigations

JSC Form 1830, Report of Medical Examination

JSC Procedural Requirement (JPR)-1700.1, JSC Safety and Health Handbook

NS-STO-CH01, General Hazard Identification Checklist

Standard Form 88, Medical Record – Report of Medical Examination

Standard Form 93, Report of Medical History

5.0 REDUCED GRAVITY OFFICE CONTACT INFORMATION

Any questions concerning this document, the program, test requirements, test schedules, etc., should be directed to:

Reduced Gravity Office
Building 993
Ellington Airport
Houston, Texas 77034
Phone: 281-244-9874
Fax: 281-244-9946
E-mail: jsc-zerog@mail.nasa.gov

6.0 INFORMATION ON HOW TO APPLY FOR NASA MICROGRAVITY RESEARCH GRANTS

Researchers interested in conducting reduced gravity research aboard the NASA C-9B Reduced Gravity Aircraft must have a NASA grant or be sponsored by another federal government agency.

7.0 ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
ANSI	American National Standards Institute
AOD	Aircraft Operations Division
CG	Center of Gravity
CHPS	Committee for the Protection of Human Subjects
COTS	Commercial-Off-the-Shelf
CST	Central Standard Time
DOT	Department of Transportation
EDMS	Electronic Data Management System
FBD	Free Body Diagram
FS	Factor of Safety
IRB	Institutional Review Board
JPR	JSC Procedural Requirement
JSC	Johnson Space Center
MAWP	Maximum Allowable Working Pressure
MB	Megabytes

MSDS	Material Safety Data Sheet
NASA	National Aeronautics and Space Administration
PV/S	Pressure Vessel/System
QA	Quality Assurance
RGO	Reduced Gravity Office
TEDP	Test Equipment Data Package
TPS	Test Preparation Sheet
TRR	Test Readiness Review
URL	Uniform Resource Locator

8.0 TEST EQUIPMENT DATA PACKAGE REQUIREMENTS

The following provides a detailed description of the documentation required in the TEDP. A TEDP must be prepared for each experiment proposed for flight on NASA reduced gravity aircraft.

It is imperative that all sections be addressed as being applicable or non-applicable. The TEDP requirements documentation should be concise, yet thoroughly explain the experiment.

8.1 TIMELINE

The TEDP must be thoroughly completed in accordance with these guidelines and submitted to the Reduced Gravity Office (RGO) [submit seven (7) paper copies or e-mail to jsc-zerog@mail.nasa.gov] no later than **six (6) weeks** prior to first flight.

NOTE

- The maximum file size accepted via e-mail is eight (8) Megabytes (MB). If your file is larger than eight (8) MB, then you must break your file into smaller elements to send via e-mail.
- Any changes to an experiment which occur after the TEDP has been submitted will be evaluated on a case by case basis.
- Errata should be submitted to the RGO as timely as possible. The RGO will make every effort to evaluate and subsequently accept late changes, if possible. However, the RGO cannot guarantee approval before the originally scheduled flight dates.

8.2 OUTLINE

The TEDP must adhere to the outline listed below:

A. Cover Page

B. Change Page

C. Quick Reference Sheet

D. Table of Contents

E. Flight Manifest

F. Experiment Background

G. Experiment Description

H. Equipment Description

I. Structural Verification

J. Electrical Analysis

K. Pressure Vessel or System

L. Laser Certification

M. Parabola Details and Crew Assistance Required

N. Free Float Requirements

O. Institutional Review Board

P. Hazard Analysis

Q. Tool Requirements

R. Photo Requirements

S. Aircraft Loading

T. Ground Support Requirements

U. Hazardous Material

V. Material Safety Data Sheet(s) (MSDS)

W. Procedures

X. Bibliography

The remainder of this document provides detailed instructions for each section of the TEDP.

8.3 COVER PAGE

The TEDP cover page must contain the principal investigator's name, research organization, and contact information (i.e., e-mail address, phone number, and mailing address), the experiment's title, and the date the package was completed.

8.4 CHANGE PAGE

A change page must be included in the document. Any content changes since the last submission to the RGO should be noted, referenced, and dated along with the change authority signature.

8.5 QUICK REFERENCE DATA SHEET

The AOD Form 72, C-9B Quick Reference Data Sheet, must contain the requested information and should be completed in the provided format and included as a dedicated page.

NOTE

It is strongly recommended that the team name and school name be included on AOD Form 72.

8.6 TABLE OF CONTENTS

The table of contents shall list the sections of the TEDP with corresponding page numbers. All pages of the TEDP shall be numbered sequentially.

8.7 FLIGHT MANIFEST

The flight manifest section must list the number of personnel required for each flight, the names of all potential flight personnel, and any additional personnel that may support on site. Ensure that all personnel have current physical examinations and current physiological training.

8.8 EXPERIMENT BACKGROUND

This section must briefly describe, at a high level, why the experiment is being flown. It should be noted whether the experiment is a follow-up of a previous experiment, a preliminary step to a future experiment, or related to a space flight experiment. Also include the name(s) of any supporting NASA organization or program.

8.9 EXPERIMENT DESCRIPTION

In this section, briefly explain the experiment; this section should be written so that a practicing engineer or scientist is able understand the experiment. Science (or engineering) goals and expected or actual results for accompanying ground-based experiments should also be presented here only if applicable to safe successful flight.

8.10 EQUIPMENT DESCRIPTION

This section shall thoroughly describe the equipment required for performing the experiment, as follows:

A. This section must include all reduced gravity flight and ground-based equipment.

1. Include drawings or photographs of the equipment, where available, along with text description.

2. Include dimensions and weights for the overall experiment, and further break down by major subassemblies that will be secured on the aircraft as distinct items.

3. Identify the type of hardware (i.e., Class I, II, III, Ground Support Equipment).

Type	Description	Considerations
Class I	Space Flight Hardware	Controlled hardware, requires Quality Assurance (QA), requires controlled storage, requires Class II or better interface
Class II	Controlled Hardware of Flight Design	Controlled hardware, requires QA, requires controlled storage
Class III	Uncontrolled Hardware of Flight Design	No special requirements
Experimental	Test Equipment for Ground or Reduced Gravity Flight	No special requirements
Ground Support Equipment	May or May Not Be Controlled	May require QA support if interfacing to Class I or II hardware

B. Include a proposed layout of the equipment on the aircraft for takeoff and landing. A layout describing the in-flight configuration of the hardware during parabolas should include placement of required operators.

C. Describe, in detail, any component with special handling requirements or special hazards.

D. List all items to be taken onboard the aircraft during flight, including cameras, outreach experiments, tools (refer to Section 8.18, Tool Requirements), personal item, mementos, etc.

E. Describe any special requirements (in-flight or ground based).

F. Identify whether or not the experiment will free float at any time. Identify the subassemblies that will free float and handling provisions.

8.11 STRUCTURAL VERIFICATION

NOTE

During the parabolic flight phase, the research package can experience loads up to 2-g's.

Follow the guidelines below to meet the documentation requirements for the structural verification section of the TEDP. Appropriate methods, or combinations of methods, are required for verifying the structural integrity of in-flight equipment during takeoff and landing (configurations) only.

8.11.1 Analysis Method

A. Submit Free Body Diagrams (FBDs) for all g-load conditions listed in AOD 33897, Experiment Design Requirements and Guidelines, Section 6.0, Test Equipment Design Requirements. FBDs are sketches used to dimensionally locate where g-loads are applied on test equipment. G-loads will be applied at equipment Centers of Gravity (CGs).

B. Create a table documenting individual component weights and overall assembly weight. Specify all materials used for test equipment fabrication and their respective allowable load. Specify all fasteners used, weld types (associated de-rating and/or post process or inspection for welds must be included), and their location on the test equipment assembly (this is best accomplished by using a table, detailed drawing/schematic, and/or digital pictures).

C. Submit all design calculations showing comprehensive compliance with all experiment structural design requirements on:

1. The attachment of components to the frame (prove all components will remain intact and attached to the experiment frame under the g-loads specified in AOD 33897, Section 6.0, Test Equipment Design Requirements).

2. The full assembly (prove the frame will withstand the g-loads specified in AOD 33897, Section 6.0, Test Equipment Design Requirements, induced from its own mass and those masses of the components attached to it, without permanent deformation).

3. The floor attachment of the experiment to the aircraft floor (refer to AOD 33897, Section 6.0, Test Equipment Design Requirements) for g-loads and allowable aircraft mounting hardware).

4. If applicable, design calculations proving free-floating hardware can withstand 3-g's in any direction for parabolic phase of flight.

5. The floor load analysis (prove that equipment will not exceed aircraft allowable floor load for hard landing case and aircraft loading/unloading).

D. Provide a table that displays the Factor of Safety (FS)/margin of safety result from each structural analysis performed. Label the load case analyzed (i.e., 9-g forward load), location of the analysis on the experiment assembly (i.e., laptop computer bracket attachment), and calculated FS or margin of safety.

NOTE

If analysis is performed by a qualified engineer, only the signed (by aforementioned engineer) FS table identified in Step D is required to be submitted in the TEDP. Supporting data should be available upon request.

8.11.2 Test or Demonstration

Components may be load-tested, at appropriate locations, using a properly calibrated tension gauge to simulate g-loads on equipment. This can be used for the structural verification of lightweight components in determining whether or not attachment brackets can withstand structural design requirements. It is not recommended that this be performed on full assemblies, without detailed conditions and assumptions listed.

To properly document pull tests, address the following questions:

A. How was the test performed (include schematics if necessary)?

B. What test equipment was utilized and how was it calibrated?

C. Who performed the test and when (include certifications of individuals performing/verifying test)?

In addition, provide the following:

A. Copies of applicable documentation [Test Preparation Sheets (TPS), etc.]

B. A table that displays the FS/margin of safety result from each structural test performed. Label the load case analyzed (i.e., 9-g forward load), location of the load on the experiment assembly (i.e., laptop computer bracket attachment), and calculated FS or margin of safety.

NOTE

If test is performed by a qualified engineer/technician, only the signed (by aforementioned engineer/technician) FS table identified in Step E is required to be submitted in the TEDP. Supporting data should be available upon request.

8.12 ELECTRICAL ANALYSIS/VERIFICATION

All experiments that use any type of electrical power (including battery power) must provide an electrical analysis structured in three parts: 1) Schematic, 2) Load Table, and 3) Emergency Shutdown Procedures.

8.12.1 Schematic

The analysis should provide a graphical schematic drawing that clearly details the top-level (not the inner circuitry of each component, but the interaction of each component at the box level) electrical design of the experiment. The schematic should include the following:

A. All wiring and electrical devices [including Commercial-off-the-Shelf (COTS)].

B. Each power cord from an aircraft power distribution panel.

C. Which aircraft outlets are used, and the voltage and current draw on each outlet (Nominal and Peak current drawn by experiment, not that provided by the aircraft).

D. A unique identifier (such as a number) matching the actual label on each wire, or wire bundle.

E. The gauge number and current carried on each wire (Nominal and Peak current values).

F. A current limiting device and its limiting value for each power cord (ideally, a current limiting device would be installed on each electrical component).

G. A master "kill switch" that must be readily accessible and prominently labeled.

H. The grounding method used to bond exposed metal surfaces and compatibility with Ground Fault Circuit Protection.

8.12.2 Load Tables

All experiments that use electrical power must provide a load table for each power source.

NOTE

Manufacturer-supplied batteries used to power camcorders, laptop computers, or similar devices should be described in the electrical analysis. A load table is not required as long as the device is operated from the battery and the COTS items are being used as designed and have not been modified. A load table is required when an Alternating Current (AC) adapter is used to power the device.

The purpose of a load table is to describe the electrical power drawn from each power source and ensure that the source is not overloaded. In the interests of safety, battery powered experiments should complete a load table as well.

One load table must be provided for each power source in an experiment. For example, if two power cords are driven by an aircraft power distribution panel, then two load tables should be completed. If a six-volt battery is used to power part of the experiment, a third load table should be completed to describe that circuit as well.

Each table shall provide a description of the power source including the operating voltage and the rated current. The table must provide a detailed list of each load device and the *maximum* current draw of each device. The sum of the *maximum* device currents must not exceed the rated current of the power source (or circuit breaker value).

Ideally, each circuit should be designed so that the total *nominal* current of all devices does not exceed 80 percent of the rated supply current.

8.12.2.1 Example

An example load table is given in Table 1. One power cord is used to run the experiment from an aircraft power distribution panel. The cord is plugged into the 115 Volt AC outlet that is circuit breaker protected to 20 Amps on the panel. The cord has a wire gauge (size) of 12. The power source in the example (the aircraft outlet) is used to run four devices, as shown on the right hand column of the table. The total *maximum* current draw of all devices is at the bottom of the column. The total *maximum* current draw must not be greater than the rated current of the supply outlet. Again, each circuit should be designed so that the total *nominal* current of all devices does not exceed 80 percent of the rated supply current.

Table 1. Example Load Table

Power Source Details	Load Analysis
Name : Power Cord A	Widget 1 - 1 Amp Widget 2 - 5 Amps Widget 3 - 5 Amps Widget 4 - 2 Amps
Voltage : 115 VAC, 60 Hz	
Wire Gauge : 12	
Max Outlet Current: **20 Amps**	Total Current Draw: **13 Amps**

8.12.2.2 Stored Energy

The analysis must describe any devices used to build a large electrical charge (e.g., large capacitors, wire coils). The description should provide the maximum voltage of the charge and explain how this energy will be dissipated in the experiment.

8.12.3 Electrical Kill Switch

Finally, each experiment must have emergency shutdown capabilities. A detailed description of the electrical shutdown procedures must be provided in the electrical analysis. The procedures shall describe the "kill switch" incorporated into the design as well as the experiment's reaction to a power loss.

8.12.4 Loss of Electrical Power

In the event of electrical power loss (expected or unexpected), all experiments must fail to a safe configuration. Researchers should be prepared to demonstrate their experiment's emergency shutdown capability at the Test Readiness Review (TRR).

8.13 PRESSURE VESSEL/SYSTEM FOR REDUCED GRAVITY FLIGHT DOCUMENTATION

All required documentation must be complete prior to the first operation on NASA facilities, and be included in the TEDP. Typically, the Pressure Vessel/System (PV/S) will be operated at the TRR within normal limits. Should mission specific parameters prohibit demonstration, an RGO Waiver to Requirement may be applied for at the time of TEDP submission. The following information is required in this section:

A. Brief description of PV/S purpose, major components of subassemblies, working fluid(s) and volumes, and general operating procedure.

B. System Schematic, numbered to correspond to associated component table.

C. Component table (refer to Table 2) listing individual components and associated specifications.

D. Detailed drawings of *non-commercially* produced components and subsystems.

E. Calculations and associated assumptions of *non-commercially* produced components and subsystems.

F. Records of certifications, inspections, and due dates for tested components.

Table 2. Pressure System Design Specifications Example

Schematic Reference #	Component Description	MAWP (psi)	Relief Valve Setting (psi)	Regulator Setting (psi)	Built By	Cert. Test/ Calib. Date	Proof Test – Certified By
1*	Nitrogen K bottle	2,200	N/A	N/A	ACME, Inc.	May 2, 1999	On “k” bottle DOT sticker
2	Regulator	3,000	N/A	200	PDT Co.	Aug 1, 1999	AJN
3	Pressure Relief Valve	500	220	N/A	E & A Indus.	Dec 31, 1999	AJN
4	Stainless Steel Tub	3,000	N/A	N/A	M & K Products	May 15, 1999	P – BCH**
5	Reaction Chamber	250***	N/A	N/A	Organization Design	Oct 9, 1999	H – AJN**

* The number “1” identifies the component labeled “1” on the pressure/vacuum system schematic.

** The “H – AJN” indicates that a hydrostatic proof-pressure test was performed on the reaction chamber by AJN on October 9, 1999. The “P” shown for component 3 indicates a pneumo-static proof-pressure test was performed.

*** The value of 250 MAWP for the reaction chamber is the Maximum Allowable Working Pressure (MAWP) designated to that component by engineering analysis. If this component were to be operated using a higher pressure, its FS would be decreased beyond a minimum of four (4). Therefore, this system must never be operated at pressures above the lowest MAWP found in the table.

8.14 LASER CERTIFICATION

The following information must be documented in the laser certification section of the TEDP and submitted to the RGO **six (6) weeks** prior to the scheduled flight date.

A. Identify the class of laser being used with the experiment.

B. For all lasers, submit the following information:

1. Laser class, type, and manufacturer
2. Brief description of the laser's purpose
3. When the laser will be used during the flight, and for what duration
4. Description of the containment controls (i.e., describe the protective housing, interlock switches, emergency kill switch, temperature/fire control, protective eyewear)

C. For lasers categorized in classes 3 and 4, submit the following additional information:

1. Detailed description of the laser hardware
2. Description of the laser parameters
3. Description of the operating and alignment procedures
4. Description of the operators' training and experience level
5. Description of the medical surveillance requirements

8.15 PARABOLA DETAILS AND CREW ASSISTANCE

In this section:

A. Provide all details on parabola requirements for the flight week(s).

B. Identify the required levels of reduced (or hyper) gravity (i.e., 0, 0.16, 0.38). Indicate how many of each type per mission will be required and at what interval. Keep in mind that flights normally include 10 parabolas per set with a 2 to 3 minute break between parabola sets.

NOTE

It is generally helpful to identify and distinguish between hard parabola requirements, and those that are desired.

C. Identify any crew assistance that may be required, both on the ground and during flight, such as free floating an experiment, medical surveillance, etc.

8.16 INSTITUTIONAL REVIEW BOARD

Test developers who plan research involving human test subjects, animal test subjects, or biological tests must obtain approval from the JSC IRB. Refer to JSC-20483, JSC Institutional Review Board: Guidelines for Investigators Proposing Human Research for Space Flight and Related Investigations, for details on the IRB process.

Twenty copies of a completed AOD Form 150, Human Research Master Protocol must be submitted to JSC at least **six (6) weeks** prior to the proposed flight.

This protocol must include the equipment safety certification described in the following section, and applicable signed consent forms for each subject (included in AOD Form 151, NASA/JSC Human Research Informed Consent). In addition to equipment safety certification, letter(s) of approval from other IRBs and/or Institutional Animal Care Use Committees is required. All signed NASA/JSC Human Research Informed Consent forms must include a Layman's Summary of the experiment.

The JSC IRB meets at least once a month with additional meetings scheduled at the call of the Chair. JSC Form 1830, Report of Medical Examination, Standard Form 88 – Medical Record - Report of Medical Examination, or Standard Form 93 – Report of Medical History should be submitted to:

JSC Institutional Review Board
Mail Code: SA
Lyndon B. Johnson Space Center
Houston, Texas 77058

8.17 HAZARD ANALYSIS REPORT GUIDELINES

These guidelines are intended to help the test developer identify hazards in the test equipment and procedures, and prepare the hazard analysis required for the TEDP.

The basic purpose of the Hazard Analysis Report section is to document the safety analysis performed to ensure all potential hazards have been addressed, and adequate controls have been implemented.

The preparation of the Hazard Analysis Report must be consistent with JPR 1700.1, JSC Safety and Health Handbook, Section 2.3, and should begin during the conceptual phase of the experiment as hazards are identified and should continue throughout the experiment's life cycle.

The report should be of sufficient depth and detail so that technical personnel can determine if adequate hazard elimination or control has been accomplished or if additional hazard resolution analysis is required.

NOTE

The hazard analysis report must be updated whenever changes to experiment design or operations affect a hazard condition.

The Hazard Analysis Report consists of NS-STO-CH01, General Hazard Identification Checklist and JPR 1700.1, JSC Safety and Health Handbook, Section 2.3

8.18 TOOL REQUIREMENTS

In this section, include information regarding the tools that will be brought to the reduced gravity facility, tools that will be used on the aircraft, and descriptions of the tools that will be borrowed from the RGO.

NOTE

No tools or loose items of any type may be brought onto the aircraft at anytime without approval of an RGO Test Director.

Include information on how the tools will be controlled, contained, inventoried, and identified (each tool must be marked to indicate its owner). Tools needed for flight shall be identified during the TRR briefing for approval and a copy of the tool inventory provided to a Test Director prior to each flight. A Test Director must approve all changes to the tool list prior to flight.

8.19 PHOTO REQUIREMENTS

This section should indicate all photographic (still and video) requests for the documentation of the experiment.

A. Still and/or video photographers.

B. Should the experiment require the S-band downlink, the researcher is responsible for the additional cost. Arrangements for use of the S-band downlink must be made with the RGO **six (6) weeks** (jsc-zerog@mail.nasa.gov) prior to the researcher's arrival at Ellington Field.

C. Indicate how many fixed camera poles will be required to mount video equipment for sufficient documentation of the experiment.

D. Indicate the product format and quantities of the imagery requested.

8.20 AIRCRAFT LOADING

In this section, document requirements for aircraft loading.

A. Identify the type(s) of ground equipment that will be needed to load the experiment into the aircraft (i.e., forklift, lifting pallet, J-bars, High Lift Truck).

B. Describe the hardware manipulation strategy on the ground and in the C-9B test cabin (i.e., lifting handles, casters). If lifting is required, handles must be available for enough personnel to limit the load to 50 pounds per person.

C. List the weights of the subassemblies that are to be loaded onto the aircraft. Identify the base plate area for each assembly in square feet. Calculate and document the amount of load that will be placed on the aircraft floor in pounds per square foot during loading operations. If casters or J-Bars are to be used, calculate and document the weight that will be loaded on each wheel. The RGO will determine if shoring is necessary and will be responsible for implementing all shoring procedures.

Critical lifts must be accompanied by an approved critical lift plan. The plan is reviewed and approved by the RGO Lead or designated representative.

8.21 GROUND SUPPORT REQUIREMENTS

In this section of the TEDP, describe what will be needed, in terms of ground support, from the RGO. Please address, but do not limit to, the following:

A. Type of power that will be needed on the ground for testing and support of research equipment.

B. The type and total number of K-bottles that will be required for ground and flight operations (also indicate per mission requirements). K-bottles can be delivered to:

Reduced Gravity Office
Building 993, Ellington Airport
Houston, Texas 77034

C. Any chemicals that are toxic and/or corrosive to be mixed and/or stored on base.

D. Any access to Building 993 (the RGO) required during hours other than normal business hours [7:30 a.m. – 4 p.m. Central Standard Time (CST)] is required.

E. Specific tool requests or needs for special ground handling equipment.

8.22 HAZARDOUS MATERIALS

In the hazardous materials section:

A. Identify whether or not the experiment will be using any toxic, corrosive, explosive, and/or flammable materials.

B. Describe the material, how it will be used, and quantities being used.

Early contact with the RGO and the JSC Safety Office for discussions on proper use and containment of proposed hazardous materials may prevent delays in obtaining approval for the use of such materials.

8.23 MATERIAL SAFETY DATA SHEETS

In this section of the TEDP, include the MSDS's that apply to any chemical, fluid, etc. that the experiment utilizes.

MSDS's must be provided for all chemicals brought onto JSC property. Copies of MSDS's must be kept with the chemicals at their ground-based storage areas.

8.24 EXPERIMENT PROCEDURES DOCUMENTATION

The information presented in this section of the TEDP will describe all of the procedures involved with operating the experiment at Ellington Field. These procedures should be comprehensive, beginning with the hardware arrival at Ellington Field and concluding with its shipment from Ellington Field. These procedures should be structured as follows:

A. Equipment Shipment to Ellington Field

Identify how equipment will be shipped, when it will be shipped, and what storage requirements are needed at Ellington Field to safely store your hardware.

NOTE

Researchers are responsible for all equipment sent to and from Ellington Airport. The RGO will not be responsible for any shipping arrangements.

Refer to AOD 33899, JSC Reduced Gravity Program User's Guide, Section 3.0, Test Operations, for additional information on the shipping and receiving of equipment to/from Ellington Airport.

B. Ground Operations

1. Identify the procedures proposed to set-up and operate your equipment on the ground at Ellington Airport.
2. List the ground facilities/equipment required at Ellington Airport to operate your equipment.

C. Loading/Stowing

1. Identify the procedures proposed to load your equipment onto the aircraft.
2. Provide a lift plan identifying lift/no lift points and method.
3. Provide a stowage diagram to include number, type, and placement (length, angles, etc.) of cargo securing devices (straps, bolts, etc.).

D. Pre-Flight

Identify the procedures proposed for pre-flight operations. Are there any special requirements regarding cabin temperatures, power availability, in-flight storage space, etc.?

E. Takeoff/Landing

Identify any special procedures proposed during takeoff and/or landing operations. Will there be any special equipment stowage requirements during takeoff and landing? Will there be any power requirements during takeoff and landing?

F. In-Flight

Include in this section:

1. All procedures envisioned.
2. A checklist for all experiment procedures proposed for parabolic maneuvers in all potential configurations.
3. Procedures, both nominal and contingency, for hyper-g and level flight conditions.
4. All emergency procedures.
5. A detailed restraining/controlling/positioning plan for each individual for all configurations.

G. Post-Flight

Identify any special procedures proposed for readying equipment for the next day's flight.

H. Off-Loading

Identify any special procedures proposed for off-loading the equipment from the NASA Reduced Gravity Aircraft. Identify the shipping arrangements that have been made for the removal of equipment from NASA property.

I. Emergency/Contingency

Provide off nominal, contingency, and emergency procedures. Include actions by researchers as well as NASA aircrew. Include specific firefighting procedures.

8.25 BIBLIOGRAPHY

List any resources (include title, originator, and date) that were referenced in writing the TEDP. Provide footnotes in the body of the TEDP to designate where references were used. For each resource referenced in the bibliography, indicate volumes, chapters, pages, Uniform Resource Locators (URLs) addresses, etc.

8.26 EXCEPTIONS/DEVIATIONS/WAIVERS

List any and all exceptions or waivers to, or deviations from, any RGO (or referenced) documented requirement and/or guideline that is being applied for. Include requirement, rationale, description, and prior approval or precedence, if applicable.

Submit a separate request for each instance to the RGO for disposition (refer to Section 5.0, Reduced Gravity Office Contact Information).

INDEX