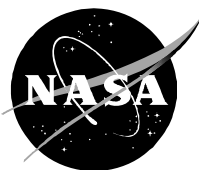


JSC Reduced Gravity Program User's Guide

Aircraft Operations Division

November 2007

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National Aeronautics and
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Houston, TX 77058

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Mission Statement

To provide a world-class, reduced gravity research platform that emphasizes user compatibility, quality reduced gravity levels, and a customer-oriented support organization.

1.0 INTRODUCTION

The Reduced Gravity Program, operated by the National Aeronautics and Space Administration (NASA), Lyndon B. Johnson Space Center (JSC) in Houston, Texas, provides a “weightless” environment, similar to the environment of space flight. This is done on a cost reimbursable basis for research and training purposes. For those researchers who have NASA research grants, are being funded by NASA or another government agency, have a Memorandum of Understanding (MOU), or Space Act Agreements with NASA, the cost reimbursable basis provides the mechanism for flying an experiment aboard NASA’s Reduced Gravity Aircraft.

The reduced gravity environment is achieved by flying a modified Boeing C-9B turbo fan aircraft through a series of parabolic maneuvers. This results in short periods of less than one “g” acceleration. The lengths of these reduced gravity periods depend on the “g” level required.

Negative-g to	1/10 max	15 seconds
Zero-g	0-g	23 seconds
Lunar-g	1/6-g (.16)	30 seconds
Martian-g	1/3-g (.38)	40 seconds

These maneuvers may be flown consecutively (i.e., roller coaster fashion) or separated by enough time to alter the test setup.

Normal missions, lasting approximately two hours, consist of 40 parabolic maneuvers, and originate and terminate at Ellington Field in Houston, Texas. Changes to the normal mission profile can be made to ensure more efficient test operations.

Requests for operations away from Ellington Field will be considered on an individual basis addressing the benefit to NASA, fiscal soundness, scientific merit, airspace accessibility, and overall Reduced Gravity Program schedule impact.

NASA’s Reduced Gravity Aircraft test area is equipped with electrical power, compressed gas, an overboard vent, accelerometer data, and photo lights. NASA JSC can provide photographers for still photography and video coverage. An S-band video downlink with two-way audio capability may also be requested. Workspace is available on the ground for buildup and checkout of test equipment to ensure its operation before installation in the airplane.

1.1 Purpose

The purpose of this user’s guide is to provide a guideline for existing and potential users of the Reduced Gravity Program. This document details user and test equipment requirements and provides information on pre-flight, post-flight, and in-flight test operations.

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1.2 Scope

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

1.3 References

[41 Code of Federal Regulations \(CFR\) 102-33, Management of Government Aircraft](#)

[AOD 33895, Visitor's Guide NASA JSC RGO](#)

[AOD 33896, Test Equipment Data Package Requirement and Guidelines NASA JSC RGO](#)

[AOD 33897, Experiment Design Requirements and Guidelines NASA 932 C-9B](#)

[AOD 33912, Interface Control Document NASA 932 C-9B](#)

[AOD Form 1492, Mishap Notification](#)

[JSC-20483, JSC Committee for the Protection of Human Subjects – Guidelines For Investigators Proposing Human Research For Space Flight And Related Investigations](#)

[JSC Form 247, Videographic Work Request](#)

[JSC Form 8500, Report of Medical Examination](#)

1.4 List of Acronyms and Abbreviations

AC	Alternating Current
AOD	Aircraft Operations Division
ARMD	Aeronautics Mission Directorate
CFR	Code of Federal Regulations
CST	Central Standard Time
DoD	Department of Defense
ESMD	Exploration Systems Mission Directorate
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FECA	Federal Employees' Compensation Act
FOD	Foreign Object Damage
FTP	File Transfer Protocol
IPP	Innovative Partnership Programs

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IRB	Institutional Review Board
JSC	Johnson Space Center
MB	Megabytes
MOU	Memorandum of Understanding
MFS	Microgravity Flight Services
NASA	National Aeronautics and Space Administration
RGO	Reduced Gravity Office
SCAP	Strategic Capabilities Asset Program
SCTF	Sonny Carter Training Facility
SMD	Science Mission Directorate
SOMD	Space Operations Mission Directorate
SVHS	Super Video Home System
TEDP	Test Equipment Data Package
TRR	Test Readiness Review
UHF	Ultra High Frequency
U.S.	United States
VHS	Video Home System
WBS	Work Breakdown Structure

1.5 Test Equipment Data Package

Test Equipment Data Packages (TEDP) are required for all experiments requesting flight time on NASA's Reduced Gravity Aircraft. This package is required to provide detailed documentation of an experiment by addressing all aspects of its design. Researchers shall submit an electronic copy of this document to the Reduced Gravity Office (RGO) **six weeks** prior to flight. The electronic copy may be submitted by e-mail, file transfer protocol (FTP), or recordable media. If unable to submit an electronic copy, researchers shall submit **seven** hard copies of this document to the RGO **six weeks** prior to flight. The document must be 100 percent complete in order to initiate its review. Failure to provide a complete and accurate TEDP **six weeks** prior to flight may result in flight disqualification. Any experiment deemed unsafe or not clearly defined through review of a TEDP may also result in flight disqualification or delays. See [AOD 33896, Test Equipment Data Package Requirement and Guidelines NASA JSC RGO](#) Section 2 for instructions on how to prepare a TEDP. For those researchers who wish to submit the TEDP electronically, contact the RGO for software requirements; the maximum size of the data file can not exceed 8 Megabytes (MB).

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All Flight Experiments (New and Re-flight) shall submit a new or updated TEDP. Researchers submitting a re-flight TEDP shall ensure that all changes/updates to the document have been annotated in the change page section of the TEDP.

1.6 Flight Crew

The flight crew for NASA's Reduced Gravity Aircraft is typically made up of a Pilot in Command, Co-Pilot, Flight Engineer, and two Test Directors. When required, a Flight Surgeon, and Video and/or Still photographers will join the flight crew as well. The Pilot in Command flies the aircraft during takeoff, landing, and during the parabolas. The Pilot in Command is responsible for the aircraft and those researchers assigned to the flight; therefore, he/she has the final say on whether or not the flight will proceed.

The Co-Pilot is responsible for all communications with the air traffic control center and also flies the aircraft when the Pilot in Command is unable. During the parabola, the Co-Pilot is responsible for navigation of the aircraft and ensures the aircraft stays within the restricted airspace provided by air traffic control.

The Flight Engineer is responsible for monitoring aircraft systems and assisting the pilots during any emergency situations. The Flight Engineer also keeps track of the parabola count and reconfigures the offset of the reduced gravity display in the cockpit for parabolas.

The Test Directors are responsible for all of the activities in the cabin area during both ground and flight operations. The primary job of the Test Directors is SAFETY. During ground phase preparations, the Test Directors lead the Test Readiness Review (TRR) and direct the loading of the experiments onto the aircraft. During the loading, the Test Directors have the final say regarding placement of the experiments, and where and how experiment hardware is integrated into the aircraft and operations.

During flight operations, the Lead Test Director is in charge of all cabin activities. At any time during the flight, the Test Directors can terminate any experiment they feel is unsafe to continue. The Test Directors communicate with the pilots via the intercom system.

Throughout the flight, the Test Directors may help any researcher who is in need of assistance. This may include helping with an experiment or helping a researcher that is having difficulty with motion sickness.

NOTE

Test Director's primary duties may supersede "helping" researchers with nominal operation.

In the event of an emergency during flight, the Lead Test Director is in charge of all cabin activity and will inform the Pilot in Command of the nature and status of the emergency.

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1.7 Photographic and Videographic Support

1.7.1 Photographic Support

The NASA JSC Imagery Acquisition Group provides photographic support, as required, for the purpose of test documentation or analysis. NASA photographic services may be arranged by including a request in the TEDP submitted prior to flight. Photographic support includes:

1. Camera, lights, and other photographic equipment
2. Expendable supplies (e.g., film)
3. Image processing and finishing (printing and writing of CD-ROMs)
4. Viewing and analysis facilities

Three categories of photographic services are available:

1. Still Photography – Documentary

Documentary still photography is performed using high-resolution digital cameras. Customers can view the still images after the flight. Selected images from the week's flight will be placed on the Internet for viewing, downloading or printing by the customer.

Digital 8 inch x 10 inch color prints or CD-ROMs will be available in limited quantities based on customer requests and approval from the RGO.

2. Still Photography – Scientific

The photographers utilize special equipment for scientific or public relations photography as requested by the user. Hasselblad 39-megapixel digital and Nikon digital cameras can be equipped to handle a variety of photographic situations.

3. Digital Motion Picture – Instrumentation (Scientific)

Digital motion picture photographic instrumentation captures information that may not be accessible, due to high speed or other factors, to the human visual system or to other instrumentation.

The JSC Imagery Acquisition Group uses high-speed or time-lapse motion picture cameras for most instrumentation applications. These cameras provide the required compression or expansion of time so that experimental data can be recorded in a form that is readily accessible.

The photographers are available (usually in Building 8 at JSC) to set viewing times, arrange viewing facilities, or provide other assistance in analyzing the imagery data.

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1.7.2 Television Support

NASA JSC Imagery Acquisition Group personnel provide support, as required, for the purpose of test documentation or analysis. Users may arrange for television imaging-capture support by including a request for NASA television service in the TEDP.

Television support personnel and equipment for each flight is based on particular test requirements. Equipment can include:

- (MiniDV, H-8MM, Video Home system (VHS), and Super VHS (SVHS) video recorders/camcorders
- Videotape stock for required equipment
- Battery- and alternating current (AC)- operated color monitors for in-flight viewing

S-band downlink is now available at an additional cost to requesting researchers. Also, at present, capability for single video channel, single downlink and ultra high frequency (UHF) voice uplink is available. Interested researchers must contact the RGO for cost and scheduling information. Researchers planning to use the S-band downlink must contact the RGO at least **six weeks** prior to flight to find out the availability of the S-band downlink. Due to Shuttle and International Space Station requirements, the S-band downlink capability is not always available for C-9B operations. Other television capabilities are also available and are described in the following paragraphs.

1. Documentation

Television coverage for documentation purposes can be provided in any of the formats indicated above if requested well in advance of flight. Generally, existing light levels are adequate to support television documentation. Additional battery operated lights are available upon advance request.

2. Instrumentation or Scientific

Television imaging of specific instruments or experiment processes, not easily discernible by the human eye, can be captured in standard speed color video with slow-motion playback.

3. Video Copies

Original camera videotape is kept on file in the RGO with the user receiving one copy. With advanced notice, copies of the videotape can be made over night, if necessary. For all other requests for copies of videos, the researcher must submit a [JSC Form 247, Videographic Work Request](#) or equivalent and e-mail it to the RGO. Windowed copies (with the time code printed in the picture) can be generated (if the original tape is mastered to a higher format with time code capabilities).

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4. Special Services

In-flight recordings can be prearranged for viewing after the flight at the RGO.

Full viewing facilities are also available at the Imagery Sciences Branch facilities in Building 8 at JSC. Editing capabilities also exist at JSC, and arrangements for such support should be made well in advance.

With advance arrangement, video, still prints (5 x 7 inch color prints) can be acquired after the flight through the Multimedia Services group in Building 8 at JSC.

Special requirements for each flight, such as: wide angle lenses, specially mounted cameras on test objects, or multiple television cameras at different viewing angles can be accommodated if arranged well in advance.

1.8 Flight Medicine

1.8.1 Motion Sickness Medication

Some researchers aboard NASA's Reduced Gravity aircraft experience motion sickness during the flight. The percentage of those with this condition is about 60 percent. Symptoms include pallor, increased perspiration, nausea, and vomiting. In an attempt to avoid this syndrome, various medications have been used for many years. However, no one medicine has been perfect in preventing this condition. *Taking* the medication does not guarantee one will not become ill and, conversely, *not taking* the medication does not mean one will automatically become ill. Individuals must decide for themselves whether or not to take any medication. It is not mandatory to take any medication.

If researchers wish, NASA will provide some medication to them for each flight. Motion Sickness medication are dispensed 1-1/2 hours prior to each flight by the flight surgeon during the medical briefing. Researchers taking **any** sort of medication should consult with the NASA physicians associated with the flight **prior to boarding** the aircraft (preferably 24 hours prior). If researchers are taking any medication for any condition, they should talk with the NASA physician if they plan to take the anti-motion sickness medicines offered because of possible drug interactions and adverse reactions. This caveat includes over-the-counter medications and "pills and potions" from a health-food source or nutrition center.

Medications provided by NASA typically wear off in six to eight hours after they are ingested, but in some individuals the effects will wear off a little sooner or somewhat later (i.e., 10 to 12 hours later). Almost 100 percent of the time, all effects are gone by the evening of the flight or by the next morning. The Reduced Gravity Program has never had a researcher have a serious reaction to medication taken for NASA's Reduced Gravity flights. Some researchers have elected to take various "preventatives" on their own (antihistamines, copper bracelets, meclizine (e.g., Dramamine®), and

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ginger). It is **imperative** for the researcher to discuss this matter with one of the NASA physicians **prior to flight**.

1.8.2 Medical Facilities

If a medical problem arises that cannot be resolved by the medical officer assigned to the flight, other medical facilities are available in the local area. Some of these are:

1. Kelsey-Seybold Clinic (occupational/industrial facility) at JSC in Building 8.
2. Christus St. John Hospital located at 18300 St. John Dr., Nassau Bay, Texas 77058 (directly across the street from JSC). Phone: (281) 333-5503.
3. Clear Lake Regional Medical Center located at 500 Medical Center Blvd., Webster, Texas 77598 (on Texas Highway 3 between Ellington Field and JSC – about 4 miles from the airport). Phone: (281) 332-2511.

In addition, there are other hospitals within 10 miles of JSC and hundreds of medical specialists in the same area.

NASA medical personnel (flight surgeons flying on NASA's Reduced Gravity Aircraft) will assist any researcher who needs additional medical care.

1.8.3 Flight Surgeon Crew Duties

On most (but not all) flights of NASA's Reduced Gravity aircraft, a NASA flight surgeon will be aboard as a medical officer. When there is no flight surgeon aboard, consultation with one of the NASA physicians will be quickly established via telephone. Most NASA physicians reside at JSC and may be contacted by telephone or pager. In addition, a telephone consultation may be established with one of the physicians at the Kelsey-Seybold Clinic at JSC. The clinic is open Monday through Friday between 7:30 a.m. and 5 p.m. Central Standard Time (CST).

If a NASA doctor is aboard, he/she has specific duties. These include helping researchers or crew who may be ill or injured. He/she will monitor all researchers during the entire flight and cannot be asked to help with experiments or take photos/videos for researchers. Physicians aboard the aircraft are directly responsible for the health and safety of all concerned and take this responsibility seriously.

2.0 USER REQUIREMENTS

2.1 Microgravity Flight Services

Microgravity Flight Services (MFS) is a corporately sponsored NASA program that provides a reduced gravity environment for research and/or development purposes. Reduced gravity is achieved on aircraft during the execution of parabolic maneuvers. NASA's Reduced Gravity Aircraft is available for microgravity parabolic flights.

Corporate management of MFS is performed through the Agency's Strategic Capabilities Assets Program (SCAP), and the day-to-day operational management is

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accomplished by the MFS Project Office located at the designated NASA Field Center. The MFS Project Office provides the technical interface and oversight for the reduced gravity flight activities of NASA's Reduced Gravity Aircraft.

Activities/Users utilizing MFS are typically funded by NASA through grants or contracts. Activities associated with other United States (U.S.) government agencies may utilize NASA's MFS on a cost-reimbursable, space-availability basis. Foreign government agencies requesting flight time using the MFS are required to have an MOU with NASA.

2.1.1 Access to MFS

Access to the MFS is arranged through the following procedural steps.

1. Conduct an **Inquiry** on Feasibility of Flying.
2. Prepare the **Test Request** (includes a Feasibility of Flying Inquiry and Initial Test Request).
3. **MFS Panel Review, Prioritization, and Flight Assignment.**
4. Submit the **TEDP and Requirements.**
5. **Schedule** the test.

2.1.3 Feasibility of Flying Inquiry

Contact the NASA MFS Project Office to discuss the feasibility of flying an experiment or activity, to establish tentative dates, and to answer or ask specific questions. This should occur at least **nine months** prior to the proposed flight.

2.1.4 Initial Test Request

The flight test/activity requestor shall prepare and submit a Test Request to the MFS Project Office at least **six months** prior to proposed flight. The Test Request shall contain the following:

1. Test objectives
2. Specific NASA programmatic and Mission Directorate relevance/linkages including applicable Work Breakdown Structure (WBS) number or other identification of fund source.
3. Desired schedule (exact flight dates will be determined later)
4. Brief description of the test and associated test equipment
5. Number of test personnel required for flight and a description of the requirement for each individual's presence

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6. Special support required or constraints, including security classification of project, if applicable
7. Preliminary Hazard Analysis identifying hazards and controls
8. Names, addresses, and phone numbers of contacts

Activities involving human test subjects, animals, or biological tests must be approved by the NASA JSC Institutional Review Board (IRB) prior to Test Request submittal. Relevant information can be found on the [NASA/JSC Aircraft Operations Web Page, C-9B User's Guides for the Reduced Gravity Research Program](#).

After screening, the MFS Project Office will forward the Test Request, the written IRB approval (as applicable), and the MFS Project Office recommendation to the MFS Program Manager for MFS Panel approval, prioritization, and flight assignment.

2.1.5 MFS Panel Approval, Prioritization and Flight Assignment

The MFS Panel, consisting of representatives from Aeronautics Mission Directorate (ARMD), Exploration Systems Mission Directorate (ESMD), Science Mission Directorate (SMD), Space Operations Mission Directorate (SOMD), Innovative Partnership Programs (IPP), Strategic Capabilities Assets Program (SCAP), and the NASA Education Office will review the Test Request and IRB approval to (1) ensure that the proposed flight activity is aligned with NASA programmatic requirements; (2) prioritize the Test Request with respect to NASA programmatic requirements; and (3) prioritize the Test Request with respect to other Test Requests.

For a Test Request to be approved, at least one MFS Panel Member must advocate for its approval. This advocacy confirms that the Test Request represents an activity that satisfies a requirement from the advocating member's respective Mission Directorate. Note that the SCAP MFS Program Manager may provide the advocacy for Test Requests for non-NASA Mission Directorate funded MFS activities. MFS Panel approval is valid for one year from the date the Test Request was approved.

Upon MFS Panel approval, the MFS Panel will prioritize the approved Test Requests. Prioritization is based on the level of the requirement that the proposed MFS activity addresses. That is, an MFS Test Request that directly addresses a NASA Level 1 Requirement will be prioritized higher than flight activities that directly address a Level 2 Requirement and so forth.

Upon approval/prioritization, the SCAP MFS Program Manager will assign the flight test/activity to fly. The SCAP Program Manager will also provide the requisite funding for the flight (for NASA Mission Directorate sponsored microgravity activities only). Non-Mission Directorate sponsored microgravity flight activities are cost-reimbursable and Non-Microgravity Flight activities are cost-reimbursable.

Note that flight assignments may be postponed, revoked, or not made at the discretion of the MFS Program Manager for reasons of aircraft availability or funds availability.

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The MFS Panel is the go/no-go gate for all NASA microgravity flight requests. MFS Panel approval does not guarantee a flight assignment; rather it is an affirmation that the proposed activity outlined in the Test Request satisfies an Agency requirement. Actual flight assignment is based on the MFS Panel approval, funds availability for flight, prioritization, and aircraft availability/scheduling.

The MFS Panel meets on a monthly basis and is chaired by the SCAP MFS Program Manager.

2.1.6 Test Equipment Data Package Requirements

The flight test/activity requestor shall submit the TEDP requirements to the MFS Project Office after MFS Panel flight assignment and at least **six weeks** prior to the desired flight date. The MFS Project Office will review the TEDP requirements and any experimental hardware to ensure consistency with aircraft safety, performance, and schedule.

The MFS Project Office will utilize the Test Request and the TEDP requirements and will work with the flight test/activity requestor to establish experiment manifest(s) for the assigned flight weeks. The TEDP template, along with information on pre-flight, post-flight, and in-flight test operations can be found in [AOD 33896](#).

2.1.7 Experiment Design Requirements

Information outlining equipment design requirements, user requirements and guidelines can be found in [AOD 33897, Experiment Design Requirements and Guidelines](#).

2.1.8 Aircraft Interface Control Requirements

Information regarding aircraft specific interface requirements for the NASA C-9B can be found in [AOD 33912, Interface Control Document NASA 932 C-9B](#).

2.1.9 Scheduling

The MFS Project Office will develop the specific schedules for an MFS flight week. The MFS Project Office is responsible for executing the flight manifest as determined by the MFS Panel. The MFS Project Office may, at its discretion, disallow or postpone a flight test/activity based on safety, technical maturity, or other reason.

2.2 Human Research Protocol

Researchers who plan experiments involving human test subjects, animals, or biological tests must obtain approval from the JSC IRB. See [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 Human Research Master Protocol must be submitted to the JSC IRB at least **six weeks** prior to the proposed flight date. This protocol must include the equipment safety certification, which is described in the following section, and applicable signed consent forms from each subject. In addition to equipment safety

certification, letter(s) of approval(s) from other IRBs and/or Institutional Animal Care Use Committees are 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. Human Research Protocol documentation should be submitted to:

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



Figure 1. Researchers in the Altitude Chamber

2.3 Test Personnel Requirements

This section describes requirements that must be met for a researcher to fly on NASA's Reduced Gravity Aircraft.

2.3.1 Medical Requirements

Flight personnel are classified in two categories: Category I and Category II.

Requirements for medical certification of crewmembers and human test subjects will be met by successful completion of an annual NASA flight physical.

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NOTE

Failure to submit the required documentation for each person on time will preclude that person from flying.

Category I Personnel (Air Force Class III Flight Physical) are:

Pilots, Astronauts, Payload Specialists, Aircraft Operations Division (AOD) Aircrew, Suited Subjects, Photographers, C-9B Test Directors, Flight Engineers, Aircraft Crew Chiefs, Medical Officers, and any test subjects involved in a flight requiring Level I or Level II medical coverage as mandated by the IRB. These individuals are required to have a physical once a year.

Category I personnel must have successfully completed an Air Force Class III flight physical within the previous 12 months.

Category II Personnel (C-9B Examination) are:

Pressure Suit Engineer/Technicians, Test Safety Officer, Reduced Gravity Aircraft Researchers/Investigators, Research Assistants, Test Observers, Chamber Directors/Operators/Conductors, students involved in NASA sponsored programs, news media representatives, test subjects not involved with Level I or Level II type experiments, and any other personnel not included in the mandatory United States Air Force Class III physical category and not mentioned in this group. These individuals are required to have a physical once every three years.

All Category II personnel with a demonstrated necessity to participate in reduced gravity flight must provide the results of a C-9B Examination or equivalent Federal Aviation Administration (FAA) Third Class Aviation Physical. Contact Mike Fox at (281) 792-5724 for medical requirements guidelines. This examination must be reported on [JSC Form 8500](#), Report of Medical Examination, and **dated within the previous three years**. Additionally, all test personnel must meet height and weight standards set forth in the medical requirements.

The examining physician **MUST** be certified as an FAA Medical Examiner or a designated Flight Surgeon.

Costs for physical exams are the sole responsibility of the individual.

All medical questions posed by examiners should be directed to the Physiological Training Officer at (281) 792-5724. The Chief, Aircraft Operations Division reserves the right to refer any NASA Reduced Gravity Aircraft manifested person to the JSC Medical Office for a medical determination of a person's fitness for flight. **The Chief of the Medical Sciences Division at JSC has the final authority on whether or not a person is physically qualified to fly on NASA's Reduced Gravity Aircraft.**

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2.3.2 Physiological Training Requirements

All personnel with a demonstrated necessity to participate in reduced gravity flight must have received physiological training **within the last three years**. Physiological training will include appropriate classroom instruction and an altitude chamber hypoxia demonstration. Requirements for physiological training may be obtained from:

NASA Johnson Space Center
Physiological Training Officer
Mail Code SD27
Houston, TX 77058
Or call Mike Fox at (281) 792-5724

There is no cost for physiological training. The only costs an individual will be required to pay are travel costs to and from JSC or to a Department of Defense (DoD) (Air Force or Navy) facility.

A NASA employee must schedule individuals for physiological training. Those researchers working with an Experiment Coordinator must contact them to make arrangements for physiological training.

NASA employees will not need any additional badging for physiological training at the Sonny Carter Training Facility (SCTF). All others must meet the badging requirements documented in paragraph [2.3.5](#).

NOTE

Failure to submit the required documentation will preclude those individuals from flying.

2.3.3 Medical and Physiological Documentation

For individuals who have received a physical at a location other than JSC and received physiological training at a DOD (Air Force or Navy) or FAA facility, a copy of the physical examination results ([JSC Form 8500](#)) and the physiological training record for each person must be received by the Physiological Training Officer at JSC **at least four weeks prior to flight**.

Send or FAX completed physical and physiological training records to:

NASA Johnson Space Center
Physiological Training Officer
Mail Code SD27
Houston, TX 77058
Office: (281) 792-5724
Or fax to Mike Fox at (281) 792-5731

It is the responsibility of each individual to confirm with Mike Fox that his or her medical and physiological documents were received. Failure to do so could result in not being able to fly.

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2.3.4 Security

Access to Ellington Field Building 993 is controlled. The building is locked after normal duty hours; however, personal valuables should not be left unattended. Researchers are responsible for providing additional security, if required. All non-NASA badged individuals must obtain a temporary security badge prior to entering any JSC facility, including Ellington Field. Temporary badges are available from the Security Office in Building 110, on-site at JSC or with prior arrangement at Guard Post 18 at Ellington Field. See [AOD 33895, Visitor's Guide NASA JSC RGO](#) Section 2.2 for more details concerning security badging of personnel (U.S. citizens and foreign nationals).

2.3.5 Badging Requirements

All individuals who visit JSC, including Ellington Field (Reduced Gravity Operations) and SCTF (physiological training), must have a valid JSC visitor's badge or NASA employee badge. This section will discuss the badging requirements.

All visitors to JSC must be sponsored by a JSC-badged employee. The RGO at JSC performs this function for most visitors to the RGO and the SCTF. If your visit to JSC is being sponsored by an office at JSC other than the RGO, you must provide the correct visitor information for both U.S. citizens and foreign nationals to that office so they can properly process your badge request paperwork.

The SCTF has become a gated facility, meaning you will have to pass through a guard gate to gain access to the parking lot at the SCTF. In order to do so, you will need to get your visitor's badge (U.S. citizen or foreign national) at Building 110 (main gate) at JSC or if special arrangements have been made with the RGO you may pick up your badge (U.S. citizen ONLY) at Post 18 at Ellington Field.

The badging process at JSC is accomplished two ways: one method for U.S. citizens and another for foreign national visitors.

U.S. Citizens

All researchers (flyers or ground crew supporting your experiment) will be required to have the appropriate badge during their stay at JSC (Ellington Field). A NASA JSC employee must make each request for a badge. Badge requests can be made through the RGO or through the JSC office sponsoring the research.

It is the responsibility of the researcher, the project manager, or the principle investigator to provide badge request information to the RGO. This information shall be provided to the RGO **3 weeks** prior to the visit. The JSC badging office requires a minimum of 3 days to process a U.S. Citizen badge request. To request a badge for U.S. citizens, the following information is required:

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Name
Organization (Company/University)
Citizenship
Dates of visit
Reasons for visit

Upon arrival at JSC, researchers will pick up their badge at the badging office in Building 110 at JSC. The office hours are 6 a.m. to 10 p.m. CST daily (including Saturday and Sunday).

For those individuals who are U. S. citizens and are going to the RGO at Ellington Field, you will be able to pick your badge up at Post 18 at Ellington Field the morning of the first day of your visit. Prior arrangements for this must be made with the RGO.

Permanent Resident Aliens (Green Card)

Permanent Resident Non-U.S. citizens who have a Permanent Resident Alien Card (Green Card) are treated the same as any foreign national.

Foreign Nationals

A foreign national is defined as an individual from a country other than the United States of America who is not a U. S. citizen. Additionally, U.S. citizens working for a company or corporation headquartered outside the U.S. will be treated as a foreign national and are listed as “foreign representatives.”

NASA Headquarters must approve the visit of those individuals who are citizens of a country that is listed on the “List of Designated Areas.”

Foreign nationals will not have access to any NASA computer systems while on site.

Foreign national visitors to JSC/Ellington Field must provide the following information and documents **3 months** prior to the visit to the RGO at jsc-zero@mail.nasa.gov:

- First Name, Middle Name, Last Name, Other names used
- Gender, Eye color, Hair color, Height, Date of birth, City, and Country of Birth
- Greencard? If yes, Resident Alien Number; If yes, Greencard Exp Date
- Citizen of what country(ies) (up to 2)
- Visa #, Type of Visa, Visa Expiration Date
- Passport #, Passport Country of Issue, Passport Expiration Date
- Social Security # , Drivers License #
- Employer: Address, city, state, zip and country, phone, fax, and e-mail address
- Title or Position
- Type of visit: “To conduct research on NASA’s Reduced Gravity Aircraft” or “attend Physiological training (1) day training course.”
- Name of NASA Center managing your research

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- Name and contact information of your Principle Investigator
- Name of University
- Name and contact information of your NASA Technical Monitor
- NASA Grant Number
- Title of your experiment
- Type of Research (e.g., Fluid Physics, Combustion, Materials, Life Science)
- Justification of your Experiment

PLEASE E-MAIL SCANNED COPIES OF YOUR VISA, PASSPORT, SOCIAL SECURITY CARD, GREENCARD AND DRIVERS LICENSE TO THE RGO AT AT jsc-zerog@mail.nasa.gov

FAILURE TO SEND SCANNED DOCUMENTS WILL DELAY THE PROCESSING OF YOUR FOREIGN NATIONAL BADGE REQUEST.

When a JSC office other than the RGO sponsors the research visit, the researcher must contact the sponsoring JSC office and send the above information and all accompanying information to that office for processing.

All foreign nationals must report to Building 110 at JSC to pick up their badges. The Badging Office's hours of operation are 6 a.m. to 10 p.m. CST daily (including Saturday and Sunday). The individual must have with them a current passport, VISA, and driver's license. All foreign nationals must have a NASA escort while at JSC/Ellington Field and will not have access to any NASA computer systems.

2.3.6 Visitors

All visitors to the RGO (Building 993) shall have the appropriate visitors badge. Contact the RGO at least three weeks prior to the visit to ensure that badges will be available.

Foreign nationals will need to follow the procedures documented in the Foreign Nationals paragraph in Section [2.3.5](#).

2.3.7 Mishap Form

All researchers (flyers and ground crew), upon arrival at the RGO, must fill out [AOD Form 1492, Mishap Notification](#). This form contains the information necessary for contacting family members, or individuals of choice, in the event of an aircraft/ground incident. All flyers must fill out AOD Form 1492 prior to their first flight on NASA's Reduced Gravity Aircraft. The completed forms will be kept on file in the RGO during the current flight week.

2.3.8 C-9B Safety Training

All researchers who fly on NASA's Reduced Gravity Aircraft shall receive a safety briefing prior to each flight. The briefing explains the use and operation of safety

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equipment located on the C-9B and how to egress the aircraft in the case of an emergency. All researchers/visitors must be informed and abide by the ground safety policies and procedures.

2.3.9 Disclosure Statement for Crewmembers and Qualified Non-Crewmembers Flying on Board Government Aircraft Operated as Public Aircraft

In accordance with [41 CFR 102-33, Management of Government Aircraft](#), Section 102-33.165;(e), crewmembers and qualified non-crewmembers flying on board Government aircraft operated as either civil or public aircraft on the behalf of NASA shall have on file in Flight Operations a record of acknowledgement of the following disclosure statement:

Generally, an aircraft used exclusively for the U.S. Government may be considered a “public aircraft” as defined in Public Law 106-181, provided it is not a Government-owned aircraft transporting passengers or operating for commercial purposes. A public aircraft is not subject to many Federal Aviation Regulations, including requirements relating to aircraft certification, maintenance, and pilot certification. If an agency transports passengers on a Government-owned aircraft or uses that aircraft for commercial purposes, the Agency must comply with all Federal Aviation Regulations applicable to civil aircraft. If you have any questions concerning whether a particular flight will be a public aircraft operation or a civil aircraft operation, contact the Agency sponsor of that flight.

You have certain rights and benefits in the unlikely event you are injured or killed while working aboard a Government-owned or operated aircraft. Federal employees and some private citizens are eligible for workers’ compensation benefits under the Federal Employees’ Compensation Act (FECA). When FECA applies, it is the sole remedy. For more information about FECA and its coverage, consult with your Agency’s benefits office or contact the Branch of Technical Assistance at the Department of Labor’s Office of Workers’ Compensation Programs at (202) 693-0044.

State or foreign laws may provide for product liability or “third party” causes of actions for personal injury or wrongful death. If you have questions about a particular case or believe you have a claim, you should consult with an attorney.

Some insurance policies may exclude coverage for injuries or death sustained while working or traveling aboard a Government or military aircraft or while within a combat area. You may wish to check your policy or consult with your insurance provider before your flight. The insurance available to Federal employees through the Federal Employees Group Life Insurance Program does not contain an exclusion of this type.

If you are the victim of an air disaster resulting from criminal activity, Victim and Witness Specialists from the Federal Bureau of Investigation (FBI) and/or the local U.S. Attorney’s Office will keep you or your family informed about the status of the criminal investigation(s) and provide you or your family with information about rights and services, such as crisis intervention, counseling, and emotional support. State crime victim compensation may be able to cover crime-related expenses, such as medical costs, mental health counseling, funeral and burial costs, and lost wages or loss

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of support. The Office for Victims of Crime (an agency of the Department of Justice) and the U.S. Attorney's Office are authorized by the Antiterrorism and Effective Death Penalty Act of 1996 to provide emergency financial assistance to state programs for the benefit of victims of terrorist acts or mass violence.

If you are a Federal employee. If you are injured or killed on the job during the performance of duty, including while traveling or working aboard a Government aircraft or other Government-owned or -operated conveyance for official Government business purposes, you and your family are eligible to collect workers' compensation benefits under FECA. You and your family may not file a personal injury or wrongful death suit against the U.S. or its employees. However, you may have cause of action against potentially liable third parties.

You or your qualifying family member must normally also choose between FECA disability or death benefits, and those payable under your retirement system (either the Civil Service Retirement System or the Federal Employees Retirement System). You may choose the benefit that is more favorable to you.

If you are a private citizen not employed by the Federal Government. Even if the Federal Government does not regularly employ you, if you are rendering personal service to the Federal Government on a voluntary basis or for nominal pay, you may be defined as a Federal employee for purposes of FECA. If that is the case, you and your family are eligible to receive workers' compensation benefits under FECA, but may not collect in a personal injury or wrongful death lawsuit against the U.S. or its employees. You and your family may file suit against potentially liable third parties. Before you board a Government aircraft, you may wish to consult with the department or Agency sponsoring the flight to clarify whether you are considered a Federal employee.

If the agency determines that you are not a "Federal employee," you and your family will not be eligible to receive workers' compensation benefits under FECA. If you are onboard the aircraft for purposes of official Government business, you may be eligible for workman's compensation benefits under state law. If an accident occurs within the U.S. or its territories, its airspace, or over the high seas, you and your family may claim against the U.S. under the Federal Tort Claims Act or Suits in Admiralty Act. If you are killed aboard a military aircraft, your family may be eligible to receive compensation under the Military Claims Act, or if you are an inhabitant of a foreign country, under the Foreign Claims Act.

NOTE

This disclosure statement is not all-inclusive. You should contact your Agency's personnel office, or if you are a private citizen, your Agency sponsor or point of contact for further assistance.

2.4 Funding

Activities/Users utilizing MFS are typically funded by NASA through grants or contracts. Activities associated with other U.S. Government Agencies may utilize NASA's MFS on a cost-reimbursable, space-availability basis. Foreign government

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Agencies requesting flight time using the MFS are required to have an MOU with NASA. Reference paragraph [2.0](#) for the procedures to fly research hardware/experiment on the reduced gravity aircraft. NASA Headquarters SCAP Program Manager has funding control of this program.

2.5 Timeline

This timeline has been designed to assist researchers in the timely submittal of required documentation.

Test – 9 months

Make initial inquiry about the feasibility of flying an experiment on the C-9B (see Paragraph [2.1](#)).

Test – 6 months

Submit a Formal Test Request to an Experiment Coordinator and the RGO. Approval Questionnaires must be resubmitted every two years (see Paragraph [2.1](#)).

Test – 3 months

Submit badging request for foreign nationals (see Paragraph [2.3.5](#)).

Submit Initial Test Request (see Paragraph [2.1](#)).

Test – 6 weeks

Submit TEDP (see Paragraph [1.5](#)).

Submit IRB Requirements (see Paragraph [2.2](#)).

Submit photographic and video support and “S” Band Downlink requirements as part of the TEDP (refer to [AOD 33896](#)).

Submit compressed Gas (K-Bottle) requirements (breathing air, nitrogen, argon, helium) (refer to [AOD 33912](#)).

Test – 4 weeks

Submit test personnel data (medical, physiological) (see Paragraph [2.3.3](#)) and names of flyers to the RGO.

Test – 3 weeks

Submit badging request for all U.S. citizens (see Paragraph [2.3.5](#)).

Test – 4 days

Research hardware arrives at the RGO at Ellington Field.

Test – 1 day

All research hardware goes through the TRR (see Paragraph [1.6](#)).

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Test + 1 day

Arrange for shipping hardware.

Test + 1 week

Hardware must be removed from Building 993/990.

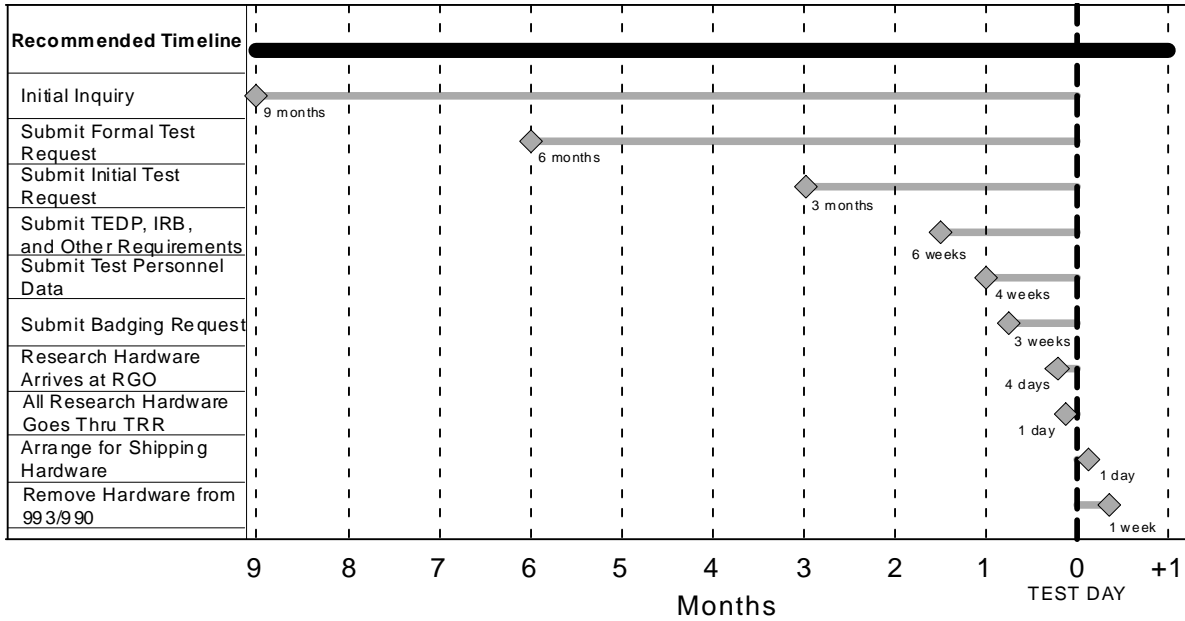


Figure 2. Required Documentation Submittal Timeline



Figure 3. Typical Research Equipment Load (GRC Feb 23, 2006)

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3.0 TEST OPERATIONS

3.1 Pre-Flight

The test equipment should be received at JSC Ellington Field in a timely manner to allow for buildup, inspection, and the TRR. The address to use for shipping is:

Reduced Gravity Office
Building 993
Ellington Field
Houston, Texas 77034

The buildup and checkout of test equipment is the sole responsibility of the researcher. The RGO provides a general tool box for researcher use; therefore, it is not necessary for researchers to bring tools with them. If there are unique tools required by researchers, the researcher will have a complete inventory of those unique tools. The Reduced Gravity Office imposes a strict Tool Control/ Foreign Object Damage (FOD) program.

The TRR will normally be conducted in Building 993 or in Hangar 990. All research and engineering hardware will go through a TRR each and every visit to the RGO. Test equipment, personnel, procedures, and documentation will be examined as indicated in [AOD 33912](#). A simulated ground run may be required during this review whereby the researcher will demonstrate normal and contingency in-flight procedures. The TRR is normally held at 10:30 a.m. every Monday morning of each flight week. If approved for flight by the TRR committee, the equipment will subsequently be loaded on the aircraft. Hardware that has flown recently, a list of modifications to previously flown equipment, and changes to test procedures must be provided to the RGO no later than **six weeks** prior to flight and brought to the lead test director's attention by e-mail.

Flight suits will be issued immediately after loading hardware onto the aircraft. A completed mishap form must be on file with the RGO before a flight suit can be issued.

A preflight safety briefing will be given to all researchers prior to boarding. The briefing will cover the emergency equipment on board the aircraft and the emergency egress procedures. The typical preflight schedule is as follows:

8:15 Medical Briefing
8:45 Preflight/Safety Briefing
9:00 Board aircraft
9:30 – 11:30 Takeoff and Flight

There will be no unattended operation of research equipment on the aircraft or in Buildings 993, 994, and 990. Someone familiar with the shutdown procedures will be in attendance during any equipment operation.

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3.2 In-Flight

All personnel aboard the aircraft will be under the direction of the aircraft flight crew and Test Directors, both for normal and emergency conditions and test operations. The Lead Test Director is in charge of all test activities, and the Pilot in Command is the final authority for all operations from boarding through deplaning. Strict adherence to the authority of these personnel will be rigidly enforced. Any deviation from the flight-test plan must be discussed with a Test Director before implementation. The C-9B flight crew members have formulated the following guidelines to help make research on the C-9B effective, enjoyable, and most importantly, safe.

1. Drinking water is available throughout the flight on request to the Flight Surgeon or Test Directors. It is the researcher's responsibility to make sure that the water remains contained and accounted for at all times.
2. Food is not allowed on the aircraft at any time.
3. Wear layers of clothing (i.e., typically one sweatshirt, T-shirt, and shorts) underneath the flight suit provided by the RGO. Cotton is the best material to wear under the flight suit, as it will insulate and absorb perspiration. Tennis shoes are the preferred type of footwear. Test cabin temperatures are comfortable, but can fluctuate somewhat in-flight. Researchers should not bring their own flight suit and should not wear jewelry. Flight suits have many pockets, and should only be used to store flight essential items that have been properly inventoried.
4. Personal camcorders and cameras are generally allowed on NASA's Reduced Gravity Aircraft Post-Flight

A post flight debriefing will be held immediately after landing to review any problems that occurred during the flight and to discuss possible alterations to the test hardware or test procedures.

Upon completion of the flight week, the equipment will be offloaded and prepared for shipment by the researcher. It is the researcher's responsibility to ensure that all test articles and materials used in the test (including compressed gas cylinders, chemicals, packing, and crating) are removed promptly from Building 993 to make room for incoming researchers. It is also the responsibility of the researcher to make arrangements for shipment of the test equipment back to the home base of operation. Be sure to advise shippers that pickups must be made no later than 3 p.m., Monday through Friday only. Researchers should arrange for the shipment of their research hardware to and from Ellington Field. The address for shipping research hardware is:

Reduced Gravity Office
Building 993
Ellington Field
Houston, Texas 77034
Phone Number (281) 244-9874

Researchers should arrange for shipments to be delivered to the RGO during normal business hours (8 a.m. to 3 p.m. CST, Monday thru Friday). Prior to the completion of a flight week, the researcher shall make the necessary arrangements for the return shipment of research hardware. The RETURN-shipping label will show the following:

Ship To: (researcher company, school, or NASA Center)

Ship From: (researcher company, school, or NASA Center)

NOTE

The RGO is a pickup location ONLY. It must **NOT** be named as the SHIP FROM location on any shipping documents.

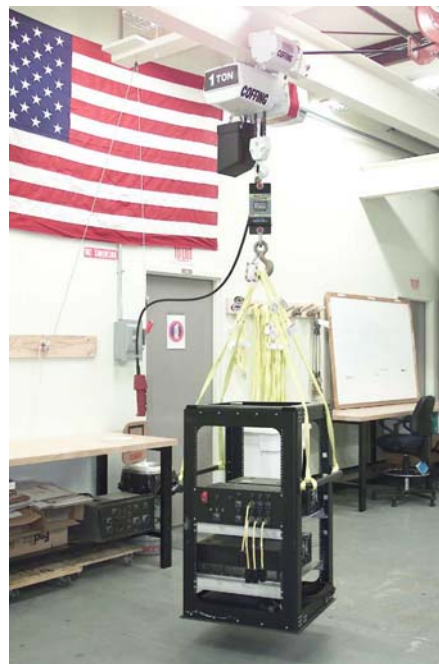


Figure 4. Building 993 High-Bay Crane

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