

PROJECT Safety Document

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PROJECT TITLE: MAIR-E

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RAF PROJECT MANAGER: Peisang Tsai

PROJECT SAFETY OFFICER: Dave Allbee and Jason Morris

RESEARCH PERIOD: 3 October 2022 ~ 18 November 2022

I. PROJECT SPECIFIC FACTORS

A. HAZARDOUS MATERIALS:

- a. Compressed Gas: Zero air, compressed breathable calibration gas and UHP Nitrogen
- b. Liquid: 30% Propylene glycol in water

B. OVER WATER OPERATIONS: Yes

C. PENETRATION OF STRONG CONVECTIVE SYSTEMS: Not planned

D. OPERATION UNDER PROBABLE ICING CONDITIONS: Minimal

E. HAZARDS ASSOCIATED WITH FOREIGN BASES OF OPERATION: None

F. MISCELLANEOUS HAZARDS:

- a. Electrical hazards
- b. Sharp edges and points (wing trailing edges, racks, nose gear doors)
- c. COVID-19

II. GENERAL FACTORS

A. All RAF field deployments will have a designated Project Safety Officer – separate from the Project Manager - to oversee the implementation of these safety guidelines. Any safety related issues that come up during the course of the payload integration or field deployment should be raised directly with that individual. The responsibilities of the PSO are outlined in the UCAR Safety Manual available online.

B. Normal risks involved in working on or near both propeller and jet aircraft. (For example: noise, moving machine parts, blown dust or particles, equipment racks and other floor mounted hardware, etc.)

C. Only members of the flight crew or trained observers necessary to complete the scientific mission may be carried on board.

- D. Flying research profiles onboard the RAF aircraft require a certain level of physical fitness – particularly for work around severe weather or for extended durations. Legal limitations prevent RAF from screening potential crew members directly so it is the responsibility of each individual participant to determine their fitness for inclusion in the list of potential onboard observers. A summary of common issues that should be taken into account in your assessment of your fitness is appended to this document.
- E. While the aircraft are maintained and operated within rigorous guidelines, all NCAR aircraft are officially designated as “PUBLIC AIRCRAFT” and are not subject to the same certification requirements as civil aircraft. Certain life insurance policies have coverage exemptions for flying on non-airline flights. RAF recommends that all flight participants check with your individual insurance companies to see if you are covered. NCAR also maintains blanket liability coverage for all crew members. See the Disclosure Statement for Government Aircraft for details.
- F. All ground operations, including the installation, testing and maintenance of scientific equipment, application of electrical power, aircraft maintenance, loading, fueling and aircraft movements will only be conducted by, or under the supervision of qualified RAF personnel.
- G. The installations of all user-supplied equipment must be performed in compliance with the aircraft specific RAF Investigator’s Handbook. These documents set forth the procedures to be followed in the design, fabrication, and RAF approval of user-supplied equipment to be flown on board an NCAR aircraft.
- H. Each group will document the integration and layout of their equipment on the aircraft using the standard “RACK BOOK” forms provided by the RAF.
- I. The entire research payload must undergo a complete safety inspection (SAR) by representatives of the three RAF technical support groups (aeronautical engineering, technicians and mechanics) prior to the first test flight. This inspection must be documented using the RAF “Equipment Installation Form” and be accepted by RAF’s Chief Pilot. A copy of this form will be kept in the project file.
- J. Once the SAR is completed, the temporary removal of any component from its secured position for maintenance or repair must be documented in the assigned RACK BOOK. 90 minutes prior to any flight, the RACK BOOK will be examined to determine which, if any, systems were affected. Those installations must be re-examined for adequate integration prior to proceeding with pre-flight preparations. If any system has not completed this examination by the 90 minute deadline, the flight will be delayed to maintain the inspection timeline.

- K. All compressed gas cylinders brought into the facility must be secured when not in use. Individual loose cylinders must be stored in the storage room in the old hangar. Groups of cylinders can be secured as blocks or on pallets in the open hangar. During the installation, removal or exchange of all cylinders on/from one of the aircraft, a safety cap must be in place protecting the valve.
- L. The RAF has an extensive sheet metal shop on site at Jeffco. Users are only allowed access to this equipment after they have been judged qualified for its use by the RAF Maintenance staff.
- M. Open toed shoes may not be worn on the aircraft during project cabin preparation or research flight operations due to the likely presence of various types of floor mounted hardware.
- N. Prior to departing for the field site, all project personnel will receive a “Climate Briefing” from the assigned project leader on possible local weather hazards. Such items as the frequency of severe storms (hail, tornados, etc.), exposure to extreme cold, or the likelihood of extended intervals with high ambient temperatures will be addressed.
- O. There will be no smoking within the RAF facility or within 50 feet of the aircraft on the ramp.
- P. All personnel working around the aircraft must familiarize themselves with the location of fire extinguishers within the aircraft and in the vicinity of the aircraft. Consult with an RAF aircraft mechanic.
- Q. Aircraft fuses or circuit breakers will be replaced or reset only with the consent of qualified RAF personnel.
- R. At the completion of each day’s activities, all liquids, refuse and litter must be removed from the aircraft and ramp areas.
- S. There will be no electrical power left on the aircraft without RAF supervision.
- T. Users are not allowed to operate any of the maintenance lifts at Jeffco or during field deployments. An RAF operator will be required to get access to this equipment.
- U. Tool control: once flight operations begin, instrument operators shall maintain a list of the tools that they bring onboard, and furnish the tools along with the list to the RAF project manager for check 90 min prior to a scheduled take-off. In case of missing tools, flights

will be delayed until all tools are accounted for, or a waiver is issued by the RAF flight operations.

III. FLIGHT PERSONNEL (FLIGHT CREW AND SCIENTIFIC OBSERVERS)

- A. The cabin will normally be pressurized to cabin altitudes below 10,000 feet. Research flight operations with cabin pressures above 12,000 feet will not be conducted unless this requirement has been stated at the time of the original project request. Specialized training and more restrictive physical requirements for flight crews and observers are needed for such operations.
- B. The project manager has the responsibility to ascertain that everyone onboard is familiar with normal and emergency procedures, and the use of the following equipment as pertinent to the flight: oxygen system and masks; the interphone system; emergency exits; and emergency survival equipment. This is accomplished through a pre-flight safety briefing, which must be documented prior to participation in a flight as a crew member.
- C. Supplemental emergency oxygen is available for all persons aboard and must be used when the aircraft is operating at cabin altitudes above 10,000 feet.

IV. FLIGHT OPERATIONS

- A. All flight operations will be conducted in accordance with Federal Aviation Administration Regulations Part 91 Subpart B.
- B. The pilot-in-command is responsible for the safe conduct of all flight operations.
- C. Any malfunction in scientific equipment, mechanical or electrical, will be immediately reported to the pilot-in-command. No in-flight repairs will be permitted without permission from the pilot-in-command.
- D. No in-flight handling of toxic chemicals or gasses, or other hazardous materials, will take place until specifically authorized by the pilot in command. The pilot shall assess the current flight conditions prior to authorizing such activities.

- E. Safety belts will be worn by all personnel during taxi, takeoff and landing and at such times as instructed by the flight crew.
- F. Research flight profiles often call for low altitude flying. RAF flight operations conform to the minimum altitudes established in the appropriate FAR's. When FAR's are not restrictive or when the restrictions have been waived for specific flights, RAF operations will be permitted to use the following guidelines:
- i. Daylight, visual flight rule (VFR) conditions / level legs: 100 feet AGL
 - ii. Daylight, visual flight rule (VFR) conditions / turning: 300 feet AGL
 - iii. Nighttime, visual flight rule (VFR) conditions: 500 feet AGL
- G. Adequate rest for onboard personnel, both flight crew and scientific observers, is essential to the safe and efficient operations of NCAR aircraft in support of research programs. RAF has established specific crew duty limits for flight operations as follows:
<https://www.eol.ucar.edu/content/raf-crew-duty-policy>
- i. Maximum Crew Duty Period per Day: 14 hours
 - ii. Any 24-hour period: 10 flight hours
 - iii. Any consecutive 7 day period: 40 flight hours or 60 duty hours
 - iv. Any 30 day period: 120 flight hours
 - v. Consecutive working days: 6 days
 - vi. Minimum crew rest period: 12 consecutive hours
 - Vii. Normal duty day: 8 hours
 - Viii. Maximum consecutive days over 10 hours, not to exceed 2 days
 - Viiii. Time required to change over from day to night time operations 36 hours
 - X. Maximum takeoff time shift during night operations, from the previous night's takeoff 3 hours
- All scientific observers are strongly encouraged to comply with these limits. Any onboard observers who are deemed to be unfit for flight at the time of the pre-flight briefing will be barred from participating in that particular flight.
- H. There will be no smoking on any NCAR aircraft. Smoking is only permitted in designated areas. No smoking is permitted within 50 feet of parked aircraft, or flammable liquid storage points.
- I. Whenever an engine or the Auxiliary Power Unit is in operation, hearing protection will be worn near the aircraft. (Hearing protection is required within the C130 aircraft).

- J. In the event of fire, the crewmember observing the fire will warn the other crew members by shouting, “FIRE-FIRE” and reporting the location of the fire. If smoke, fumes or fire are present within the personnel compartment, all occupants regardless of altitude will don pressure demand oxygen masks and select “100% OXYGEN” on his/her respective oxygen regulators. All available means will be used to extinguish the fire. The RAF technician has the primary responsibility for fighting the fire and directing the actions of other personnel.
- K. Research electrical power will normally be available at all times. All power changes will be coordinated between the scientific observer and flight crew. Any fuse replacement or circuit breaker reset in the primary power supply system will be performed only by or with the consent of the pilot-in-command.
- L. It will be the duty of the scientific crew aboard to properly adjust or secure research and related equipment prior to takeoff and landing. However, it is the responsibility of the pilot-in-command to specifically check and ascertain that such duties have been satisfactorily completed.
- M. The operation of user-supplied research equipment onboard the aircraft will only be permitted under the supervision of, or with the approval of the RAF and the scientist concerned.

V. HAZARDOUS MATERIALS, ENERGIES, AND TOXIC GASES

Hazardous materials, non-eye safe lasers, compressed inert gases or toxic gases will not be carried aboard NCAR aircraft without review and permission from the RAF Safety Committee. Applicable Federal and OSHA regulations regarding both onboard and ground support activities will be adhered to in each case. Provisions for dealing with said materials or gases will be defined by the RAF Safety Committee in coordination with the NCAR Safety Office and applicable regulations. All hazards must be declared and listed by each participant on the RAF’s Hazardous Materials and Devices Form. This form includes a section on special “handling” procedures to be followed in order to limit the dangers associated with the various hazards. A copy of each HMD form will be submitted to the NCAR Office of Safety. The appropriate Safety Data Sheets (SDS) for each chemical hazard will be carried aboard the aircraft.

VI. EMERGENCY EQUIPMENT AND PROTECTIVE CLOTHING

Emergency equipment and protective clothing will be carried aboard NCAR aircraft for the following purposes:

- To cope with air and ground emergencies.
- To sustain crew members' lives in case of forced landings.

Emergency equipment is divided into two categories as listed below. Emergency equipment is considered a part of the aircraft and will not be carried by individual crew members. Scientific crew may carry tools necessary for airborne maintenance and specialized research equipment. Crew judgment is the paramount factor deciding emergency equipment needs.

A. CATEGORY I EQUIPMENT

Category I equipment is a part of the basic aircraft inventory and will be carried aboard NCAR aircraft at all times.

- Fire Extinguishers
- Axe
- First Aid Kit
- Tool Kit: Pliers, screw drivers, wrenches, fuses, tape, allen set, and knife
- Flashlight

B. CATEGORY II EQUIPMENT

Category II equipment is primarily crew survival equipment and will be carried during specialized operations, over water, desert, mountains, arctic areas, etc.

CATEGORY II A

Category II A equipment will be aboard NCAR aircraft for all operations conducted over desert and over water beyond gliding distance of land.

- One life preserver for each crew member
- Enough life rafts to safely carry all crew members
- Water in addition to that carried in the survival kit
- Emergency radio
- Survival kit

CATEGORY II B

Category II B equipment will be carried on all flights where operations are to be conducted over mountainous terrain and arctic areas.

- Emergency radio
- Survival kit
- Exposure suits, sleeping bags, or blankets, as appropriate

C. PROTECTIVE CLOTHING

Prior to any deployment, local conditions will be examined to determine whether or not protective clothing will be required appropriate to conditions which may be encountered. This issue will be discussed in the mandatory “Climate Briefing” discussed above. It will be the responsibility of the project manager & the pilot-in-command to ensure that non-NCAR and other aircrew members wear appropriate clothing.

Medical Information for Airborne Research^[1]

The following information should assist you in identifying potential problems that could interfere with your ability to participate in research in NCAR/NSF aircraft. The information contained herein is in no way designed to be comprehensive. If you have any concerns about your ability to fly on NCAR/NSF aircraft, please consult your physician.

There is a possibility that you may be in situations that would require you to take care of yourself including such activities as evacuating the aircraft, dealing with turbulence, opening doors, and wearing an oxygen mask. It is important to identify conditions that may interfere with your performance of such duties. If you feel you cannot perform any duty or feel there may be an issue that could affect any aspect of your participation, do not continue without first consulting your physician.

The following medical conditions and policies could affect your safety and ability to participate in research in NCAR/NSF aircraft. Should you feel that you possess any of the conditions listed below or if you are unable to comply with any of the policies listed, you should NOT participate in NCAR/NSF aircraft at this time.

1. Any medical condition that would not allow you to continuously walk for 10 minutes or up two flights of stairs.
2. Any medical condition that would inhibit your ability to be able to lift 40 pounds.
3. Interruption of your normal activities because of difficulty breathing, conditions such as asthma, or other lung/heart problems that interrupt your normal activities.
4. Ear or sinus problems when flying.
5. Motion sickness when flying.
6. Problems with hearing and speech that would interfere with the ability to give and receive instructions in a room with moderate background noise.
7. Taking any medication that gives side effects of drowsiness or difficulty in maintaining alertness.
8. Any condition, illnesses or injuries that would interfere with the ability to perform duties on research flights and to evacuate the aircraft if necessary.

9. Any condition, illnesses or injuries that might require the assistance of a RAF crewmember.
10. RAF policy limits flying for 24 hours after immunizations, dental work, and SCUBA diving.
11. Pregnancy beyond the 20th week as well as any other concerns related to the health of a pregnant mother or baby.
12. RAF policy prohibits carrying any person suffering effects from alcohol consumption on a flight, regardless of when it was consumed, and also restricts flight if alcohol has been consumed within 8 hours prior to flight.
13. Symptoms of upset stomach, gas, or diarrhea prior to flight.

[1] Prepared with the assistance of Dr. Warren Jensen, FAA Senior Medical Examiner, Director of Aeromedical Research, University of North Dakota.

OGC August 03

Disclosure Statement for Government Aircraft

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

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 purpose. A public aircraft is not subject to many Federal Aviation Regulations, including requirements relating to aircraft certification, maintenance, and pilot certifications. If an agency transports passengers on a Government owned aircraft or uses that aircraft for commercial purpose, 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 operation, you should 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 Program at (202) 693-0044.

State or foreign laws may provide for product liability or “third party” causes of action 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 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 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 United States 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 United States 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 United States, or its territories, its airspace, or over the high seas, you and your family may claim against the United States under the Federal Tort Claims Act or Suites in Admiralty Act. If you are killed aboard as 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.



HAZARD REPORT	
To:	From (optional):
Summary of Hazard:	
Suggested Corrective Action:	
Summary of the Investigation:	
Corrective Action Taken:	
Signature and Date:	Comments: