Chapter 3 GV Performance and Flight Planning Guidelines

3.1 Runway Requirements

7,000 feet of runway is generally required for G-V operations to allow for adequate safety margins in case of emergency aborts and/or landings. However, atmospheric conditions such as rain, ice or hot temperatures may cause an increase in required runway length. RAF Flight Operations may approve shorter runway operations on a case by case basis.

3.2 Operational Limits

Investigators should consult with the RAF project manager for planning research flights. The RAF project manager will work with RAF flight operations group to help analyze the specific conditions required by the research mission. The range and altitude capabilities are significantly affected by payload weights, flight maneuvers required, and departures from standard atmospheric conditions.

For more detailed flight planning to account for deployment location, local climate, specific payload, specific flight profiles and ATC considerations, contact RAF Flight Operations.

3.3 External Configuration Considerations

The performance of the aircraft is affected if external devices are installed on the GV (i.e., cooling scoops, wing pods, and inlets). For more information to account for specific external configurations, contact the RAF Project Management, Flight Operations or Aeronautical Engineer.

Chapter 4 Flight Operations

4.1 Aircraft Certification Overview

The GV aircraft is certified to the FAA's Federal Aviation Regulations (FAR) Parts 25 and 26. The aircraft carries Civil Registration Number N677F and a standard airworthiness certificate (FAA Form 8100-2) in the transport category. RAF operates the aircraft per FAR Part 91.

4.2 Crew Duty Limitations

Crew duty limitations apply not only to EOL staff (flight crew, maintenance and technician personnel, instrument operators, etc.) but also to any other persons flying on board NSF/NCAR aircraft. Research personnel participating on flights should abide by the duty limitations specified. These limitations have been established to prevent crew fatigue from becoming a safety concern during flight operations. Thus, specific project flight schedules may necessitate additional staffing in order to meet the crew duty limitation requirements specified. The crew duty limits for a single crew are outlined in Table 4.1.

Any 24 hour period	10 flight hours
Any consecutive 7 days	40 flight hours or 60 duty hours
Any 30 day period	120 flight hours
Consecutive working days	6 days
Maximum crew duty period	14 consecutive hours
Maximum consecutive duty days over 10 hours	2 days
Minimum crew rest period	12 consecutive hours
Normal crew duty day	8 hours
Definition of max duty day	10-14 hours
Night Duty	Show time earlier than 5 am LT; landing after midnight
Switching from day to night or night to day flight operations	36 hours notice and no work to all flight crew members

Table 4.1: GV crew duty limitations

Investigators are advised that the above limits may be extended for aircraft ferry purposes at the Pilot in command's discretion.

Flight hours are calculated from block to block times, i.e., from the time the aircraft first moves under its own power for the purpose of flight to the moment it comes to a rest at the next point of landing. Crew duty periods start at the briefing time or when the crew is considered on alert and ends when the aircraft is shut down and secured.

4.3 Operating Policies for Flight Planning

All missions will be flown in accordance with FAA Regulations Subpart B, appropriate Flight Information Planning Publications, ICAO procedures applicable to the host country, and NSF/NCAR directives, and RAF policies and procedures. The RAF project manager can provide further guidance on these policies and procedures.

4.3.1 Operations under Adverse Conditions

Adverse conditions include but are not limited to ceiling or visibility at or near minimums, marginal runway conditions, marginal approach aids, aircraft emergencies, severe turbulence, near maximum crosswind, unusual icing, terrain features that present an unusual hazard, and aircraft system malfunctions.

NSF/NCAR aircraft will not be operated into known or forecast weather conditions (icing included) that will exceed aircraft limitations. Aircraft limitations will be determined by the applicable flight manual. The GV will not be operated in known or expected hail or graupel formation regions.

NSF/NCAR aircraft will not be operated into areas of known or forecast thunderstorms unless radar is installed and operational or the weather forecast indicates that the flight can be conducted through the areas visually. Projects planning operations in the proximity of convective systems require the presence of a Mission Coordinator onboard the GV, who is typically an experienced EOL meteorologist. The Mission Coordinator's role is to assess the radar, lightning, satellite and other real time meteorological information and to assist the pilots in selecting safe operation regions and to assist the project scientists in carrying out their research objectives

Final responsibility for the safe conduct of the mission rests with the Pilot in Command. If in his/her judgment an unsafe condition exists, the mission will be delayed, canceled, or re-routed.

An RAF-approved, radar-trained aircraft meteorologist with access to a real- time radar display may be assigned to monitor and direct the aircraft operations to coordinate with the onboard Mission Coordinator and to assist the investigators on the ground in achieving their research objectives. The aircraft meteorologist will maintain surveillance of the storm radar structure and voice contact with the plane at all times the aircraft is in the near-vicinity of storms, keeping cognizant of growth rates within storms, the fall rates of hail, and the limits of radar scan processes. The Pilot in Command retains overall responsibility for safety of the aircraft and will remain in contact with the Mission Coordinator and the radar scientist for all storm penetrations.

Investigators planning research flights should consult with the RAF project manager and RAF Flight operations to discuss likely limitations on planned research fights.

4.3.2 Altitude Restrictions for NSF/NCAR aircraft

Minimum altitudes apply unless a waiver has been obtained. Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

- Anywhere: An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.
- Over congested areas: Over any congested area of a city, town, or settlement, or over any open-air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.
- Over other than congested areas: An altitude of 1,000 feet above the surface, except over open water. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.
- Over open water: VFR conditions, a minimum altitude of 100 feet for short durations straight and level; 300 minimum for turns;
- Auto pilot engaged: Minimum altitude of 300 feet above the surface.

Added constraints for hours of darkness or during restrictive visibility:

- When operating under these conditions, over a flat surface such as the ocean or polar ice cap, a minimum altitude of 500 feet above the surface will be observed providing the radar altimeter is operational. Flight path excursions of short duration to a radar altitude of 300 feet are permissible.

The above minimums have been established with near ideal conditions in mind. The Pilot in command must evaluate other factors such as turbulence, surface conditions, fatigue, and duration of flight at low altitudes, etc. It may be necessary to raise these levels to what in his/her judgment, is appropriate for the existing conditions.

Note: These minimums do not apply to coupled approaches.

4.3.3 Use of Oxygen

Crew members will use oxygen as specified in the appropriate aircraft flight manual, FAR 91.32, or as follows:

Unpressurized flights from 18,000 feet to 25,000 feet MSL require pre-flight de-nitrogenation breathing for 10 minutes. All crew members will breathe 100% oxygen from start of pre-breathing until the mission above 18,000 feet MSL has been completed and the aircraft has descended below 18,000 feet.

Unpressurized flights above 25,000 feet MSL will not be conducted.

A supplemental oxygen system is optionally available on the GV that provides an additional oxygen supply to the crew members in the main cabin. This system is intended to provide additional fuel reserve in case of depressurization in a remote location. The supplemental oxygen system can support up to 4 persons in the main cabin, which limits the research crew to three persons. The supplemental oxygen system utilizes the compressed gas rack (see Section 5.1.9) in the aft of the GV cabin, making this rack inaccessible for any other use.

4.3.4 Weather Forecasts

The Pilot in Command will ensure that the destination and alternate weather forecasts are obtained before reaching Equal Time Point (ETP) on over-water missions. Weather forecasts will provide the Pilot in command with sufficient terminal weather information for diverting or continuing to destination.

4.3.5 Normal Procedures for Formation Flight

Close formation is only to calibrate and datum scientific instruments with other aircraft participating in scientific exercises.

Close formation is defined as when an aircraft is flying in close proximity to another aircraft in such a manner as to require the following aircraft to take all external visual references from the lead aircraft.

Close formation leading is defined as being totally responsible for all aspects of the safety, terrain clearance, positioning and handling for aircraft that are formatting in close proximity to the lead aircraft.

Close formation is only allowed with one other aircraft at any one time - formation lead and the formating aircraft (No.2).

The more restrictive regulations of the aircraft's state of registration, and airspace used, will always apply.

Aircraft shall not fly formation unless the pilot in commands of the aircraft have agreed to do so.

4.4 Flight Personnel Requirements

Under the government regulations for research flights on government-owned aircraft only two types of people may fly on the aircraft: crew members (pilots, copilots, flight engineers, and mechanics) and those that are required to fly for the purpose of the research (referred to as qualified-non crewmembers). Basically this means the flight crew and scientific staff with a specific research task on the flight. Crew manifests require NSF approval prior to the start of any field campaign. This assures that flight personnel are flying for the Government's purpose in conducting research.

All persons interested in participating in GV research flights are required to review the document "Medical Information for Airborne Research," which has been prepared for the EOL by Dr. Warren Jensen, FAA Senior Medical Examiner and Director of Aeromedical Research of the University of North Dakota. This document is provided in Appendix B of this handbook.

The GV aircraft is fully certified in the transport category. Consequently, no special risks to investigators, other than those normally encountered in business air travel, are anticipated from the aircraft operations part. However, certain research situations may require special fitness testing. These include:

4.4.1 Operation at reduced cabin pressure.

The GV will not normally be operated at less than normal cabin pressures (e.g., there are no plans to fly the aircraft un-pressurized). The payload certification process is designed to avoid a possibility of cabin de-pressurization. Any request to operate at reduced cabin pressures must be submitted at the time of the request for usage of the aircraft, and will be considered in the feasibility studies. Flights above 14,000 feet internal cabin pressure require physiological training and altitude chamber testing. These training and testing procedures must be arranged well in advance of any flight program where such cabin altitudes will be required. Users considering such requests should discuss their requirements with the RAF prior to submission of the facility request.

4.4.2 Operations with unusual windows or inlets.

The RAF certified standard optical windows and inlets to the same standards as the rest of the aircraft. However, if the certifying authorities (i.e., the FAA Designated Engineering Representative [DER], or other FAA representatives) or the RAF determine that there is any increased risk of cabin depressurization due to any specific instrument installation, physiological training and altitude chamber testing may be required.

4.5 Emergency Procedures

Aircraft emergencies will be handled in accordance with the FAA-approved Airplane Flight Manual, Rev. 15, November 13, 2000, and FAA-approved GV Operating Manual, Rev. 15, November 13, 2000, when applicable. Emergencies involving onboard research systems emergency or medical emergency situations will be evaluated by the in-flight RAF data system operator and require flight crew notification as soon as is practical. The Pilot in command will be responsible for decisions concerning the flight plan after receiving notification of an emergency. All participants in GV research flights are responsible for promptly reporting any safety concerns (e.g., pressure leaks, smoke in the cabin, etc.) to the Pilot in Command..

4.6 Safety Training

RAF personnel have participated in GV all-crew training courses that involve instruction in aircraft ditching safety procedures and cabin evacuation skill training. Some of the safety procedures learned by RAF staff members have been incorporated into the standard RAF GV safety training course for all flight participants.

All individuals who will be participating in GV research flights will be required to attend an RAF safety briefing before the start of the specific project flight operations. These briefings are normally conducted at the RAF. Arrangements to conduct special briefings in the field can be made with advance request. The briefing takes approximately two hours. Topics covered include the following:

- A review of RAF standard operating procedures relevant to flight operations, with an emphasis on ground and airborne safety procedures;
- Training regarding emergency procedures to be followed onboard the aircraft;
- Briefing and operating procedures on the hazardous materials used in the course of the project;
- Briefing regarding project-specific safety issues;
- Instruction in the operation of aircraft systems (intercommunications system, lighting, seatbelts, emergency exits, etc.);
- Project location specific safety and security concerns, precautions and procedures;
- Additional training for investigators who will also be serving as mission scientists during specific projects will be also provided.

4.7 Security

RAF is an ISBAO compliant organization. This means that a certain level of business aviation standards and reporting is maintained, and all users have to comply with the RAF safety and security policies.

Flight operations with the GV are performed from national or foreign airports and all operations are subject to the security measures those airports have in place. In the U.S. this means compliance with the TSA requirements. RAF will arrange for ramp access for the science crew in advance and may request photographs or other personally identifiable information (PII) that is required in order to obtain ramp access clearances

for individuals. RAF does not retain PII after the project and people will be asked for it again as necessary for future projects.

RAF issues bag tags to identify luggage and tool bags that are authorized to fly on the GV. This allows the crew to easily identify bags that should be loaded onto the GV and prevent a possible placement of a suspicious items onboard the aircraft.

Special policies aimed to maintain compliance with the U.S. export regulations also apply and may require limiting access to certain equipment or documentation to foreign nationals.