C-130 Investigators Handbook

Chapter 4. Flight Operations

4.1 Aircraft Certification Overview (public)

The NSF/EOL C-130 is a retired military aircraft and does not have an airworthiness certificate. Technically it is operated as a United States government “State Aircraft” in the FAA “Public” category. This means that the aircraft does not have the same payload certification requirements as the GV. While not required to do so, EOL maintains and operates the aircraft under FAA Part 25 regulations and attempts to comply with basic military specifications for a Model C-130Q airframe. The avionics and communications equipment are suitably advanced enough to allow the conduct of international flight operations under the “State Aircraft” classification.

4.2 Crew Duty Limitations

Adequate rest for crew members is essential for the safe and efficient operations of NSF/NCAR aircraft in support of research programs. The restrictions in this section are the minima and maxima allowable. The 14-hour duty limit is intended for short, intensive operational periods and is not to be considered as a normal work day for NCAR flight crews. Investigators must be aware of other factors that flight crews must contend with, such as the fatiguing effects of continued IFR operation, extremes of temperature, complexity of mission requirements, and other variables that the pilot-in-command must consider in determining actual crew limits for any operation. During extensive research periods, proper rest becomes increasingly important, and when deemed necessary, the project pilot may elect to declare additional crew rest periods other than those listed below. Specific project flight schedules may necessitate additional staffing in order to meet the crew duty limitation requirements specified.

Single C-130Q crew duty limits, assuming ideal working conditions		
1.	Any 24-hour period	10 flight hrs
2.	Any consecutive 7 days	35 flight hrs
3.	Any 30-day period	110 flight hrs
4.	Consecutive working days	6 days
5.	Crew duty period	14 hrs
6.	Minimum crew rest period	12 hrs

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. Days off will be scheduled at least 12 hours in advance, with the crew being relieved of all duties.

4.3 Operating Policies for Flight Planning

NCAR missions will be flown in accordance with FAA Regulations Subpart B, appropriate FLIP publications, ICAO procedures applicable to the host country, and NCAR directives.

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.

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.

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.

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

4.3.2 *Maximum Cloud Reflectivity During NCAR Operations*

Radar reflectivities of clouds have traditionally been utilized to establish rainfall rates that in turn are associated with turbulence and possible hail formations. Areas of high reflectivity gradients indicate steep rainfall gradients and are associated with turbulence. In order to maximize safety criteria for NCAR aircraft operations and still accomplish research objectives, maximum cloud reflectivity levels are hereby established. While this will not guarantee that NCAR research aircraft will not sustain damage the risk will be minimized.

Criteria – NCAR aircraft may penetrate, operate under, and operate within two nautical miles of a radar reflectivity echo of up to 40 dbz providing:

a. A properly calibrated ground radar is operated by a skilled technician within the quantitative observing range of the radar.

b. An RAF-approved, radar-trained scientist has access to the real- time display and is assigned to monitor and direct the aircraft operations. The radar scientist 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 Aircraft Commander retains overall responsibility for safety of the aircraft and will remain in contact with radar scientist for all storm penetrations.

c. In the absence of ground radar data, when only airborne radar is utilized, NCAR aircraft will not penetrate, operate under, or operate within three nautical miles of any storm cell having a radar echo that shows contouring reflectivity judged to be 39 dbz or greater.

4.3.3 *Altitude Restrictions for NCAR Aircraft*

Minimum stated 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:

a. Anywhere. An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

b. 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.

c. Over other than congested areas. An altitude of 1,000 feet above the surface, except over Ocean water. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

d. Over Ocean water - VFR Conditions - An altitude of 100 feet above the surface for straight and level flight, and a minimum altitude of 300 feet for turning maneuvers exceeding bank angle of 5 degrees.

e. Auto pilot engaged – Minimum altitude of 300 feet above the surface.

Added constraints for hours of Darkness or During Restrictive Visibility

f. 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.

g. The above minimums have been established with near ideal conditions in mind. The Aircraft Commander 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.

4.3.4 *Use of Oxygen*

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

a. During daylight when the cabin pressure altitude is above 8,000 feet in excess of four hours, pilots and flight engineers 100% should use oxygen for 10 minutes of the last 45 minutes of the flight.

b. Un-pressurized flights from 18,000 feet to 25,000 feet MSL require pre-flight de-nitrogenation breathing for 10 minutes. All crewmembers will breath 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.

c. Un-pressurized flights above 25,000 feet MSL will not be conducted.

4.3.5 Cancellation of IFR Flight Plans, Airborne

Flight plans should not be canceled during daylight hours whenever weather in unknown, reported as marginal, or when scud, haze, or other restrictions to visibility are known to exist. In these cases, maximum use of all available navigation facilities should be utilized to effect an instrument approach to the point of intended landing.

IFR flight plans should not be canceled during night operations until an instrument approach is initiated and then only if the terminal airfield is in sight and VFR weather conditions are reported and verified by the pilot.

The above policy is in no way intended to restrict the authority of the Aircraft Commander during in-flight emergencies or under any other condition wherein the cancellation of an IFR flight is fully at his/her discretion .

Note: For safety reasons the aircraft should have flight following until landing.

4.3.6 *Weather Forecasts*

The Aircraft Commander will insure that the destination and alternate weather forecasts are obtained before reaching ETP on over-water missions. Weather forecasts will provide the Aircraft Commander with sufficient terminal weather information for diverting or continuing to destination.

4.3.7 *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 forming 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 aircraft commanders of the aircraft have agreed to do so.

4.4 Fitness Requirements

The C-130 will not normally be operated at less than normal cabin pressures so no special training or physical testing is typically required to fly on the C-130. However, thermal control of the cabin is limited in warm climates and the interior is loud in flight. Natural vibrations resulting from the propeller motion are also significant. Prolonged missions in excess of 6 hours are common and can be particularly fatiguing under the most adverse conditions. A special request to operate the aircraft at reduced cabin pressures, or un-pressurized, can be made for special operations but must be submitted at the time of the request for usage of the aircraft. If such a request is approved, special fitness testing may be required for all research crew. 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.

All persons interested in participating in C-130 research flights are required to review the document "*Medical Information for Airborne Research*," which has been prepared for the RAF 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 C** of this handbook.

As of this writing, Federal requirements for investigators flying on U.S. government aircraft are undergoing review. Additional information about such requirements that may be applicable to the operation of the NSF/NCAR C-130 will be provided in future releases of this handbook.

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. In-flight emergencies involving onboard research systems or medical emergency situations will be evaluated by the in-flight RAF data system operator and will require flight crew notification as soon as is practical. The Pilot-In-Command (PIC) will be responsible for decisions concerning the flight plan after receiving notification of an emergency. All participants in C-130 research flights are responsible for promptly reporting any safety concerns (e.g., pressure leaks, smoke in the cabin, etc.) to the PIC.

4.6 Safety Training

RAF personnel have participated in special 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 C-130 safety training course for all flight participants.

All individuals who will be participating in C-130 research flights will be required to successfully complete an RAF safety and operations course before the start of the specific project. These courses are normally conducted at the RAF. Arrangements to conduct special classes in the field can be made with advance request, provided the aircraft is available. The class takes approximately one hour to complete. 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;
- Training on the handling of hazardous materials;
- Briefing regarding project-specific safety issues;
- Instruction in the operation of aircraft systems (intercommunications system [ICS], lighting, seatbelts, emergency exits, etc.)

Additional training for investigators who will also be serving as mission scientists during specific projects are also provided (see Chapter 7, Section 7.2.4 of this handbook).

4.7 Security

At the time of this writing, the FAA and National Security Agency are considering the implementation of several measures that may require passenger screening. This may include a requirement for the performance of background checks. Any measures adopted by the U.S. government which will affect RAF flight operations will be outlined in future releases of this document.