



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Advisory Circular

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**Subject:** Civil Air Patrol and State  
and Regional Disaster Airlift  
Relationships.

**Date:** March 18, 1987  
**Initiated by:** APR-130

**AC No:** 00-32 A  
**Change:**

1. PURPOSE. This circular is issued to advise all interested persons and State officials responsible for emergency planning activities of an updated Memorandum of Understanding (MOU) between the Civil Air Patrol (CAP) and the Federal Aviation Administration (FAA) relative to CAP/State and Regional Disaster Airlift (SARDA) relationships. It transmits a copy of the revised memorandum (Appendix 1) and provides additional guidance that may be useful to improve the use of non-air carrier aircraft in time of emergency.

2. CANCELLATION. This circular replaces AC No. 00-32, Civil Air Patrol and State and Regional Defense Airlift Relationships, dated July 2, 1970.

3. BACKGROUND. The CAP is an existing organization of trained volunteers capable of conducting emergency operations. It has performed numerous services to minimize the effects of natural disasters and has conducted thousands of search and rescue missions to aid persons in distress. SARDA plans have been developed to mobilize non-air carrier resources in time of emergency. These plans are incorporated in each State's "Emergency Resource Management Plans." They are developed in accordance with guidance provided by the FAA. Unlike the CAP, SARDA is not an existing organization. It is a published plan to be used by the individual States to activate and organize all non-air carrier resources in time of emergency. The object of this circular is to help incorporate the principles recommended in the FAA/CAP MOU into State SARDA plans to improve the CAP and SARDA responses to local and State requests for emergency airlift.

4. INCORPORATING THE CIVIL AIR PATROL INTO STATE AND REGIONAL DISASTER AIRLIFT PLANS.

a. States will provide airlift services, during time of emergency, to support essential State functions in accordance with published SARDA plans. When activated, these plans will mobilize all aircraft and supporting resources within the State that are not assigned to Federal operations (Civil Reserve Air Fleet and War Air Service Program). Included as aviation resources upon activation of SARDA are the aircraft, airmen, and supporting equipment associated with the CAP.

b. To assure the most efficient use of all non-air carrier resources during emergencies, the CAP organization should be included as an integral part of the SARDA organization. However, the CAP should retain its identity as an organizational unit from the State level down through the local level. Additionally, overall direction and support of CAP activities, through the Wing Commander, by the State SARDA Director is essential, if all State aviation resources are to be used as a coordinated whole. Therefore, whenever possible, the CAP Wing Commander and his Headquarters organization should become a staff element reporting to the State SARDA Director. The Wing Commander, however, should retain overall supervision over CAP subordinate units. This arrangement will provide the SARDA Director with CAP staff experience without disrupting the CAP organization.

c. Also, to fully utilize non-air carrier aviation, close relationships should be established between the local airport SARDA manager and a collocated CAP unit. Although the CAP should retain organizational identity, with the Wing Commander having line authority over subordinate units, some adjustment of this concept may be desirable for the local SARDA manager to maintain flexibility. A provision in local plans for the SARDA manager to exercise operational control over the aircraft of collocated CAP units during a national emergency would give the necessary flexibility. Operational control should be limited to the assignment of tasks and missions whenever the unit is not responding to a mission assignment from the CAP Wing or United States Air Force (USAF).

d. Variations to the suggested handling of SARDA/CAP organizational relationships may be necessary to accommodate local or State requirements, or to be compatible with other agreements and plans having an influence on the CAP or SARDA. In any event, an effort should be made, where needed, to clarify this relationship so that personnel of both organizations can operate efficiently.

e. There may be circumstances where it is necessary to incorporate some of these additional or expanded CAP/SARDA relationships in State airlift plans, but is impractical to rewrite existing documents. In these circumstances, an agreement between the State and SARDA official responsible for emergency planning, covering the expanded relationships, should suffice.

5. CIVIL AIR PATROL COMMITMENT TO USAF. The CAP presents a unique opportunity for the USAF to assign specific missions and tasks to a segment of non-air carrier aviation in support of defense needs. In so doing, the USAF should be assured of a priority response on those missions it considers vital to the defense of the Nation. Whenever possible, USAF plans or the identification of the units involved should be made available to State officials so they may be considered when SARDA is activated. In cases where this is not feasible, State plans should contemplate USAF requests for CAP assistance in support of defense needs. Accordingly, upon receipt of such requests, State officials should provide all possible

assistance and give these missions the necessary priority. State support of CAP units conducting missions for the USAF will be essential. The units involved remain a civil resource even though the CAP is an auxiliary of the USAF, but their tasks may be military in nature. Their aircraft will require civil fuel, operate from civil airports, and will need maintenance from civil repair agencies. Accordingly, resource managers should plan to allocate State resources for all CAP operations, both civil and military, from the same sources that will sustain SARDA.

6. SPECIALIZED TRAINING CONDUCTED BY CAP. The States have available the technical and managerial skills necessary for a vibrant civil aviation environment, and plans are well developed to marshal these skills into an organization to be used during emergencies. However, additional special skills will be needed to conduct emergency operations successfully. These additional skills must be acquired in the specialties of mission coordinators, clearance officers, ground operation officers, and communication officers, for example, if the SARDA is to be successful. These special skills are available to the States in CAP units, but not in sufficient numbers to accommodate an expanded emergency airlift, or without the possibility of jeopardizing the effectiveness of the CAP. Although some cross utilization of the CAP skills with SARDA may be practical in some instances, many voids will still remain. To overcome this deficiency, the FAA recommends that SARDA officials arrange for the training of key SARDA personnel by the CAP.



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Associate Administrator  
for Aviation Standards



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

Office of the Administrator

AC 00-32A  
Appendix 1

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**MEMORANDUM OF UNDERSTANDING  
BETWEEN  
FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION  
AND CIVIL AIR PATROL**

WHEREAS, the Administrator of the Federal Aviation Administration has heretofore prepared national emergency plans and has developed preparedness programs, and sponsors aerospace-aviation programs to educate the public;

WHEREAS, the Civil Air Patrol, as the volunteer civilian auxiliary of the United States Air Force, is an aviation organization trained and equipped to assist in national and local emergencies, and is committed to sponsoring aerospace-aviation programs to educate the public;

**NOW, THEREFORE:**

1. To enhance the maximum effective use of non-air carrier aircraft during time of national emergency, the Administrator of the Federal Aviation Administration and the National Commander of the Civil Air Patrol, have mutually determined to recommend to State level CAP/State and Regional Disaster Airlift (SARDA) officials that they include the following CAP/SARDA relationship and concepts in their planning wherever necessary:

a. Incorporating Civil Air Patrol into State and Regional Disaster Airlift Organizations. Existing plans for use of Civil Air Patrol during a national emergency should be revised, if necessary, to include the Civil Air Patrol Wing as a state level organization unit of SARDA. In so doing, the Civil Air Patrol Wing should retain its organizational identity receiving overall direction from the State SARDA Director.

b. Civil Air Patrol Commitment to USAF. State SARDA officials and emergency resource planners should take cognizance of priority USAF mission assignments to selected CAP units in support of USAF war plans. Such missions will be in the national interest and state officials should provide all necessary assistance including additional state resources when available.

c. Specialized Training Conducted by CAP. CAP units are encouraged to train non-CAP personnel to perform SARDA emergency service tasks such as: mission coordinators, clearance officers, ground operations officers, and communications officers. The names of individuals who successfully complete emergency service training should be forwarded to the designated SARDA Director.

d. Specialized Training Provided by FAA. FAA will provide CAP members the specialized training necessary to conduct FAA data collection and field surveys. FAA will reimburse individual CAP members for expenses incurred during training commensurate with rates authorized by applicable travel regulations.

e. Coordination of CAP/SARDA Activities. State SARDA and CAP officials are encouraged to enter into formal arrangements to enhance the effective use of state aviation resources in time of national emergency. Such arrangements may include assignments of the CAP Wing and subordinate CAP organizations to: (a) serve as a primary emergency operational staff for the State Director of Aviation and other SARDA officials at control airports; (b) provide emergency service training for non-CAP personnel; and (c) provide specific emergency services, including those in support of USAF war plans. Arrangements or agreements between Civil Defense agencies and the Civil Air Patrol will also provide the means for rapid response to Civil Defense needs.

f. CAP Communications Support. Through an extensive complex of fixed base and mobile communications units possessing air-to-ground and ground-to-ground capability over UHF, VHF, and HF radio frequencies, the CAP will provide essential, supplementary communications support to civil and military authorities requiring augmentation during SARDA, Continental United States Airborne Reconnaissance Air Damage Assessment (CARDA), and state and regional emergency operations.

## 2. Aerospace-Aviation Education.

a. FAA and CAP are jointly committed to the sponsorship of aerospace-aviation educational programs designed to increase public awareness of the professional, social, and economic advantages to be derived from careers in aviation and space exploration. Various forms of instructional materials are made available for use at all educational levels of the national school system including elementary, secondary, and university degree program curricula. Seminars, symposia, briefings, and field trips are made available for teachers, students, and the public for topical update of aviation and space related information and materials.

b. FAA and CAP will maintain direct and continuing communication and liaison for purposes of developing a mutually effective strategy to infuse aviation and space content into elementary and secondary curricula, and to demonstrate how aerospace-aviation can be a valuable educational tool to prepare American youth to deal with rapidly changing advancements associated with aviation and space technology and sciences.

c. The FAA and CAP will maintain a leadership role in aerospace-aviation education, and will coordinate with, and support the educational community and aerospace industry. Consistent with legislative mandates of the Congress, aviation and space information, expertise, and material will be provided to the maximum extent permissible.

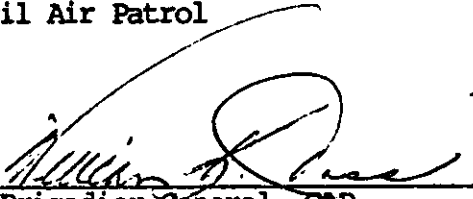
3. The National Congress on Aviation and Space Education (NCASE).

Sponsored by the National Aeronautics and Space Administration, National Air and Space Museum, FAA, and CAP, the NCASE is designed to promote an understanding of aviation and space; to further the cause of aerospace and aviation education; and to motivate its participants to inform the public of the impact of the aerospace industry on all segments of society. This unique annual leadership event brings together teachers, counselors, school administrators, and representatives of industry and government in the furtherance of aviation and space education. The FAA and CAP dedicate their continued support and sponsorship to this worthwhile endeavor.

APPROVED:

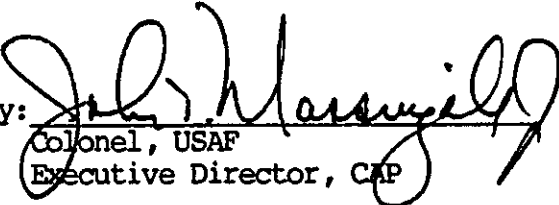
Civil Air Patrol

Federal Aviation Administration,  
Department of Transportation

By:   
Brigadier General, CAP  
National Commander

By:   
Administrator

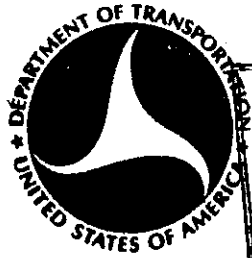
Date: 14 November 1985

By:   
Colonel, USAF  
Executive Director, CAP

Date: 14 NOVEMBER 1985

AC NO: 00-33A

DATE: 14 Feb 73



DEPARTMENT OF  
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# ADVISORY CIRCULAR

**DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION**

**SUBJECT:** NICKEL-CADMIUM BATTERY OPERATIONAL, MAINTENANCE,  
AND OVERHAUL PRACTICES

1. **PURPOSE.** This circular provides guidelines for more reliable nickel-cadmium battery operation through proper operational and maintenance practices, and has been reissued to include reconditioning information.
2. **CANCELLATION.** Advisory Circular 00-33, dated 26 August 1971, is cancelled.
3. **BACKGROUND.** An increasing number of potentially hazardous incidents involving nickel-cadmium batteries, during flight and ground operations, have been reported. The failures are more prevalent where the batteries are charged directly from the DC bus rather than by a separate battery charger. Although the nickel-cadmium battery is capable of delivering large amounts of current, the battery is inherently temperature sensitive and a majority of the reported incidents can be attributed to overheating. The overheat conditions can be minimized or averted by following proper operational, maintenance, and overhaul practices.
4. **THERMAL EFFECTS ON NICKEL-CADMIUM BATTERIES.** The nickel-cadmium battery is capable of performing to its rated capacity when the ambient temperature of the battery is in the range of approximately 70° to 90° F. An increase or decrease in temperature, from this range, results in reduced capacity. A combination of high battery temperature (in excess of 100°F) and overcharging can lead to a condition called "thermal runaway." Basically, "thermal runaway" is an uncontrollable rise in battery temperature that will ultimately destroy the battery. This condition can occur when a nickel-cadmium battery is operated at above normal temperatures and is subjected to high charging currents associated with constant voltage charging. As the temperature of the battery increases, the effective internal resistance decreases and higher current is drawn from the constant voltage charging source. The higher current increases the battery temperature which in turn results in even higher charging currents and temperatures.

Initiated by: AFS-350/130

5. BATTERY OVERHEAT FACTORS. Battery overheating can be caused or accelerated by the following factors:
- a. Frequent engine starts and excessive engine cranking.
  - b. Aircraft generator bus voltage too high.
  - c. Improper charging and infrequent battery reconditioning.
  - d. Unnecessary use of the aircraft batteries to run auxiliary equipment such as lights, avionics equipment, ventilation systems, etc. during ground operations.
  - e. Poor or no ventilation of the battery compartment during high ambient temperatures particularly during ground operations.
  - f. Loose cell-to-cell connections (commonly called links).
  - g. Current leakage between cell and battery container and airframe ground.
  - h. Cells low on electrolyte.
  - i. Ground operations using power units with voltage settings higher than the recommended aircraft bus voltage, or power units with poor regulation.
  - j. Cell imbalance.
6. OPERATIONAL PRACTICES TO PREVENT BATTERY OVERHEATING.
- a. Reduce the number of consecutive engine starts by programming the use of a well regulated external power supply when a series of short duration flights or consecutive engine starts are planned. This procedure will allow the battery to dissipate some of its accumulated heat. Avoid prolonged engine cranking and follow the manufacturer's recommended rest periods between starts to minimize battery overheating.
  - b. Frequent inflight monitoring of the aircraft bus voltage and load current will provide an indication of any increase, decrease, or fluctuations of the aircraft bus voltage or load current indicating an abnormal condition.
  - c. An increase in load or charge current as indicated on the aircraft load meter, especially during normal cruise, with no additional circuits being energized may be an indication of battery overheat or failure. Initiate corrective action as soon as possible.



**7. MAINTENANCE PRACTICES TO PREVENT BATTERY OVERHEATING.**

- a. Service batteries at the interval recommended by the aircraft and battery manufacturer; however, more frequent servicing may be necessary depending upon the type of operation you are conducting.
  - b. The aircraft voltage regulator setting should be checked periodically to correct for out-of-calibration units and replacement of defective units thereby reducing the possibility of an inadvertent increase in charging voltage/current and a resultant rise in battery temperature.
  - c. During extended ground operation, under high outside ambient temperatures, keep the battery loads to a minimum and ensure there is adequate battery compartment ventilation. Additional ventilation may be provided by opening the battery compartment access door or using forced air ventilation.
  - d. Check and maintain the manufacturer's recommended torque values on intercell connections during routine maintenance inspections. This will reduce the possibility of localized heating that can be caused by high currents passing through poor connections and feeding back into a cell or cells.
  - e. Periodic measurement of battery leakage current and removal of any electrolyte that may have accumulated around and between the cells will prevent high leakage currents and short circuits from developing and heating the battery.
  - f. Cell electrolyte level should be monitored frequently and if below the minimum requirement the battery should be removed from service for reconditioning. This will reduce the possibility of localized cell overheating.
  - g. When charging a battery in the aircraft assure that:
    - (1) The battery compartment is well ventilated.
    - (2) The ground power unit voltage setting does not exceed the aircraft bus voltage specified by the aircraft manufacturer; is well regulated; and its volt/ammeters are accurate.
    - (3) The battery cover is off during charging to allow visual monitoring and to increase ventilation.
    - (4) The battery is not charged when the battery temperature or battery compartment temperature is above approximately 100°F.
8. BATTERY INSPECTION. Visually inspect the battery and associated hardware on a regular basis. Depending on the type of aircraft operation, it is considered good practice to establish an electrolyte level inspection

interval based on the battery and aircraft manufacturer's recommendations. Conduct a detailed investigation when any of the following conditions are noted:

- a. Cell case distortion indicates the battery may have been overheating. The battery should be removed and sent to a maintenance facility or factory for cell replacement.
- b. Cell link corrosion.
- c. Burn marks or signs of overheating on battery terminals or cell links. This indicates that the connectors involved have not been properly tightened.
- d. Electrolyte has spewed or leaked from cells.
- e. Battery and cell vents are obstructed.

The use of a service log provides an accurate service record of battery inspections and malfunctions. It can also be a useful tool in determining the optimum period between reconditionings.

9. RECONDITIONING SERVICE. It is characteristic of a nickel-cadmium battery to undergo a temporary loss of capacity during its normal duty cycle. This temporary loss of capacity is normally an indication of imbalance between cells. If not regularly maintained, this imbalance can lead to cell reversal and premature battery failure. The purpose of periodic reconditioning is to restore a battery to its full capability and to prevent premature damage and failure. The following factors should be considered when establishing reconditioning cycles for various types of aircraft.

- a. Battery manufacturer recommendations; for example one battery manufacturer recommends the following approximate battery reconditioning cycle periods:

<u>Type</u>	<u>Approximate Reconditioning Period</u>
(1) Lear 23, Jet Commander, MU-2 and Turbo Commander	100 hours
(2) King Air, Beech 99, Fan Jet Falcon	100 hours
(3) Hansa Jet, Twin Otter, Merlin I and IIB	100 hours


- b. Frequency of engine or auxillary power unit starting service.
- c. Battery duty cycle.

- d. Ambient operating temperatures.
- e. Operator service experience will dictate the need for an increase or decrease of time between reconditioning periods. One method of determining this is by the amount of water consumption between reconditioning. (Each manufacturer specifies the amount of water that can be expected to be needed after a specific period of service.) If during servicing, all of the cells require more water than is normally specified by the manufacturer it may indicate problems with the aircraft voltage regulator (charging voltage too high) or you may have a need for more frequent reconditioning.

Aircraft equipped with battery temperature sensors should have the sensor accuracy tested at the time of battery reconditioning. It is important that this test be performed on a regular basis.

- 10. SHOP MAINTENANCE. Follow the battery manufacturer's instructions regarding periodic servicing, capacity checks, and reconditioning procedures to ensure a reliable and properly conditioned nickel-cadmium battery. The following area should be given special attention:
  - a. Battery facilities. Separate shops, equipment, and tools are recommended for servicing nickel-cadmium and lead-acid batteries.
  - b. Anything associated with lead acid batteries (acid fumes included) that comes in contact with a nickel-cadmium battery or its electrolyte can cause severe damage.
- 11. OVERHAUL PRACTICES. The construction and design of nickel-cadmium batteries allows easy overhauling of the individual cells. The following guidelines are recommended to ensure meeting the original battery manufacturer's specifications.
  - a. It is recommended cells be overhauled only once. It is the repair facility's responsibility that repaired cells meet all manufacturer's specifications before approval for return to service.
  - b. Manufacturers do not recommend mixing cells. Some manufacturer's warranties are void if cells are mixed.
  - c. New and overhauled cells may be identified as follows:
    - (1) New cells by the manufacturer's part number stamped on the case.
    - (2) Overhauled cells with the manufacturer's or repair station's identification stamped on the cell case, or color coded on the cell cases.

- (3) The original manufacturer's part number should be retained on the overhauled cell to preclude mixing of cells. Repair agencies should mark the overhauled battery with their identity mark so as to not obliterate the original manufacturer's identification.
- d. In addition to the standard quality control procedures, inspect plates carefully for evidence of burned, crimped, or frayed edges, hot spots or other damages.
- e. Damaged cell plates or stacks should be discarded. Nickel-cadmium cells are not consistently identical with respect to their capacity.
12. SUMMARY. Optimum and reliable performance can be expected from nickel-cadmium batteries only when they are operated, maintained, and overhauled in accordance with the battery and aircraft manufacturers' instructions. Overheating and thermal runaway are the prime causes of battery degradation and cell/battery destruction. The degree of reliability is directly proportional to the quality of the practices followed in their operation, maintenance and overhaul.



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