

WORK CENTER:

PERIODIC REQUIRED TRAINING:

Lesson Number and Topic:

1/PRT/F21 Aircraft Battery Handling and Safety

<u>Time:</u>	Instructional Hours	0.5
	Classroom	0.5
	Laboratory	0.0

Date Prepared: November 1995 Code: N44A

Prepared By: Mr. P. Bratton

Date Reviewed: June 2002

Reviewed By: AT2 Reed, CHTWP NORIS

Trainee Preparation Material:

A. Trainee Support Materials:

1. None.

B. Reference Publications:

1. None.

Instructor Preparation:

A. Review Assigned Trainee Materials.

B. Reference Publications:

1. NA 17BAD-1 - Naval Aircraft Batteries

2. NA 00-80R-14 - Aircraft Crash and Salvage Operations Manual (AFLOAT)

3. OPNAVINST 4790.2H Naval Aviation Maintenance Program (NAMP)

C. Training Materials Required:

1. None.

1. INTRODUCTION TO THE LESSON

- a. All AE's and AT's must handle batteries on a continuing basis during aircraft maintenance. They must understand the precautions, which must be taken, and the hazards, which must be avoided in order to perform these functions efficiently. Batteries can be our friend but we must handle them correctly.

2. THIS LESSON TOPIC

- a. Topic - **Aircraft Battery Handling and Safety**
- b. Topic Objectives

3. PRESENTATION

A. Reasons for battery safety

1. Naval aircraft use both lead-acid nickel-cadmium and lithium batteries
 - a. Subsystems such as sonobuoys use lithium batteries
2. These batteries can cause chemical as well as electrical burns
3. If internally shorted they can overload and damage the aircraft electrical system
4. To prevent these occurrences certain precautions should be followed

B. Types of batteries in naval aircraft

1. Lead acid batteries are made up of lead plates and have an electrolyte of sulfuric acid
2. Nickel -cadmium batteries are made up of negative and positive cadmium plates with potassium hydroxide electrolyte

3. Lithium batteries are maintenance free, wet cell type batteries, which use salt water (sea water) as the electrolyte

C. Hazardous chemical content and physical safety precautions

1. Both lead acid and nickel cadmium batteries contain an electrolyte that can cause serious chemical burns and is highly corrosive
 2. Use care not to get electrolyte on the skin or on your clothing
 3. Wash your hands after handling the battery
 4. A deluge shower and eye wash station shall be provided in the vicinity where battery maintenance takes place
 5. If electrolyte gets into your eyes, flush with water for a minimum of 15 minutes and seek immediate medical attention
 6. If sulfuric acid should come in contact with the skin wash with large quantities of water and neutralize with a solution of 6 ounces of sodium bicarbonate to one gallon of fresh water
 7. If potassium hydroxide (an alkaline) should contact the skin wash with large quantities of water and neutralize with a 3% boric acid solution
 - a. A premixed container of 3% by weight boric acid solution shall be readily available. Do not use to flush eyes
8. A container of fresh water shall be provided as a means to rapidly cool an overheated/thermal runaway battery

9. Lithium batteries if damaged may vent sulfur dioxide gas (SO₂) which is highly toxic and extremely irritating to eyes and respiratory tracts

a. Jettison/remove sonobuoy with venting lithium battery to natural ventilation

D. Training of personnel

1. Only properly trained personnel shall be used in the maintenance and servicing of aircraft batteries

2. The AV/ARM Division Officer shall ensure that all personnel concerned with battery maintenance and handling are qualified and are fully aware of proper safety precautions

a. The AV/ARM Division Officer shall conduct quarterly training in the hazards of handling batteries. The training shall be a routine part of the division's training syllabus (IAW OPNAVINST 4790.2G)

3. Personnel training records shall show that these qualifications have been met and have been authenticated by the division officer

E. Personnel Protective Equipment (PPE)

1. Wear approved chemical goggles, gloves and aprons when handling batteries and electrolyte. In addition, rubber boots should be worn when handling concentrated sulfuric acid

F. Correct lifting and handling techniques

a. Do not lift battery by vent tubes, damage to battery may occur

b. Do not lift battery from hold down bracket, damage to battery may occur

c. Aircraft batteries can be heavy, as much as 60 lbs, and have sharp corners. All personnel involved shall be properly instructed in correct lifting and handling techniques, to prevent serious injury

d. Ensure battery terminals and connectors are covered during handling and installation

1) Failure to cover terminals and connectors during installation may result in arcing causing damage to battery and/or aircraft and injury to personnel

G. Precautions to take prior to installation

1. Ensure all vent caps are on tight
2. Ensure battery voltage is at least 24 volts
3. Ensure no leakage is less than .5 milliamps
4. Ensure battery switch is off
5. Always transport batteries with terminals covered

H. Battery thermal runaway or battery fire

1. Thermal runaway
 - a. Current for a fully charged nickel-cadmium battery rises out of all proportion to the impressed voltage
 - 1) Can occur if battery is overcharged
 - 2) Can occur if an internal short exists
 - b. After a battery is fully charged excess charging energy is dissipated as heat. Continued over charging has the effect of reducing internal battery resistance
 - 1) It draws a higher current from the impressed voltage
 - 2) The temperature of the battery increases
 - 3) Effective internal resistance continues to decrease
 - 4) Current becomes progressively greater
 - 5) This process eventually destroys the battery
 - c. Thermal runaway can be identified by:
 - 1) Smoke or steam coming from the battery vents
 - 2) Loud bumping or banging coming from the co- pilots seat well
 - 3) Battery discoloration. Normal color of the battery is a bright blue
 - 4) Leaking electrolyte from the battery compartment

- e. Upon observation or notification that an aircraft has an overheated battery, thermal runaway, or a battery fire
 - 1) If battery is being used, turn the battery switch off
 - 2) Open "UTIL LTS" circuit breaker located on lower console circuit breaker panel
 - 3) Clear all unnecessary personnel from the vicinity of the helicopter
 - 4) Notify Maintenance Control
 - 5) Have a fire extinguisher manned but DO NOT use it unless flames are visible
 - a) Warning: Never use any fire extinguisher agent except water fog to cool an overheated battery.
 - b) In no case should CO2 fire extinguisher be directed into a battery compartment to effect cooling or displace explosive gases
 - c) Static electricity generated by the discharge of the extinguisher could explode hydrogen/oxygen gases trapped in the battery compartment
 - d) CO2 is an acceptable extinguisher agent only after flame have developed
 - 6) If a battery fire develops, prior to crash crew arrival the following actions shall be taken
 - a) Use any available fire extinguisher agent on the flames
 - b) Clear all unnecessary personnel from the vicinity of the helicopter
 - c) Notify Maintenance Control
 - 7) When battery is removed it shall be submerged in a container of water (could be a trash can) for at least 12 hours
 - 8) After cooling contact Material Control for proper disposal of the cooling water
 - 9) The recovered battery will be routed via normal channels to the AIMD battery locker

4. SUMMARY AND REVIEW

A. SUMMARY

1. Reasons for Battery Safety.
2. Type of Batteries.
3. Hazardous Chemical Content.
4. Precautions Prior to Battery Installation.
5. Emergencies.

B. QUESTIONS

1. What are the two types of batteries used in Naval aviation?
 - A. Lead-acid and Nickel-cadmium.
2. What can happen if these batteries are internally shorted?
 - A. Damage to the aircraft electrical system.
3. What type of burns can these batteries cause?
 - A. Chemical and electrical.
4. What is a lead-acid battery made of?
 - A. Lead plates and an electrolyte of sulfuric acid.
5. What is a nickel-cadmium battery made of?
 - A. Negative and positive Cadmium plates with a potassium hydroxide electrolyte.
6. What type of damage can both lead acid and nickel cadmium batteries cause?
 - A. Serious chemical burns and corrosion.
7. What should be done if electrolyte gets into your eyes?
 - A. Flush with water and seek immediate medical attention

8. What should be done if sulfuric acid comes in to contact with your skin?
 - A. Wash with large quantities of water and neutralize with baking soda.
9. If potassium hydroxide should contact the skin, what should be done?
 - A. Wash with large quantities of water and neutralize with a 3% boric acid solution.
10. What precautions should be taken prior to battery installation?
 - A. Ensure all vent caps are tight, ensure battery voltage is at least 24 volts, ensure leakage is less than .5 milliamps, ensure battery switch is off, and always transport battery with terminals covered.
11. What causes thermal runaway?
 - A. An overcharged battery or internal short?
12. What should be done if thermal runaway occurs?
 - A. Remove power from the aircraft and call the crash crew.
13. What should be done if the battery is smoking and no flame is visible?
 - A. Let battery cool down after power is removed.
14. What could happen if a CO2 fire extinguisher is used on a smoking battery?
 - A. A static spark from the CO2 could cause the battery to explode.
15. What should be done if the battery is emitting flames?
 - A. Use a CO2 fire extinguisher.