



IMPROVED FLASHLIGHT  
ROSCOMMON EQUIPMENT CENTER  
PROJECT NO. 23  
FINAL REPORT

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Disclaimer

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## PROBLEM

Flashlights (headlamps), currently available through the Federal Supply Service and commercial sources, do not provide adequate light for nighttime firefighting. A better, more compact light is needed.

## OBJECTIVES

During the December 1973 meeting for the National Forest Fire Supervisors Equipment Committee the problem was addressed. As a result a project was approved to locate or develop an improved flashlight. The following is a list of characteristics the committee deemed desirable for an improved flashlight:

1. Flashlight mounted on a hat or elsewhere on the firefighter so both hands are free for work.
2. Cost comparable to the current GSA light (\$7.00).
3. All components sturdy, reliable, and able to withstand at least 30 shifts of nighttime fire fighting.
4. Illumination capacity doubled that of current specifications.
5. Uses standard D flashlight batteries.

## COMMERCIAL MANUFACTURERS RESEARCHED

Literature from commercial manufacturers was reviewed. Five companies submitted specifications and details of performance, construction, and price for the following products:

1. The LVP 250 Nightwin Rechargeable Lantern, produced by Lowrance Electronics, Inc. of Tulsa, Oklahoma.
2. Dark Blazer Models 511, 525, and 550, manufactured by Nicholl Brothers, Inc. of Kansas City, Missouri.
3. The wonder Multi-Lite made by the Wonder Corporation of America of Derien, Connecticut.
4. Several models of Bright Star Flashlights manufactured by Bright Star Industries, Inc. of Clifton, New Jersey.
5. Kohler 130 and 5280 made by Kohler Manufacturing Company of Marlborough, Massachusetts.

Of these only the Wonder Multi-Lite seemed to be a possible improvement over the GSA flashlight. Several wonder Multi-Lites were purchased and tested. They did not meet the criteria as listed earlier. The light started to weaken and became unsatisfactory by the end of about 3 hours of continuous use.

The material used to construct the main unit wasn't heavy enough to withstand the necessary field usage. In addition, the light required a special battery which would cause problems in purchasing and stocking.

Since no satisfactory commercial light was available, REC began steps to design a new light. About that same time the U.S. Forest Service Missoula Equipment Development Center (MEDC) had received approval and financing to proceed with a similar project.

#### MEDC RESEARCH

To avoid duplication of effort REC sent MEDC a list of Project No.23 objectives and discontinued their planning of research. The following is a summary of MEDC's research.

MEDC conducted their own market search to determine the commercial availability of a one-piece headlamp with improved lighting characteristics. They discovered none. Next, power sources and bulbs were studied to determine which combinations, if any, would satisfy Forest Service requirements.

The lithium cell was the only battery found capable of providing enough power to improve lighting and reduce weight at the same time. The unique characteristics of the lithium battery required the development of a new bulb to increase light production efficiency. The headlamp reflector was also redesigned to eliminate the rings and dark areas produced by the GSA headlamp.

An item description for the new headlamp was prepared and 3000 prototypes were distributed to fire crews nationwide for field testing during the 1979, 1980, and 1981 fire seasons. Copies of the headlamp use instructions and field test questionnaire are included in Appendix A. The response from the field was overwhelmingly in favor of adopting the new headlamp as the standard Forest Service headlamp.

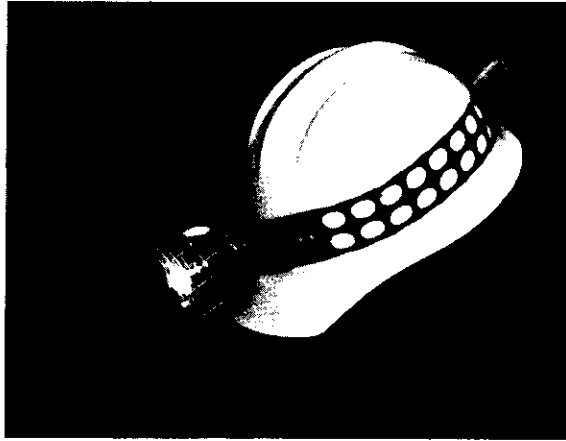


Figure 1: Prototype MEDC Single Unit headlamp.

There are two drawbacks to the new headlamp. First, D.O.T. and F.A.A. regulations prohibit transporting lithium batteries on passenger carrying aircraft at this time. MEDC is attempting to develop a battery transportation method that satisfies D.O.T. requirements. The second drawback to the new headlamps is that lithium batteries are very expensive.

MEDC plans to publish a Project Record in the near future describing the development of the single unit headlamp. Questions concerning the headlamp and lithium power cell may be addressed to:

Loren Deland  
Missoula Equipment Development Center  
Building 1, Fort Missoula  
Missoula, MT 59801

The new headlamp is not currently available from GSA. MEDC prototype headlamps were produced by:

Hartford Easter Seal Rehabilitation Center, Inc.  
80 Coventry Street  
Hartford, Connecticut 06112  
(203) 243-9741

Lithium power cells are available from:

Power Conversion, Inc.  
70 Mac Questen Parkway South  
Mount Vernon, NY 10550  
(914) 699-7333  
Contact: Stu Chodosh

Described as Model 550  
without tabs

Mallory Battery Co.  
South Broadway  
Tarrytown, NY 10591  
(914) 591-7000  
Contacts: Bruce McDonald  
Dominic Isola

Described as Model LO-30

SUMMARY

The MEDC single unit headlamp has many advantages over the standard GSA headlamp. It offers better illumination, lighter weight, and is easier to use in dense brush since it lacks the battery pack cord. If air transportation is not a factor, the new headlamp is far superior to the old model for safe, efficient night operations on the fireline.

REC Project No. 23 is closed and this is the final report.

Inquiries, comments and suggestions regarding this project may be directed to:

Roscommon Equipment Center Program  
c/o Forest Fire Experiment Station  
P.O. Box 68  
Roscommon, MI 48653

Fire Protection  
U.S. Forest Service, NA  
370 Reed Rd.  
Broomall, PA 19008

APPENDIXES



USE INSTRUCTIONS

## Experimental Headlamp

The headlamp you are about to test is a radically new product, designed to eliminate the four-cell battery pack and to provide better illumination.

**Note**—The single power cell may look like a conventional “D” cell, but it is NOT. It is a very high energy cell—called a lithium cell—that operates at twice the standard cell voltage. *It can only be used with the special bulb developed for this headlamp.*

This new headlamp incorporates a number of new features. Designed to be worn entirely on a hardhat, it has an adjustable elastic support band that holds it securely in place without clips, hooks, or fasteners on any size or style of hardhat. The reflector has been carefully designed to provide uniform illumination throughout a range of spot sizes you can adjust yourself. The bulb has been developed to provide more light than previous headlamps and to function at the voltage of the new cell.

### Follow these suggestions:

- The light beam can be focused to a small spot for distance viewing by rotating the reflector-lens ring *clockwise* or spread out for close up work by rotating *counter clockwise*.
- The life of the cell is about 18 hours or about 3 night shifts. The cell delivers full power for the duration of its life and gives only brief (approximately 1/2 hour) warning signs of weakening before total power loss. (You might want to keep track of hours used.) Carry a spare cell whenever possible—preferably in a plastic bag. If a cell accidentally vents, it won't foul your clothing or pack. A 4 to 6 mil plastic bag about 6 inches square is recommended.

- The special bulb (No. 116) is designed for a shorter life in order to increase its light production efficiency. (Hotter filament temperatures are more efficient but burn out sooner.) Make sure you have a spare in the holder provided behind the reflector.

- Lithium cells are expensive, so turn off the headlamp when it is not needed.

### Always observe these do's and don't's:

- Never attempt to recharge a lithium cell.
- Do not intentionally short circuit.
- Do not incinerate or expose to extreme heat.
- Do not puncture or otherwise abuse.
- Dispose of old cells by burying, preferably in a sanitary landfill.
- Never use these cells in series or parallel combinations, as in standard flashlights, radios, and other equipment.
- Wear the headlamp on a hardhat only—never on the bare head.
- If a cell vents, do not handle with bare hands if possible. If you do, thoroughly wash hands to remove electrolyte residues.

Lithium cells are no more dangerous than other types of cells such as lead-acid, nickel-cadmium, silver oxide, or alkalines. By observing these rules, lithium cells will be completely safe to use, handle, and carry with you.

### About the Lithium Cell

The lithium cell is composed of lithium metal with sulfur dioxide as an electrolyte in a hermetically sealed steel container. The contents are pressurized to keep the sulfur dioxide (normally a gas) in liquid form. The container has a safety vent to prevent excessive pressure buildup in the event of accidental incineration, exposure to abnormally high temperature, or prolonged short circuit.

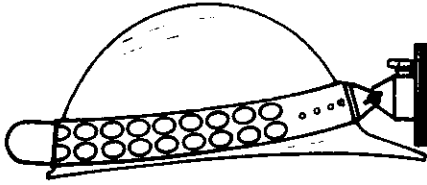
The vent is designed to open when the pressure reaches about 450 pounds per square inch (the cell is normally at about 50 psi) or when it is heated to about 230° F. The sulfur dioxide is toxic but not flammable. However, the gas is so irritating that it

provides its own warning of toxic concentrations. It is doubtful that anyone could deliberately inhale enough to do much damage.

There is only 0.1 ounce of lithium metal in a cell, but it is highly reactive with moisture and contact with the skin could produce burns. This can only happen by cutting open the steel container and handling the material. Completely discharged cells will have no remaining lithium metal.

First aid for exposure to the sulfur dioxide electrolyte in the lithium cell is to remove to fresh air. If the eyes are exposed, irrigate with large quantities of warm water. Wash exposed skin thoroughly.





QUESTIONNAIRE

# Experimental Headlamp

Agency \_\_\_\_\_

Forest Service, State, BLM, etc.

Field Unit \_\_\_\_\_

Forest, Region, District, etc.

Crew \_\_\_\_\_

Your Name \_\_\_\_\_

## ASSIGNMENT INFORMATION

1. Check block that corresponds best with the manner in which the headlamp was assigned to you:

- Seasonal issue (I used experimental headlamp only)
- Seasonal issue (Experimental headlamp was assigned to me for the season, but I used both it and the standard headlamp)
- Fire issue (I used experimental headlamp on specific fire(s))
- Other (specify) \_\_\_\_\_

2. Check block that corresponds best with the type of crew or fire assignment related to your use of the headlamp.

- Interregional fire crew     Hot shot or other regular organized fire crew     Emergency hire fire crew
- Tanker crew     Helitack     Smokejumper     District fireman, Prevention Aid, etc.
- Fire overhead     Other (specify) \_\_\_\_\_

## INSTRUCTIONAL MATERIALS

- 3. Was a *Use Instruction Sheet* given to you when you received the headlamp?     Yes     No
- 4. Did you read it?     Yes     No
- 5. Was the information adequate and understandable?     Yes     No

## USE INFORMATION

- 6. How many fires did you use the headlamp on?     1     2-4     5+
- 7. Approximately how many nights did you use the headlamp?     1     2-4     5-7     7+
- 8. On average, how many hours per night?     1-4     5-8     8+

## YOUR EXPERIENCE

- 9. How does the experimental headlamp compare to the standard headlamp for illuminating the foreground (close-up) work area?
  - Much better than SH (standard headlamp)     Better than SH     About same as SH
  - Not as good as SH     Much worse than SH

10. Make similar comparisons for illuminating more distant objects such as hazardous snags, rocks, etc., that you might want to see:

- Much better than SH (standard headlamp)   
  Better than SH   
  About same as SH  
 Not as good as SH   
  Much worse than SH

11. Check any of the following differences from SH you noticed in the experimental headlamp:

- Dimmer overall illumination  
 Brighter overall illumination  
 Less shadowy patches in light beam

12. Do you like having the entire headlamp on the hardhat?     Yes     No

13. How is the weight (check one or more)?     Well balanced     Not noticeable     Too heavy  
 Too heavy in front     Too heavy in back

14. Is it an advantage to have the battery pack and cord eliminated?

- Major advantage   
  Some advantage   
  Little advantage

15. Check blocks as appropriate regarding design of the following:

	Satisfactory	Unsatisfactory			
LENS AND FOCUS ADJUSTMENT	<input type="checkbox"/>	<input type="checkbox"/> Too tight	<input type="checkbox"/> Too loose	<input type="checkbox"/> Not enough flange	<input type="checkbox"/> Other (specify) _____
SWITCH	<input type="checkbox"/>	<input type="checkbox"/> Too tight	<input type="checkbox"/> Too loose	<input type="checkbox"/> Too awkward	<input type="checkbox"/> Other (specify) _____
HEADBAND	<input type="checkbox"/>	<input type="checkbox"/> Too tight	<input type="checkbox"/> Too loose	<input type="checkbox"/> Not durable	<input type="checkbox"/> Other (specify) _____
CELL HOLDER	<input type="checkbox"/>	<input type="checkbox"/> Too tight	<input type="checkbox"/> Too loose	<input type="checkbox"/> Not durable	<input type="checkbox"/> Other (specify) _____
CELL	<input type="checkbox"/>	<input type="checkbox"/> Did not last long enough	<input type="checkbox"/> Burned out the bulb	<input type="checkbox"/> Leaked	<input type="checkbox"/> Other (specify) _____

16. Check if any of the following broke:     Lens     Switch     Lens Pivot Adjustment  
 Headband     Cell holder     Cell wire     Cell     Bulb     Reflector  
 Other (specify) \_\_\_\_\_

17. Was the bulb performance satisfactory or unsatisfactory?

- Did not last long enough   
  Illumination too weak   
  No spare bulb   
  Did not fit properly   
  Other (specify) \_\_\_\_\_

18. Do you think this headlamp should be adopted as a replacement for the current headlamp?

- Yes   
  No; (if no, explain)

19. Comments (Make any comments on what you like or don't like about the headlamp or how it could be improved.)