A Dichroic Caving Light

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Since the beginning of human evolution, man has been associated with caves. Caves first provided shelter and a place to record history. Exploration and mining added to man's list of caving abilities with the development of portable light sources. Initially these consisted of burning sticks but through the ages transcended into candles, carbide, magnesium and electric light.

While various types of carbide generators have proven to provide the greatest duration, its by-products have meant that its use is no longer acceptable in some caves or cave areas. Electric light has proved to be the most versatile. The designs are many and varied, as is their robustness, brilliance and endurance.

The most favoured lights in most Australian speleological circles are usually miner's lights [Oldham, MSA] or their speleological cousins [SpeleoTec, Petzl] although personal experimentation continually brings hi-bred lighting systems to the forefront. Indeed, that is apparently how the British speleological community developed the SpeleoTec lamp even though it bears a striking resemblance to the Oldham light in all respects with the exception of the type of battery used.

When first developed during the late 1800's, miner's lights used incandescent globes. These globes were reliable and produced a reasonable amount of useable light [with little heat as a by-product]. One major advantage the Oldham system of lighting had over most other light sources was the inclusion of a low powered "spare" globe. The 4-volt battery could commonly power the "main" globe for 10-15 hours while illuminating the "spare" for twice that time.

During the 1970's, quartz halogen globe became available. These globes produced more light for approximately the same energy consumption. The only disadvantage apart from their higher unit cost was that they could not be handled with bare hands, the oils from the hand could set up stresses in the quartz envelope that could cause premature failure of the globe. However, they provided a great improvement in illumination technology and there would be very few mining lights using the old technology globes today.

During the latter part of the 1970's or early 1980's, a new halogen globe evolved, but not for caving. It was the dichroic tungsten halogen globe, or dichroic for short. It still used the same lamp technology as its predecessor, but worked at higher voltages and had an inbuilt reflector that passed resultant heat out through the back of the reflector instead of passing it forward. Producing so much heat that it needed special heat-resistant socket and leads, a revolution in illuminated had been unleashed. But what use might they have in caves by cavers? For a start, they were energy-hungry and appeared too fragile. Shops, galleries and trendy homes loved them. Vast amounts of high brilliance but low-voltage lights that wouldn't cook the subject of attention. Then suddenly, almost overnight it seemed, at least in Western Australia, they started appearing in caves, especially big Nullarbor caves!

Enter the "Himee"! Up to 75 watts of energy-consuming brilliance! Put one of these alongside an Oldham and you immediately thought the [Oldham's] battery had suddenly gone flat!

The first "Himee" lights were built around small 12 volt motorcycle batteries, "gelcells" or Eveready " Big Jim", 6 volt dry-cell batteries. Modelled from cave diving lights seen on the Nullarbor, Mark Norton and Greg Perejuan of Plane Caving built six of the first-generation hand held "Himee" lights for video-taping on a Nullarbor caving trip during 1992 [Norton 1993]. Since that time, many different varieties of "Himee's" have been built by numerous cavers for personal and commercial adventure-caving use. Most "Himee" lights have been made using a 50mm diameter dichroic globe generally ranging from 50-75 watts. This usually means that battery duration is short, about 20-45 minutes. Experimentation has taken place using plastic lamp-houses but due to the operating temperature of dichroic lamps - interesting results have been forthcoming - in direct proportion to the amount of time that the light has been switched on!

This author first saw a "Himee" in action in a Leeuwin-Naturaliste [Ridge] cave during 1995. The illumination output was fantastic. Entire chambers could be lit up. Unfortunately, the weight of the unit gave a new meaning to the term "a short life but a merry one," [flat batteries seem heavier than "full" ones!]. After about 30-45 minutes the battery was flat - so it was back to using lights that somehow now seemed quite inadequate.

Safe in the knowledge that there were now 35mm diameter dichroic globes available and not liking the idea of caving with hand-held lights, 1 decided to try developing a more versatile helmet mounted version with longer battery life. 1 settled on a Thorn 12 volt x 12 watt [1 amp] open dichroic globe costing about $14.00. An insulated mounting socket cost about $14.00. I field-tested an uncompleted version during the latter part of 1996, using a lead-acid motorcycle and had a completed version ready for the 1996-97 SRGWA Nullarbor Expedition, powered by a 1.0 amphere-hour Dry-power 12SBI0 "gelcell" [$55], that was worn on the waist in the same fashion as mining lights. I had incorporated an exposed 2.2-watt "low beam" beside the main lam-house. The dichroic globe can run for about 10 hours on a fully charged battery while the "low beam" can bum for about 54 hours [on a fresh battery]. A miniature 3-position switch, cable clamp, normal three core flex and a piece of heat-resisting glass completed the parts list. The lamp-house was custom-machined from brass and aluminium and its weight is comparable to an Oldham lamp-house.

Despite its low wattage and size in contrast to globes used in a "Himee", the resultant beam of my light is still quite impressive. It has been used for videotaping, and makes focusing a camera much easier. Very large Nullarbor chambers have been effectively illuminated. Following a few minor modifications, it is now my primary light source.

The disadvantages are many:

1. Dichroic lamps have high operating temperatures - mine is no different. I have measured my lamp-house temperature at 75 degrees Celsius meaning that once it has reached that peak, the lamp-house can only be comfortably handled with gloved hands.
2. Being custom-made and in dire need to dissipate heat, the lamp-house is not waterproof and the low-beam globe and switch require protection meaning that the entire assembly is not as robust as a miner's light lamp-house.
3. Medium duration "gelcell" batteries are more bulky and heavier than mining lights. I built my light around a 10a/h battery that is 150 x 100 x 90mm and weighs 4.1kg, as against 2kg for a similar duration Oldham. If you want to carry same-size "spare" on those extra long trips, you'll need a lot of staying power! The battery does not have rounded edges. Shorter duration "gelcells" would naturally be lighter, smaller and less expensive.
4. Unless all electric terminals are insulated, the system is not suitable for caves where the entire unit is likely to get wet.

So what are the advantages?

1. Discounting the cost of the custom-made lamp-house, dichroic light units are relatively cheap to construct, measured against commercial mining lights.
2. If 12-volt dichroic lights are used, recharging of the batteries can be done direct from a vehicle's alternator system or, inexpensive main operated trickle chargers can be employed.
3. Smaller, lower amphere-hour batteries can be used for shorter duration trips, thus saving on weight.
4. By using sealed gel-cells, the batteries can be transported on commercial airline without difficulty - in direct contrast with well-cell mining lights.
5. Probably the most important advantage of these lights is that they are very, very BRIGHT!

To conclude, despite the depressing weight of the battery, [that I use], the perceived fragility lamp-house and susceptibility to moisture, I feel that for in dry and moderately wet caves, the level of illumination far outweighs the disadvantages.

Materials -

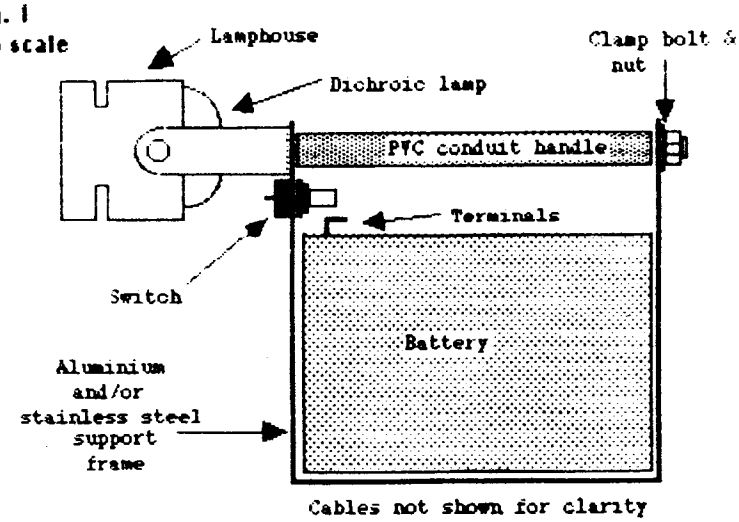
Thorn 12V x 12V Watt [1amp] open dichroic globe [M64/FTA][GZ4]	$14.00
Dry-power 12SB10'gelcell', 12V 10a/h battery - 4.1kg, 150 x 100 x 90mm	$55.00
Radio spares [on-off-on] single pole miniature switch [344-710]	$13.00

12 V 2.2 Watt miniature single contact bayonet globe
Single contact bayonet globe holder
Custom-made battery belt, kindly manufactured by Heather Jefferies and Wayne Tyson [SRGWA]

References - 1993 Norton M. "Himee History - and the building thereof". The Western Caver Vol#33 pp 7-9

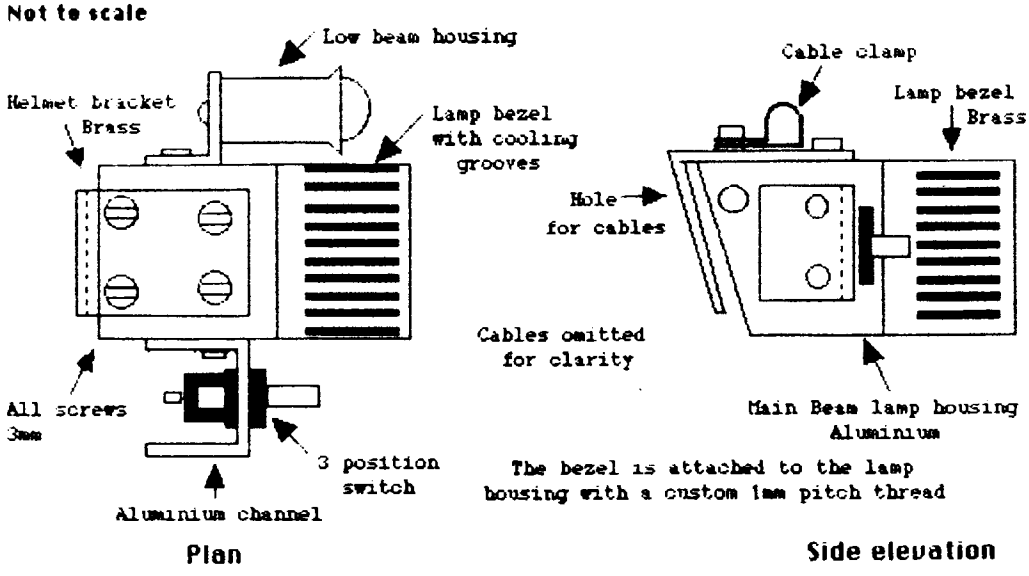
Dichroic Caving Lights

Fig. 1
Not to scale



"Himee" Light - after Mark Norton 1992

Fig. 2
Not to scale



Dichroic caving light - lamphouse

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