

Roscommon Equipment Center Program

Newsnote #4

COOLING SYSTEM FOR SMOKEY BEAR SUIT

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Northeast Forest Fire Supervisors

In Cooperation with

Michigan's Forest Fire Experiment Station

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Introduction

In 1984, the National Wildfire Coordinating Group's (NWCG) Fire Equipment Working Team (FEWT) determined national fire equipment needs by conducting an extensive survey of state and federal wildfire agencies. An item listed as "an improved Smokey Bear suit with better ventilation and audio" ranked 13th nationally out of over 200 items. In the northeast state agency list, this item ranked at the top. However, most agencies found costume costs higher than prevention budgets could afford. For this reason, redesign of the costume did not appear a good option.

In 1990, Forestry Canada's Petawawa National Forestry Institute (PNFI) began working with Exotemp Limited. Exotemp designed a cooling system for use by workers needing protective overgarments. PNFI assisted REC in making the contacts to evaluate Exotemp's cooling system with the Smokey Bear costume. In the U.S., it is marketed by MSA under the name Core Control[®].

Core Control Cooling System

The Core Control[®] system cools the body by pumping ice water through plastic tubes sewn in special undergarments. The full garment complement consists of a shirt, pants, and hood. A 12-volt DC Ni-Cad battery powers a compact pump. Plastic bottles mounted in an insulated waist or backpack store the ice water mixture. Water can be frozen in the bottles prior to use, or an ice cube/water mix can be made in the bottle. REC made its evaluation using a 2 liter (ice water) capacity Core Control[®] with a 2-speed 9.6 volt pump. A slightly more compact 1.3 liter 7.2 volt pump, costume cooling system, is also available. Web gear allows the 1.3 or 2 liter units to be mounted on the chest, back, or waist. Larger 4 liter back mounted and 10 liter umbilical cooling units are available. The 4 liter system was considered too bulky for costume use. The umbilical system with remote ice chest may have some applications in special cases. Smokey riding on a float in a long parade, would be an example.



Figure 1 - Core Control system with Shafton costume.

Evaluation

Several studies have been done using the Core Control[®] system in different work settings. From these studies it was clear that this system could keep a costume wearer comfortable for the duration of the ice. How long the ice lasts will depend on how much work (activity) the costume wearer will perform and the temperature of the wearer's surroundings. We looked at variables that related to the costume and its mission. Would the cooling system fit underneath the costume? Was the pump noise acceptable? How much garment was needed to keep the wearer comfortable? The evaluation was made using primarily the Shafton costume. Shafton was chosen because it is currently available, popular, and its design causes a relatively hot internal environment. We also tried this system with an older Facemaker costume. We chose an experienced costume wearer with physical measurements of 6 feet tall, 46 inch chest, and 36 inch waist. To simulate a reasonably hostile environment, we conducted the evaluation in a room with the temperature at 85°F. Since the Smokey suits have breathable denim pants, we did not use the pant undergarment during the evaluation.

Conclusions

The 2 liter system will provide adequate cooling in low activity environments, typical of the Smokey costume use. The wearer found that the cooling system provided a much more comfortable environment than without. Expect about 1 hour endurance per 2 liter bottle at low pump speed. During use, ice in the pack will deplete long before battery changing is needed.

If the wearer was relatively inactive, only the cooling shirt was needed to adequately cool the wearer of a Shafton suit at 85°F. and low pump speed. During the trials the observers were sweating and mildly uncomfortable. The wearer did not sweat and was comfortable.

A rear waist mounted configuration was preferred with the Shafton suit. The suit's torso and pants covered the area well, leaving no visual hint of the unit's presence. The rear location also helped mask the pump noise from observers seeing Smokey from the front. The high pump speed was too noisy for use if visitors were close-up. However, the low speed was relatively quiet and provided adequate comfort, as long as Smokey was not very active.

Shirts will be needed to fit different size individuals. Shirts come in S, M, L, and XL. Because of the cooling tubes sewn in the garment, you will find that garment sizing will be a little less forgiving than with normal shirts.

The cooling hood was also tried with the shirt. The wearer did not feel that the hood contributed enough extra comfort to be warranted. For some, the hood may be

uncomfortable. Smokey's headband may put pressure on the plastic tubes in the hood and cause discomfort to the skull.

With the Facemaker suit, only the waist mount harness was acceptable. The wire, framework, and padding in the front make front mounting not practical. A bulge in the costume shows noticeably if mounted as a backpack. When mounted as a waist pack, it is still somewhat noticeable.

The cooling system does take up space inside the costume. This will further limit the maximum size of the wearer. Persons larger than our evaluator will not fit in a Shafton costume with the Core Control 2 liter pack.

The Core Control system provided a more comfortable environment for the Smokey Bear costume wearer. The duration of the ice is adequate for most Smokey Bear presentations. Depending on the components selected, the cost for a single unit will be about \$1,200.00. Aside from increased comfort, there may be some cost benefits. A cooling system use will reduce the number of times that the costume is removed and put back on for stress relief. This will likely reduce wear and tear on the costume. Likewise, the amount of moisture from perspiration will be reduced, which will also help preserve the costume. We found no reservations concerning this product. The Core Control system can solve the comfort and heat stress problems of costume wearers. Budget will be the primary factor for determining its viability.

Purchasing Recommendations

REC could not find any personal cooling systems that compete favorably with Core Control. Other products, such as ice vests, have been shown to provide only marginal relief from heat and do not provide long term body cooling when compared to core control. In the United States this product is sold through Mine Safety Appliances (MSA). To help agencies discuss this product with sales representatives, we have included MSA part numbers where appropriate.

For a single kit for use with the Shafton Smokey Bear costume, our minimum recommendations are:

- One cotton-polyester shirt in either S, M, L, or XL
- One holster and pump assembly, including harness
- Two rechargeable Ni-Cad batteries
- Two plastic bottles
- One battery charger

The 2 liter system utilizes a 9.6 volt pump. It is available in a 2-speed motor model (MSA #696495) or 5-speed model (MSA #696496). There is also the MM-1 cooling unit (MSA #696731) that utilizes a 7.2 volt pump battery and has the 1.3 liter capacity. The

MM-1 unit is available with a remote switch. This will allow the wearer to activate the pump when necessary.

Three other items might be useful options:

- Cotton polyester hood (MSA #696442) fits all head sizes
- Repair kit that includes o-rings, quick connect fittings, clamps and tubing for making minor repairs on the cooling system (MSA #696467)
- Carry bag for storing and travel.



Figure 2 - Core Control system used for the evaluation included, from top left clockwise: harness, battery charger, carrying case, 2 liter bottle, pump system hood, and shirt.