

INFANTRY LETTERS



PROTECTING SOLDIERS IN COLD-WET CONDITIONS

Lieutenant Colonel Jack H. Cage, in his article "Light Infantry in Cold-Wet Conditions" (INFANTRY, November-December 1993, pages 11-12), raises serious concerns about the performance of the extended cold weather clothing system (ECWCS) parka in wet weather. He and his soldiers went to the field believing their Gore-Tex parkas would provide waterproof protection. Instead, they encountered unusually severe weather, and the garments failed to keep them dry.

Essentially, Colonel Cage was right in trying to find out why this happened and how light or dismounted infantry soldiers could be protected in cold and wet weather.

Since my company, W.L. Gore & Associates, Inc., manufactured the fabric used in all of the parkas worn during this exercise, I was also concerned with determining what had caused this situation. After reading Colonel Cage's detailed description of what happened and the reports of the personnel from the Army's Natick Research, Development, and Engineering Center who investigated the situation, I believe the following observations are relevant:

Natick's position that the ECWCS is designed for use only in "cold" conditions is debatable; it certainly does not reflect the original intent of the program under which these garments were developed. The requirement documents of both the U.S. Army and the U.S. Marine Corps mandate that the ECWCS be functional in the temperature range of 40 to -25 degrees Fahrenheit and that the shell garments (the parka and trousers) be constructed of materials that are water-resistant (Army) or waterproof (Marines) and moisture vapor permeable. The reason for this is that the pri-

mary function of the parka and trousers is to provide a windproof barrier and keep the clothing worn under them dry. As Colonel Cage and his soldiers can testify, the weather can get exceedingly wet and soldiers can become dangerously cold at 40 degrees.

While I may disagree with the Natick personnel concerning the intent of the original ECWCS design, they are accurate in saying that the current parka design will not provide waterproof protection. But this does not mean waterproof garments cannot be constructed using Gore-Tex fabric. The material itself is absolutely waterproof and has been used successfully in both commercial and military wet-weather garments in some of the world's worst climates. If this is the case, then why didn't these garments provide the protection the soldiers expected?

First, the ECWCS parka was designed more than ten years ago and used state-of-the-art features to make it as weatherproof as possible. Unfortunately, at that time, we did not realize the importance of sealing all the seams in a garment. Therefore, the seams attaching the zippers in front and under the arms are not sealed and allow water to enter through the holes made by the stitches. Although one would not expect these tiny stitch holes to cause significant problems, we learned over time that they do contribute to leakage in a garment.

During the past decade, we have also learned to appreciate the effect of *wicking* on garment design. This term is used to describe the tendency of a material to transfer moisture from one location to another. In the case of the ECWCS parka, the lining material wicks moisture from any point that gets wet to areas well removed from that point. This means that moisture on the hood lining wicks down the back of the

garment, unless the hood is raised as soon as it begins to rain. Water entering the stitch holes along the zippers can migrate to the areas around the chest and back; and if a soldier is not wearing waterproof trousers, the trouser material becomes saturated, and where the trousers contact the lower lining of the parka, it will wick moisture up into the body of the garment. In this situation, the soldier can become soaked even if his garment does not "leak."

The statement that "the PTFE suit's water-resistant capability might be degraded after repeated wear and laundering" should not have come as a surprise. Natick personnel who investigated this situation determined that about half of the garments worn by Colonel Cage's soldiers had been manufactured in 1985 and, under average wear conditions, should have reached the end of their service life in 1989. We recommend that commanders have their soldiers inspect the garments periodically for excessive wear, paying particular attention to garments with contract dates more than four years old. But even if Colonel Cage had done this, half of the unit would still have had garments well within their service life.

Can soldiers do anything to improve the performance of the materials in these parkas? The answer is an unqualified *yes*.

First, many soldiers think the Gore-Tex fabric used in their parkas is fragile and don't wash the garments until absolutely necessary. The truth is that this material is very tough, and the water-repellent finish performs better when it is clean. The material is actually constructed of two fabrics laminated to a film. When the laminate is manufactured, a water-repellent finish is applied to the exterior fabric, but this finish is not what makes the laminate waterproof. The film provides this

quality while the finish causes water to bead on the surface of the exterior fabric, reducing its tendency to wick water toward the unsealed areas. By getting water to run off the surface, we keep the material from feeling cold and clammy.

Another benefit of the water-repellent finish is that it allows passage of moisture vapor more readily from inside the parka. Without this finish on the fabric, water can soak in and cool the surface as it evaporates. Moisture generated by a soldier's body in the form of vapor can pass easily through the laminate unless the vapor contacts a cool surface; then it condenses into a liquid (just as warm breath does when it contacts a cool piece of glass). Once this occurs, the water must be re-vaporized before it can pass through the laminate. It is readily apparent, then, that the water-repellent finish should be kept in good shape. Fortunately, this is not difficult.

When water no longer beads on the surface, the garment should be washed and then dried in a standard home dryer on the permanent press or sturdy cotton setting. This is important because the

heat in the dryer helps prolong the life of the finish. Simply washing and drying the garment may restore its ability to make water bead on the surface. If water still does not bead on the surface, ironing the parka, using a warm steam setting (for synthetics or nylon), may temporarily restore the fabric's water repellency. After the garment has had extended wear, however, a soldier may have to maintain surface beading by applying a commercially available non-silicone water repellent (such as Scotchgard, Ultrathon, or Prevail brands) to the outer fabric. These steps may be repeated as necessary.

Unfortunately, given the current situation relative to the ECWCS parka design, I have to agree with Colonel Cage's position that soldiers in light infantry units and dismounted soldiers in mechanized units need the standard Army wet-weather parka and trousers (WWPT) in addition to the ECWCS to protect themselves during severe wet conditions. This is certainly not an acceptable answer, however, if soldier's load is considered, and the Army and the

Marine Corps are working aggressively toward a solution. They have launched an 18-month program with Natick to redesign the ECWCS parka and trousers to eliminate the problems described. If this program is successful, soldiers should not have to carry both the WWPT and the ECWCS parka and trousers. Until that time, I think the following recommendations are in order:

- Take the WWPT to the field to augment the ECWCS parka and trousers if severe wet weather is expected.

- When using the ECWCS parka in wet weather, also wear the ECWCS trousers to prevent wicking from the BDU trousers onto the parka's lining.

- Follow the cleaning instructions described here, and as the garment ages, restore the water-repellent finish as described.

- Inspect garments periodically and turn in worn-out items.

S. NICHOLAS ALLEN
W.L. Gore & Associates
Albuquerque, New Mexico

