



FIRE EQUIPMENT WORKING TEAM

To: Gene Madden, Chair Safety & Health Working Team
27, 2005

Date: June

From: Tory Henderson, Chair

Subject: New Generation Fire Shelter

The enclosed New Generation Fire Shelter Update is provided in order to meet the Safety and Health Working Team's request for additional information due to recent issues discovered by a few firefighters with the new generation fire shelter.

This document will become a Tech Tip in the near future and that Tech Tip will contain this type of information, however it was imperative the answers to questions raised be communicated quickly. The Tech Tip that will be released in the future is the second of two that are focusing on the new generation fire shelter. The first one, issued recently addressed the large size new generation fire shelter.

The fire shelter will always be an evolving project as technologies continue to change which will lead to improvements in the shelter. If anybody does encounter a problem with a shelter I do ask that they contact Tony Petrilli immediately. Tony may be reached at (406) 329-3965.

Again, we are committed to continually improving the fire shelter.

Sincerely,

/s/ Tory Henderson

Tory Majors, Chair FEWT

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NEW GENERATION FIRE SHELTER UPDATE

JUNE 2005

These talking points are in response to concerns voiced by firefighters and to the NWCG Safety and Health Working Team's request for more information concerning the New Generation Fire Shelter.

From its inception, the old-style shelter saved many lives and prevented many serious injuries. The development of the New Generation Fire Shelter started in January 2000. The Federal Fire and Aviation Leadership Council selected the new shelter design in June 2002. This shelter design uses the latest advances of technology. As a continuous improvement process, Missoula Technology and Development Center (MTDC) will address technology advancements, concerns and policy direction.

Rips or tears in material and seams:

The fire shelters are designed for one time use. For more realistic training, many units practice deployments with actual shelters. Most reports of rips or tears happen after multiple deployments of the same shelter, particularly when reused by large firefighters. Two reports of open seams (6 inches) in the shelter shell, and two reports of floor material tears resulted from single practice deployments. There has been one report of a missing hold-down strap. MTDC has inspected more than 270 shelters and have found no open seams and no missing hold-down straps. Manufacturing inspection by GSA and MTDC is at an unprecedented level. Inspection has been increased to meet the goal of zero defect. Manufacturing defect reports are being filed with GSA.

Shake handle detachment:

There have been reports of shake handles from shelters becoming detached during practice deployments. One of the shelters has been recently received by MTDC for

inspection. MTDC has performed shake and deployment tests as part of shelter inspections and have had no detachments.

Pull strap:

Los Angeles County Fire Department and California Department of Forestry have identified a problem of pull straps becoming detached from the PVC shelter bag during fire shelter drill simulations. This issue has only been seen in shelters that were manufactured by Weckworth Manufacturing. A retrofit has been designed and is undergoing further testing. This retrofit can be done by local units. Further updates about this issue will follow.

Reduced air space:

The ability of the old-style shelter to protect firefighters depended on the reflectivity of the aluminum foil and the airspace within. The New Generation Shelter protects by using a material that is much more heat resistant and by using the more aerodynamic and better heat reflecting rounded shape, which makes airspace less important. Testing has shown that even with less airspace the New Generation Shelter performed much better than the old style. In 2001 and 2002, fire shelter testing was performed by the Protective Clothing and Equipment Research Facility of the University of Alberta in Edmonton and published in the MTDC Tech Tip, *New Generation Fire Shelter Developed for Wildland Firefighters* (0351–2313–MTDC). In the 300-second radiant test, the old-style shelter showed a temperature rise of 203 °F (95 °C) and a heat flux average of 3.7 kW/m². In the same test, the New Generation shelter showed a rise of 169 °F (76 °C) and a heat flux average of 1.5 kW/m². In the 40-second flame test, the old-style shelter showed a temperature rise of 572 °F (300 °C) and a peak heat flux of 44 kW/m². The New Generation Shelter showed a rise of 131 °F (55 °C) and a peak heat flux of 1.3 kW/m².

Structural integrity:

Structural integrity of a fire shelter is its ability to hold its shape during deployment. The New Generation Shelter holds its shape well when deployed, however the mid-section of the shell may droop in windy conditions. During design of the New Generation Shelter,

support systems were tested and evaluated, but no acceptable systems were found. MTDC continues to search for an acceptable support system to increase structural integrity.

Touching of shelter material:

In response to concerns of firefighters with the shelter material touching the occupant during deployment, testing done in May 2005 was sponsored by MTDC and conducted by the Protective Clothing and Equipment Research Facility of the University of Alberta in Edmonton. The New Generation Shelter was exposed to a single burner propane flame to get some indication of interior and exterior surface temperature (figure 1). The burner was set so that flames would impinge on the surface. Flame temperatures were 1472 °F to 1652 °F (800 °C to 900 °C) as expected from a diffusion flame. After 7 seconds of flame the outer surface temperature was 376 °F (191°C) while average inside surface temperature was 187 °F (86°C). After 18 seconds of flame exposure the outer surface temperature was 590 °F (310°C) while average inner surface temperature was 318 °F (159°C). Similar testing with the old-style shelter showed that the flame burned through the material within 15 seconds allowing flame to enter the shelter. Further testing will be conducted by the University of Alberta during the International Crown Fire Modeling Experiment in the Northwest Territories of Canada this summer.

Large shelter:

The print version of MTDC Tech Tip, *Large New Generation Fire Shelter Now Available* (0551–2325–MTDC), will be distributed July 2005. It contains more information about the large-size shelter. This shelter provides better protection for larger individuals by:

- Reducing body contact with the hot shelter material during deployment
- Providing more air space and comfort for the occupant.
- Preventing the shelter from being damaged when a large person stretches out inside the shelter and pushes hard against the shelter.

Specifically, any firefighter taller than 6 feet 1 inch should carry the large shelter. Any firefighter whose girth is larger than 53 inches at any point should carry the large shelter. Firefighters shorter than 5 feet 7 inches should not carry a large shelter. Firefighters

whose girth is less than 53 inches and are between 5 feet 7 inches and 6 feet 1 inch may choose to carry the large shelter. These firefighters should practice with a large practice shelter or an actual large shelter before deciding whether to carry the large shelter on the fireline.

Recent Changes in the Design:

Several design changes developed during work on the large-size fire shelter are also being incorporated into the regular-size shelter as part of ongoing design improvements.

The improvements include:

- The shelter floor is now being made with a single piece of laminated material instead of several small pieces sewn together. This change takes advantage of improvements in cloth strength that have been developed and tested since the new generation shelter was first released. The effect of this change is a stronger shelter with less weight and bulk.
- A short piece of $\frac{3}{4}$ -inch plastic pipe has been added to the shake handles allowing the shake handles to be held easier with gloved hands. The attachment of the shake handles to the shelter has been strengthened.
- Binding tape was removed around most of the bottom edge of the shelter. With the use of stronger floor material, the tape was no longer needed. Removing the tape reduces the weight and bulk of the shelter. Binding tape was retained where the shake handles attach to the shelter to maintain strength in these areas that are highly stressed during deployment of the shelter.
- A new line of fiberglass stitching was added to improve the strength of the major seams at low and moderate temperatures. Quartz thread already present in the seams maintains its strength in the very high temperatures that can occur in a fire shelter deployment.
- A reinforcement has been added to the PVC shelter bag and the pull strap to strengthen the attachment point.

The future:

The US Forest Service and MTDC are committed to continually improve the fire shelter. The fire shelter project will test the latest advances in technology when possible. A newly designed material that may offer more protection, better structural integrity, lighter weight, and less bulk will be tested starting this year.

For additional information, contact Tony Petrilli, project leader; USDA Forest Service, MTDC; 5785 Hwy. 10 West; Missoula, MT 59808-9361. Phone: 406-329-3965; e-mail: apetrilli@fs.fed.us

Figure 1. May 2005 shelter surface temperature testing.

