Fire Tech Tips

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What's New With the New Generation Fire Shelter?

Tony Petrilli, Project Leader

All firefighters are encouraged to carry the New Generation fire shelter. According to the National Fire and Aviation Executive Board (Federal wildland fire directors and the National Association of State Foresters fire director), target dates for transition to the New Generation fire shelter are December 31, 2008, for Federal agency wildland firefighters and December 31, 2009, for all other wildland firefighters.

Many wildland firefighters already have been issued the New Generation fire shelter. The National Fire and Aviation Executive Board recognizes the need for an interagency transition strategy to meet the target dates. A small group will identify the factors involved in the transition. This group will include representation from Federal and State agencies as well as the county, local, and rural firefighters who assist with the suppression of wildland fires.

Highlights...

- Target dates for transition to the New Generation fire shelter are December 31, 2008, for Federal agency wildland firefighters and December 31, 2009, for all other wildland firefighters.
- An Interagency Fire Shelter Advisory Board has been established to guide the fire shelter program into the future.
- Although the New Generation fire shelter has less airspace than the old-style fire shelter, tests show it performs much better.
- The pull-strap attachment point on PVC shelter bags manufactured since 2005 has been reinforced to prevent the pull strap from tearing off. This tech tip includes instructions for retrofitting older PVC fire shelter bags.

Interagency Fire Shelter Advisory Board

The Forest Service, U.S. Department of Agriculture, has provided the specifications and requirements for the fire shelter since the shelter's development during the 1960s. Because the fire shelter program is one of the most critical for the interagency wildland firefighting community, a new Interagency Fire Shelter Advisory Board has been established. The board held its first meeting in February 2006 in Boise, ID. The board's purpose is to guide the fire shelter program into the future, to involve stakeholder groups in decisions on fire shelter management, and to ensure that technical specialists at the Missoula Technology and Development Center (MTDC) receive needed support and direction from leadership.

Rips or Tears in Material and Seams

The fire shelters are designed to be used just once. For more realistic training, many units practice deployments with actual shelters. Most reports of damage to fire shelters involve multiple deployments of the same shelter. MTDC has received two reports of open seams in the shelter shell, two reports of floor material tears after a single practice

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deployment, and one report of a missing holddown strap. MTDC has inspected more than 300 shelters. No open seams and no missing hold-down straps have been found. In 2005, three fire shelters received slight damage to floor seams during deployment at the Tarkio Fire, I-90 Complex, in western Montana. Manufactur-ing inspections by the General Services Administration and MTDC have increased to meet the goal of zero defects. If you encounter a problem with a New Generation fire shelter, contact MTDC project leader Tony Petrilli at 406–329–3965.

Shake Handle Detachment

There have been reports of shake handles becoming detached from shelters during practice deployments. MTDC performs shake and deployment tests as part of shelter inspections and has experienced no problems.

Shelter Shape

The New Generation fire shelter holds its shape well when deployed. However, the midsection of the shell may droop in windy conditions. During design of the New Generation fire shelter, several support systems were evaluated, but no acceptable systems were found. MTDC continues to search for an acceptable support system to increase shelter rigidity.

Reduced Airspace

The ability of the old-style shelter to protect firefighters depends on the reflectivity of the aluminum foil and the airspace inside the shelter. The New Generation fire shelter protects its occupant with a more heat-resistant material than the old-style fire shelter and with a shape that is more aerodynamic and rounded to better reflect radiant heat. Testing shows that even though the New Generation fire shelter has less airspace inside, it performs much better than the old-style shelter. During the development of the New Generation fire shelter in 2001 and 2002, fire shelter testing (figures 1 to 5) was performed by the Protective Clothing and Equipment Research Facility of the University of Alberta in Edmonton.

Figure 1—A New Generation fire shelter was exposed to a radiant heat panel during fire shelter testing at the University of Alberta in Edmonton.

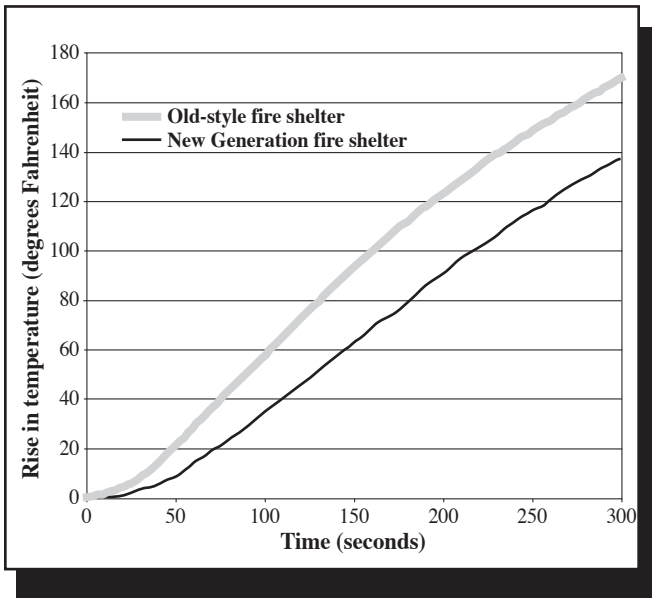


Figure 2—Internal temperatures in full-scale radiant heat tests.

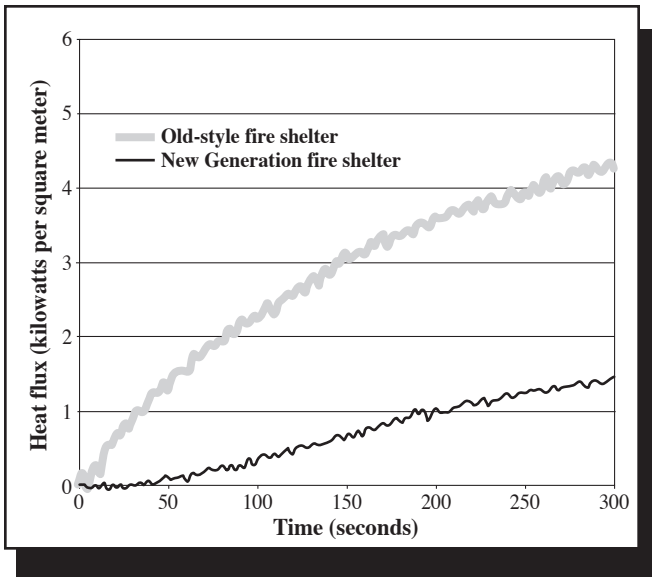


Figure 3—Internal heat flux in full-scale radiant heat tests. Heat flux is defined as the rate of energy transfer. Death is likely if a person is exposed to 14 to 18 kilowatts of heat per square meter for 30 seconds.

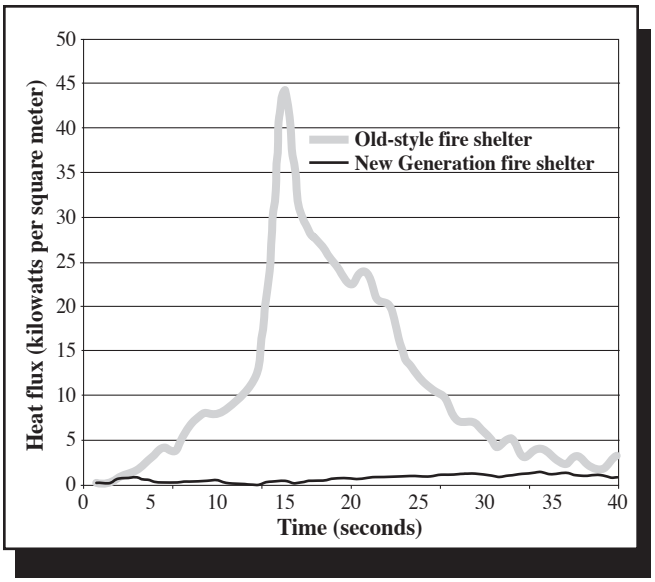


Figure 5—Internal heat flux in full-scale direct flame tests. The flames burned through the old-style shelter within 15 seconds. Death is likely if a person is exposed to 14 to 18 kilowatts of heat per square meter for 30 seconds. The facility was not able to run the burners for longer than 20 seconds.

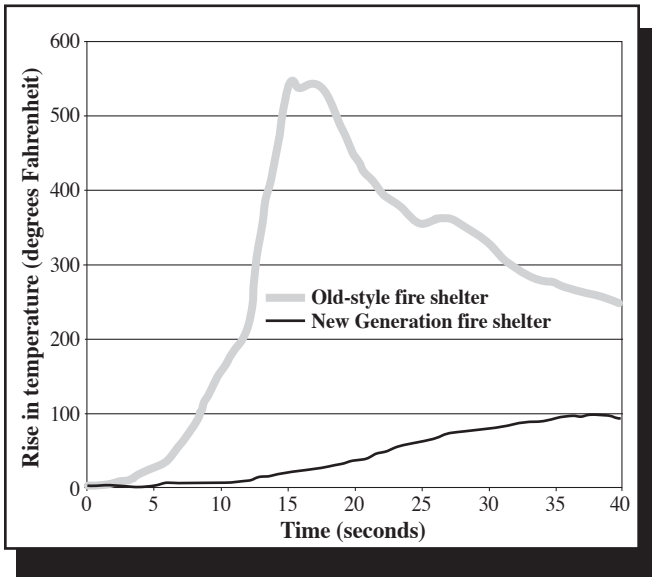


Figure 4—Internal temperatures in full-scale direct flame tests. The flames burned through the old-style shelter within 15 seconds. The facility was not able to run the burners for longer than 20 seconds.

Touching Shelter Material

Some firefighters are concerned about hot fire shelter material touching them during deployment. In May 2005, MTDC sponsored tests conducted by the Protective Clothing and Equipment Research Facility of the University of Alberta in Edmonton. The researcher applied flames from a single propane burner to the surface of the New Generation fire shelter and measured the interior and exterior surface temperature (figure 6.) Flame temperatures ranged from 1,472 degrees Fahrenheit to 1,652 degrees Fahrenheit (800 degrees Celsius to 900 degrees Celsius) as expected from a diffusion flame. After 7 seconds of flame, the outer surface temperature reached 376 degrees Fahrenheit (191 degrees Celsius) while the average inside surface temperature reached 187 degrees Fahrenheit (86 degrees Celsius). After 18 seconds of flame exposure, the shelter's outer surface temperature reached 590 degrees Fahrenheit (310 degrees Celsius) while average inner surface temperature was 318 degrees Fahrenheit (159 degrees Celsius). The researcher observed the material of the New Generation fire shelter remained intact and provided

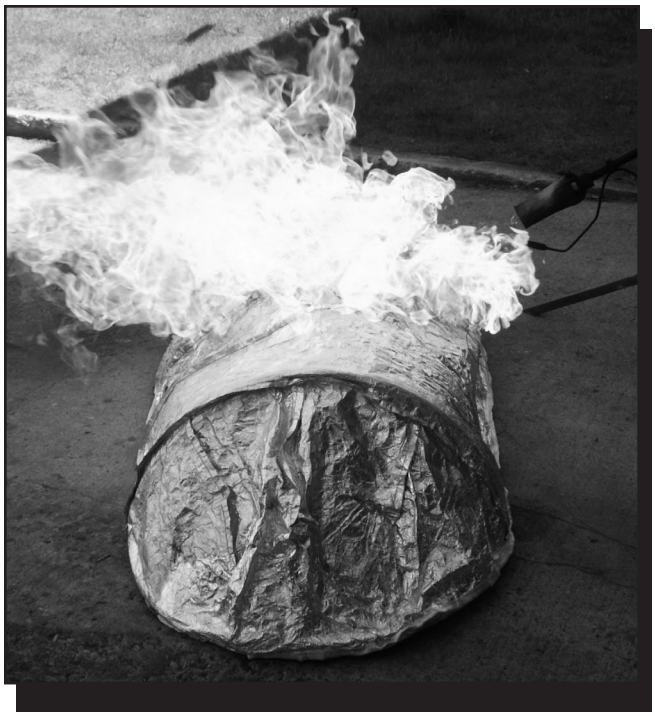


Figure 6—Flames are impinging on a New Generation fire shelter during a surface temperature test.

protection from the flames for the duration of the 1-minute test. In a similar test with the old-style shelter, the flame burned through the material in 15 seconds, and flames entered the shelter. Although the hot material of the New Generation fire shelter may touch the occupant, in this test the researcher observed this shelter provided more protection than the old-style shelter.

Remember, no fire shelter—whether New Generation or old-style—is fail safe. Carrying a fire shelter should never be considered as an alternative to safe wildland firefighting.

Fire Shelter Polyvinyl Chloride Bag

The main function of the polyvinyl chloride (PVC) bag is to protect the fire shelter from dirt and abrasion, which can reduce its service life. Wildland firefighters should treat their fire shelters with care and protect them from damage. The fire shelter sleeve of the Fireline Pack (NSN: 8465–01–503–4484) has been redesigned to lessen the amount of dirt and debris that enters the sleeve.

The pull strap on the PVC shelter bag was designed to help remove the shelter from its pack during a shelter deployment. This feature was incorporated into the old-style shelter design in 1999 and was brought forward to the New Generation fire shelter. There have been no reports of the strap detaching from the old-style shelter. However, during shelter deployment drills performed by firefighters and tests done by MTDC, the pull strap detached from the PVC shelter bag when the strap was jerked abruptly. Pull tests show the pull strap tore from the shelter bag with an average force of 65 pounds when pulled straight away. When pulled at an angle, some pull straps tore away with only 35 pounds of force.

Equipment specialists at MTDC have reinforced the pull-strap attachment point on the PVC shelter bag that holds the New Generation fire shelter. With the reinforcement, the tear-away force has been increased to over 100 pounds. All PVC bags manufactured since June 2005 are made with the reinforced design.

PVC shelter bags made before this change can be retrofitted. The reinforcement retrofit uses an adhesive and nylon webbing to strengthen the attachment point. The adhesive is available through many hardware and home improvement stores nationwide. Nylon webbing can be purchased in fabric stores, sewing shops, or by contacting Matt Cnudde at the National Interagency Fire Center (208–387–5277).

Retrofit Materials

Adhesive: 3M Marine Adhesive Sealant—Fast Cure 5200. Part No. 051135-05220

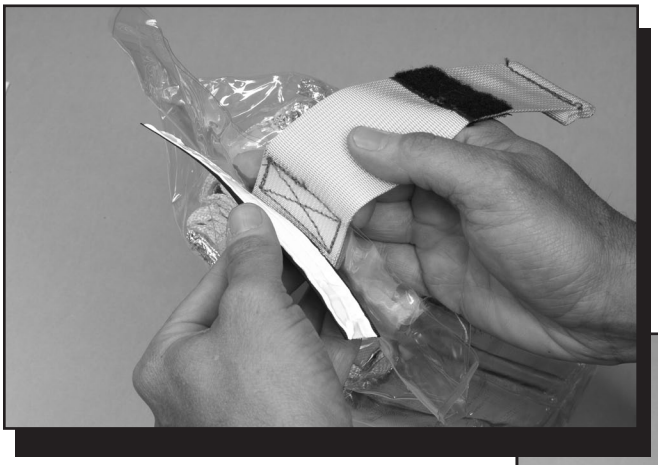
Nylon webbing: Mil-T-5038, type 3, 1 inch wide, 5½ inches long. Cut the webbing with a heat knife or sear the ends with a match to prevent them from fraying.

Instructions

The following photographs show a simple way to reinforce PVC shelter bags produced before June 2005.

STEP 1: Apply a thin bead of adhesive to the nylon webbing.

STEP 2: Spread adhesive so it is $^{1}/_{16}$ inch thick.



STEP 3: Apply the webbing to one side of the pull strap attachment area and smooth it in place. Repeat on the opposite side of the pull-strap attachment area.

STEP 4: To ensure positive contact until the adhesive cures, use clothespins or paper binders to hold the webbing in place. The adhesive cures in 24 hours.

Other Fire Shelter-Related Information

Appendix C of the *Tarkio Fire, I-90 Complex, Shelter Deployment Investigation Review Documents* contains the personal protective equipment report that was based on information from inspections and interviews conducted after three firefighters deployed New Generation fire shelters. The report is on the Northern Region fire information Web page at: *http://www.fs.fed.us/r1/fire_r1/.*

A tech tip, *New Generation Fire Shelter Developed for Wildland Firefighters* (0351–2313–MTDC), provides information on the new fire shelter system. This tech tip includes instructions on modifying existing fireline packs to fit the new shelter.

The tech tip, *Fire Shelters Weaken Transmissions From Hand-Held Radios* (0351–2342P–MTDC), provides information that shows firefighters may have difficulty communicating using hand-held radios while inside fire shelters.

The tech tip, *Large New Generation Fire Shelter Now Available* (0551–2325–MTDC), provides information on the new large fire shelter. This tech tip discusses the differences between the standard and large fire shelters, which size wildland firefighters should use, and provides information on training and on ordering fire shelters.

About the Author

Tony Petrilli is an equipment specialist for the fire and aviation and safety and health programs at MTDC. He has a bachelor's degree in education from Western Montana College. Petrilli began working for the Forest Service in 1982 and joined the center full time in 2000. He has worked as a firefighter on the Lewis and Clark and Beaverhead National Forests and as a smokejumper for the Northern Region. He is also a division/group supervisor and type III incident commander.

Library Card

Petrilli, Tony. 2006. What's new with the new generation fire shelter? Tech Tip 0651–2322P–MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 6 p.

Explains the need for wildland firefighters to make the transition to the New Generation fire shelter and addresses concerns that have been raised about the New Generation fire shelter, including reports of rips and tears in material and seams, shake handle detachments, and reduced airspace. The Interagency Fire Shelter Advisory Board has been established to guide the fire shelter's future development.

This tech tip includes a list of additional sources of information on fire shelters.

Keywords: aerodynamic, deployments, equipment, fire fighting, firefighting, fire shelters, inspections, PPE, PVC, quality control, radiant heat, reflectivity, retrofit, safety at work, service life

Additional single copies of this document may be ordered from:

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Electronic copies of MTDC's documents are available on the Internet at: *http://www.fs.fed.us/t-d.*

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Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, videos, and CDs on their internal computer networks at: *http://fsweb.mtdc.wo.fs.fed.us/search.*

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