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The New Generation Fire Shelter

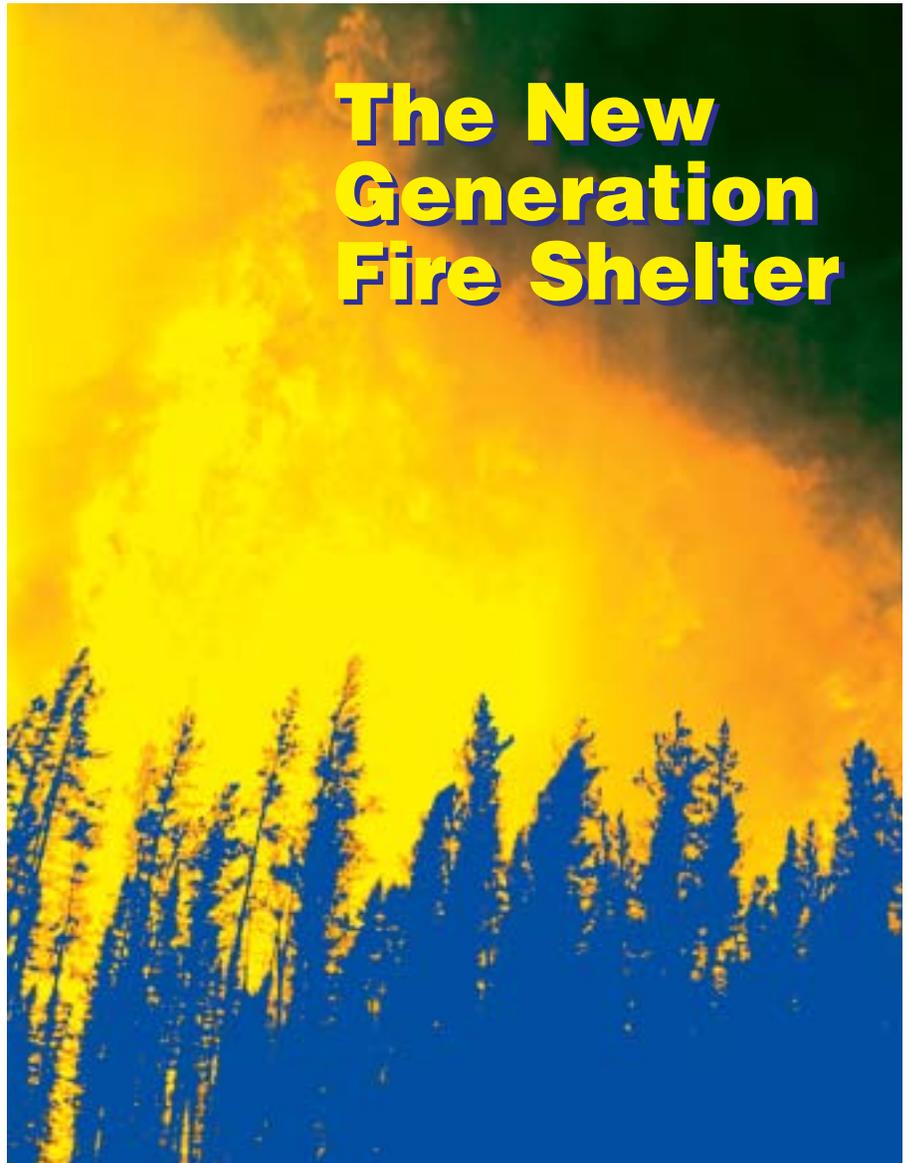


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Introduction



The fire shelter is a mandatory item of personal protective equipment for all Federal wildland firefighters and must be carried on the fireline by everyone on Federal wildland fires. State, local, and rural fire departments may have different policies regarding the fire shelter's use. However, no one who is required to carry a fire shelter should go on the fireline without reading, understanding, and practicing the recommendations in this booklet.

The fire shelter has been required equipment for wildland firefighters since 1977. Since that time, shelters have saved the lives of more than 300 firefighters and have prevented hundreds of serious injuries. A new generation of fire shelter now offers improved protection from both radiant and convective heat. Even so, the shelter will not protect firefighters under *all* fire situations.

The fire shelter should be used as a last resort if planned escape routes or safety zones become inadequate and entrapment is imminent. **Carrying a fire shelter should never be considered an alternative to safe firefighting.** If you are considering or are asked to take on a risky assignment because you have a fire shelter, it is your obligation to insist that the plans be changed. Though the new generation fire shelter offers improved protection, it is still a last resort and cannot guarantee your survival.

This booklet will help you learn how to use the new fire shelter. It:

- Explains how the fire shelter protects you

I'm sure we would not have survived without them.

Entrapment survivor

- Explains the importance of training and knowing when and where to deploy the shelter
- Tells you what to expect during an entrapment
- Describes inspection procedures that will keep worn shelters off the fireline

What you see in this booklet may be familiar to you because much of the guidance for using shelters is unchanged. Stories related by firefighters who survived

Carrying a fire shelter should NEVER be considered an alternative to safe firefighting.



entrapments using the old shelter can still help firefighters learn how to use the new shelter.

This booklet is the reference document for fire shelters. It is not intended to stand alone. New and experienced firefighters should use the booklet as part of a comprehensive fire shelter training program that includes facilitated discussion and hands-on training.

During training, be sure you understand the following key points:

- Carrying a fire shelter is not an excuse to take risks on the fireline.
- Your highest priority is to avoid entrapment. If entrapment is imminent, escape if you can.
- During an escape or entrapment, protect your lungs and airways at all costs.
- Drop your gear as soon as you realize your escape may be compromised. Take your fire shelter and your tool, but drop all dangerous flammable objects and drop any items that may slow your escape.
- If you are entrapped, get on the ground before the fire arrives.
- Deploy your shelter where flames will be least likely to contact it.
- Once you are inside your shelter, stay there. Conditions outside the shelter will be far worse than those inside.
- Train with your fire shelter as though survival is at stake.



Know Your Fire Shelter



Understanding how the fire shelter protects you as well as the factors that limit its performance will help you decide how best to deploy your shelter.

Types of Heat

Radiant Heat: Radiant heat travels in a straight line through space without heating the space itself. It turns into heat when it contacts a cooler surface. When you stand close to a campfire, radiant heat warms you. No air movement is required for the transfer of radiant heat.

Convective Heat: Convective heat requires air movement. Think of it as a blast of hot air. When flames or hot gases move past a surface, the hot air molecules transfer their heat to that surface. The hotter the air and the faster the air movement, the greater the convective heating.

How the New Generation Fire Shelter Works

The new generation fire shelter protects primarily by reflecting radiant heat and trapping breathable air (figure 1). The new shelter has two layers. The outer layer is aluminum foil bonded to woven silica cloth. The foil reflects radiant heat and the silica material slows the passage of heat to the inside of the shelter. An inner layer of aluminum foil laminated to fiberglass prevents heat from reradiating to the person inside the shelter. When these layers are sewn together, the air gap between them offers further insulation.

The outer layer of foil reflects about 95 percent of the radiant heat that reaches it. Because only 5 percent is absorbed into the shelter materials, the temperature of the material rises slowly. Unlike radiant heat, convective heat (from flames and hot gases) is easily absorbed by the fire shelter, allowing the temperature of the material to rise rapidly. When the material reaches about 500 °F, the glue that bonds the layers begins to break down. The layers can separate, allowing the foil to be torn by turbulent winds. Without the foil, the shelter loses much of its ability to reflect radiant heat. The silica material will slow heat transfer, but offers significantly less protection without the foil.

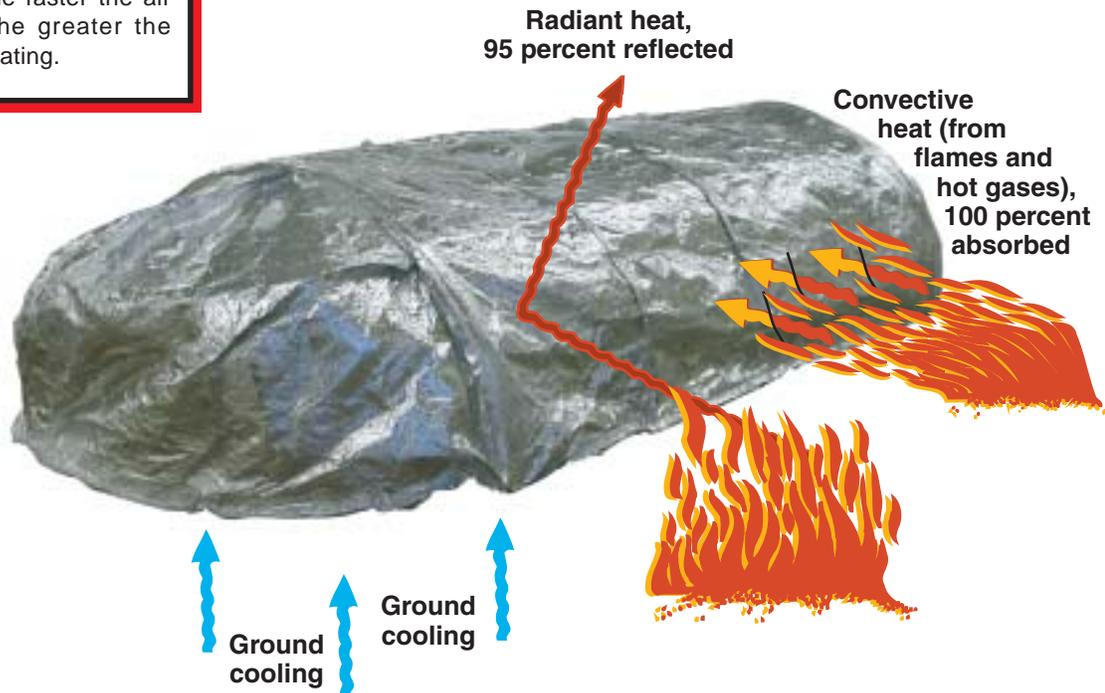


Figure 1—The new generation fire shelter reflects radiant heat and absorbs convective heat.



The right side of my shelter delaminated and the foil flipped over onto the left side. I really started to get burned at that point because the only thing that was on that side of my shelter was the glass mesh. [When] there was still a tremendous amount of radiant heat coming off the surrounding area, a wind blew the shelter half back on to the other side, back to where it belonged, and it was like somebody closing a door on the oven. The radiant heat difference that just that little piece of foil made was absolutely amazing.

Entrapment survivor

The shelter's shape allows you to lie flat. The ground protects the underside of your body and your airway is protected as you breathe the cooler, cleaner air next to the ground. The shelter's holddown straps and wide floor allow you to hold it down in high winds. You must be holding the fire shelter down before the flame front arrives.

The shelters really do an amazing job of reflecting that radiant heat. When that shelter lifted up and you got that radiant heat directly, and the convective heat that was coming [in], it was just an incredible change in what you felt in there.

Entrapment survivor



Escape



Deploying a fire shelter is a last resort. If entrapment seems likely, try to escape. You should always know the location of your safety zones and escape routes. Remember, in a true safety zone, you do not need your shelter to protect you from heat and smoke. Crew supervisors must identify escape routes and safety zones, and make sure they are known by their crews. Changing conditions may compromise planned escape routes and safety zones, requiring that new escape routes and safety zones be identified if work in the area is to continue.

If you are in an entrapment, protect your lungs and airway at all costs. Most firefighters who perish in fires die from heat that damages their airway, not from external burns. One breath of hot gases can damage your lungs, causing you to suffocate.

If you feel that entrapment is imminent, you will have to decide quickly whether you have time to escape. You will have to recognize when your only option is to deploy your fire shelter. Watch for deployment areas as you move. If you cannot reach a safety zone, do not pass through an effective deployment site only to get caught later in a more hazardous area. You

must be decisive. If you are with a crew, follow the orders given by your supervisor. If you are in charge, be sure to give clear instructions and to make sure they are understood.

Time is critical during an escape. As soon as you realize your escape may be compromised, drop your gear. Take your fire shelter with you. Keep your tool if there is a chance you may need it to clear a deployment site. Drop packs, chain saws, or anything else that might slow you down. Firefighters have died carrying packs and tools while climbing a hill to escape fires. You can move up to 30 percent faster without your gear. This can easily mean the difference between life and death in an escape.

Drop any fusees you may be carrying. Fusees are the most dangerous items you carry (figure 2). When wearing shrouds and long-sleeved T-shirts, firefighters have worked close enough to radiant heat

If you are in an entrapment, protect your lungs and airway at all costs.

to melt goggles and hardhats. These plastics melt at around 320 °F. Fusees ignite at 375 °F. Fusees are just one of the reasons you should drop your pack as soon as you recognize danger. In an entrapment situation, you do not have time to think about items in your pack that could be dangerous.

Another reason to drop your pack is to make it easier to get into your shelter. The pack can snag on the shelter as you are getting into it. If you will be deploying your shelter nearby, make sure that you toss the

You're highest priority is to avoid entrapment.

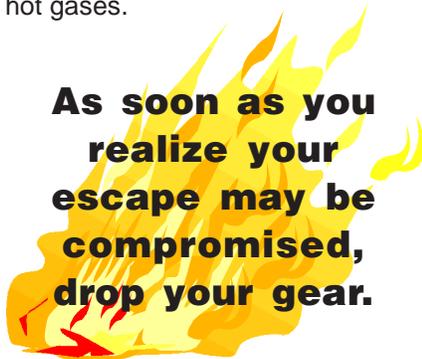


Figure 2—Never take fusees into a fire shelter.



pack far enough that it will not ignite and burn a shelter.

Face and neck shrouds offer additional protection against radiant heat during escape. Shrouds should not be used to work in areas that are so hot you could not work there without them. If shrouds are worn, they should be attached to the hardhat for quick deployment when they are needed. Do not rely on shrouds to protect your airway from hot gases.



As soon as you realize your escape may be compromised, drop your gear.

Stay Alert

When you are escaping an entrapment, stay alert and be prepared to act. If the fire is closing in behind you, get your shelter out and partially unfold it. Use the shelter to shield you from the heat if necessary. Don't drop the shelter, allow it to blow away, or snag it on the brush. Be ready to grab the shelter by an edge and get into it.

Be alert for signs of hot gases. These gases may not be smoky or dark. Your only warning may be air movement, an increase in temperature, and embers blowing past. If gases get hot enough to burn you, it is time to get under your fire shelter.

As you move along your escape route, stay alert and talk to other crewmembers. Talking helps relieve

stress and ensures that hazards are communicated quickly. Be alert for deployment areas as you move. If it becomes apparent that you are not going to reach a safety zone, keep in mind that it takes 15 to 20 seconds to deploy a shelter under ideal conditions, longer in turbulent winds or while wearing a pack (another reason to toss the pack). Leave enough time to get on the ground and under your shelter before the heat arrives. Firefighters have died or been injured because they waited too long to deploy their shelters.

While the fire shelter is considered a last resort, it can also protect you from falling embers or thick smoke. You should not hesitate to use your shelter to protect yourself. Do not worry about the cost of the fire shelter—your safety is always the highest priority.



Deployment



Selecting Your Deployment Site

The characteristics of an effective deployment site have not changed. Your goal in selecting a deployment site is to keep the fire shelter away

from heat, especially flames. Practice evaluating deployment sites (figures 3 to 15) so that you can recognize them quickly under stress. Identify effective sites whenever you are on the fireline so you know where they are before you need one.

Deploy your shelter where flames will be least likely to contact it.

Figure 3—Keep away from narrow draws, chutes, and chimneys. They tend to funnel smoke, flames, and hot gases that can damage your shelter.

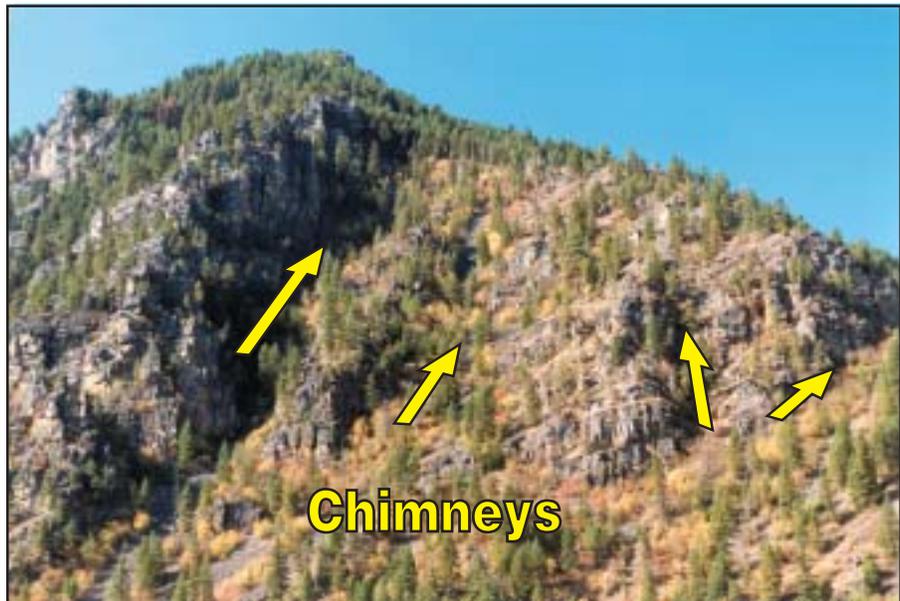


Figure 4—Avoid saddles on ridgetops. They also funnel smoke and heat.





Figure 5—Try to pick natural firebreaks such as wet meadows, wide streambeds, swampy areas, and rockslides.



Figure 6—Flat areas on slopes, such as benches or road cuts, offer some protection from radiant and convective heat. These level areas can keep you below the path of flame and convective heat. Don't deploy in the middle of a road if vehicles may be passing. A drainage ditch on the uphill side of a road cut can be an effective deployment site unless it contains fuels that could ignite and burn the shelter.

Four firefighters deployed their fire shelters on this road during a burnover. All four survived with only minor burns.





Figure 7—Stay out of draws, even when deploying on a road.



Figure 8—Do not deploy in or next to tall or thick grass, small trees, trees with low branches, brush, piles of slash, or firefighting equipment such as packs, parachutes, tools, or chain saws. Firefighters have been burned because they deployed too close to such fuels.

Large rockslides can be effective deployment sites, but you must stay away from brush and trees, and from fuels scattered in the rocks. Even though it can be difficult to seal the edges of the shelter in large, jumbled rocks, rockslides sometimes offer the largest area free of fuels and may be the best option for deployment.





Figure 9—Ground fuels, such as grass or tree litter, can ignite rapidly. Clear the deployment site to mineral soil if at all possible. If time is critical, pick a site with the sparsest fuels.



Figure 10—Deploy fire shelters well away from thick vegetation such as the shrubby understory and the trees in this photograph.





Figure 11—Objects such as large rocks, dozers, or structures such as cabins, can act as barriers to heat. But, if the objects themselves ignite, you may have to move. Testing shows that flames funnel underneath vehicles. Do not deploy under your vehicle.



Figure 12—Avoid areas where rocks or logs can roll on you or snags can fall on you.





Figure 13—The lee side of a ridgetop can be an effective deployment site because the flames and hot gases tend to rise above the ridge. Fire intensity usually drops when fire reaches a ridge. But be alert for the possibility that firebrands might ignite fires below you on the lee side of the ridge.

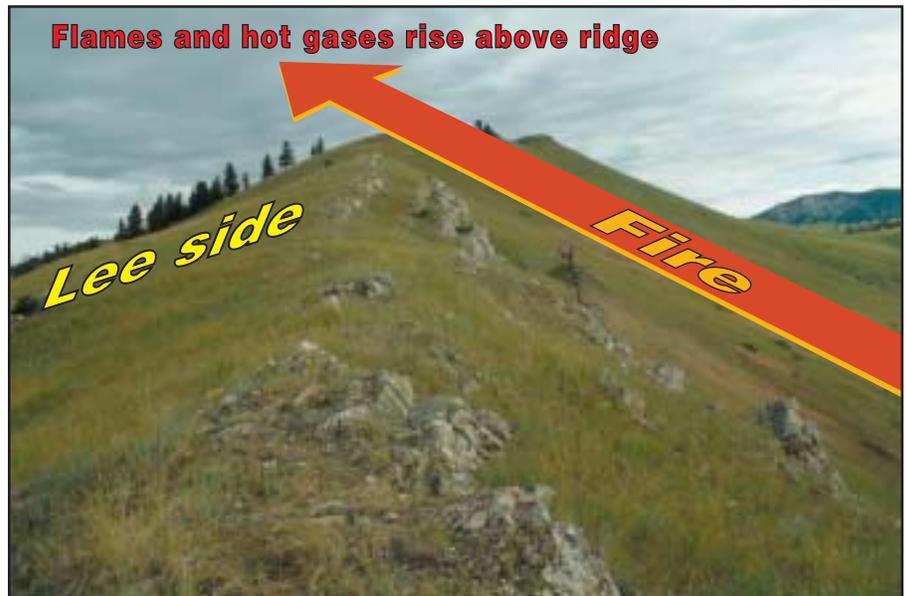


Figure 14—Wide areas that have been cleared of fuel, such as dozer lines or roads, can be good deployment sites, depending on the size of the area that has been cleared and the behavior of the fire.





Figure 15—Burned-out areas can be effective deployment sites if there is no fuel left to reburn.

