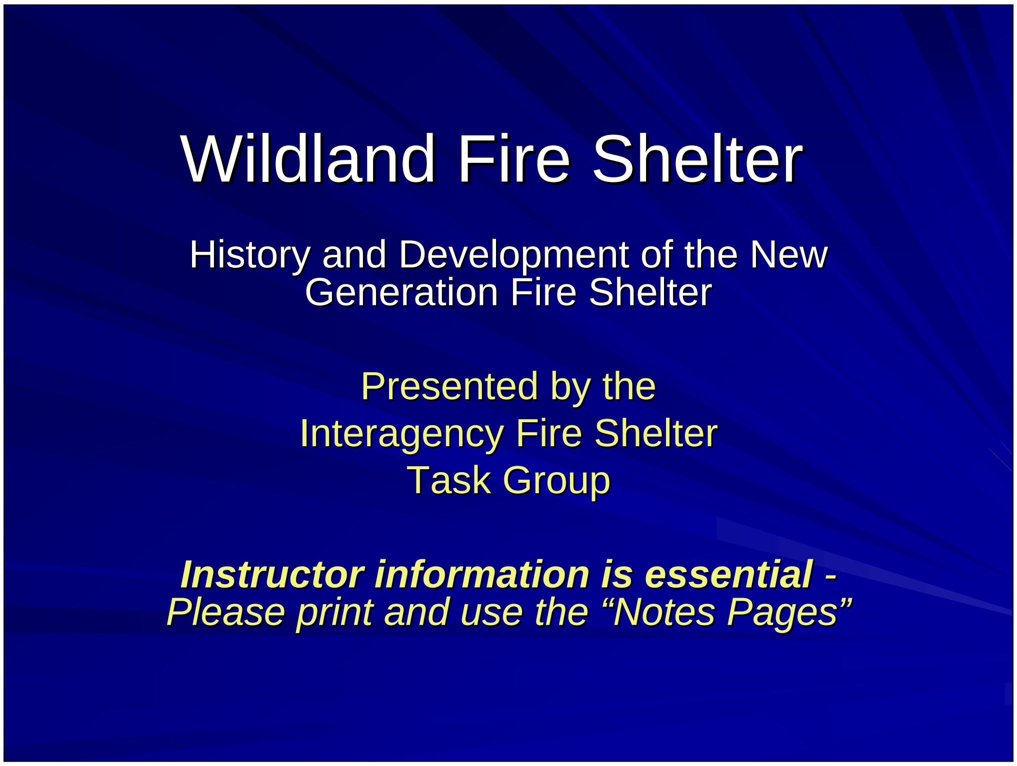


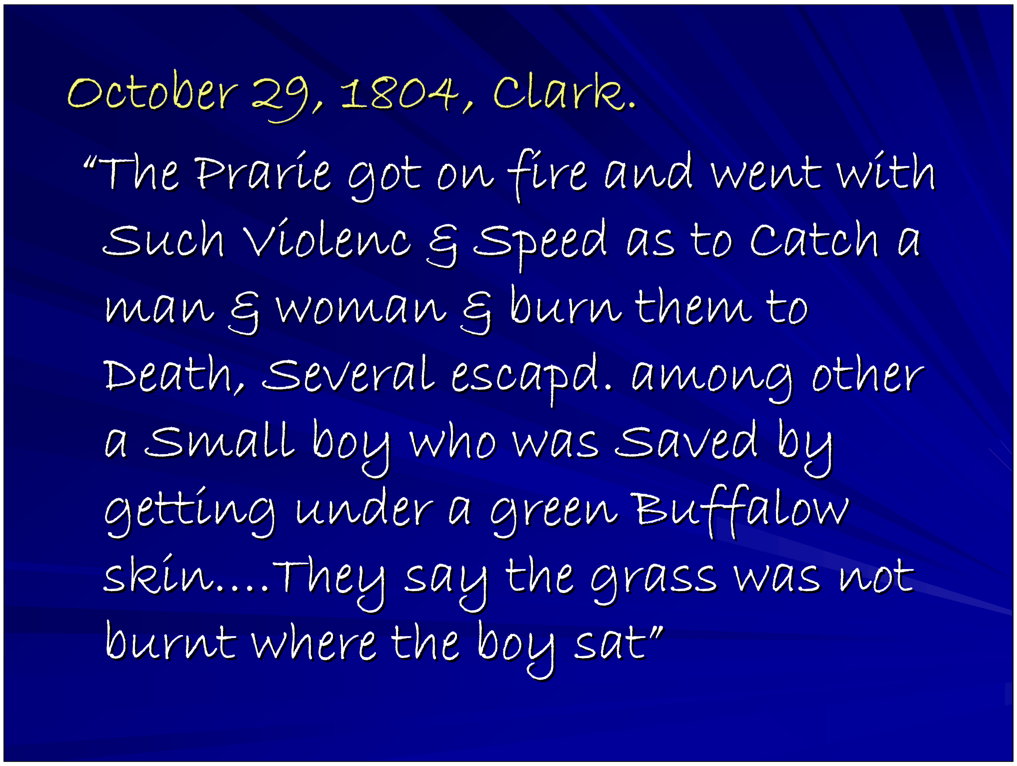
Slide 1: INSTRUCTOR INFORMATION:

Wildland Fire Shelter – History and Development of the New Generation Fire Shelter

This presentation is designed to explain the history and development of the New Generation Fire Shelter. Firefighters are the target audience. Time required for this presentation is 45 to 55 minutes.

To the Instructor: The "Notes Pages" provide essential supporting information for each slide. Instructors can print the "Notes Pages" .pdf file that is included on this CD, or follow these directions:

1. Click on "File"
2. Select "Print Preview"
3. Click on "Print What" drop down menu arrow
4. Select "Notes Pages"
5. Click on "Options" drop down menu arrow
6. Select "Grayscale" (for quicker printing)
7. Select "Print"

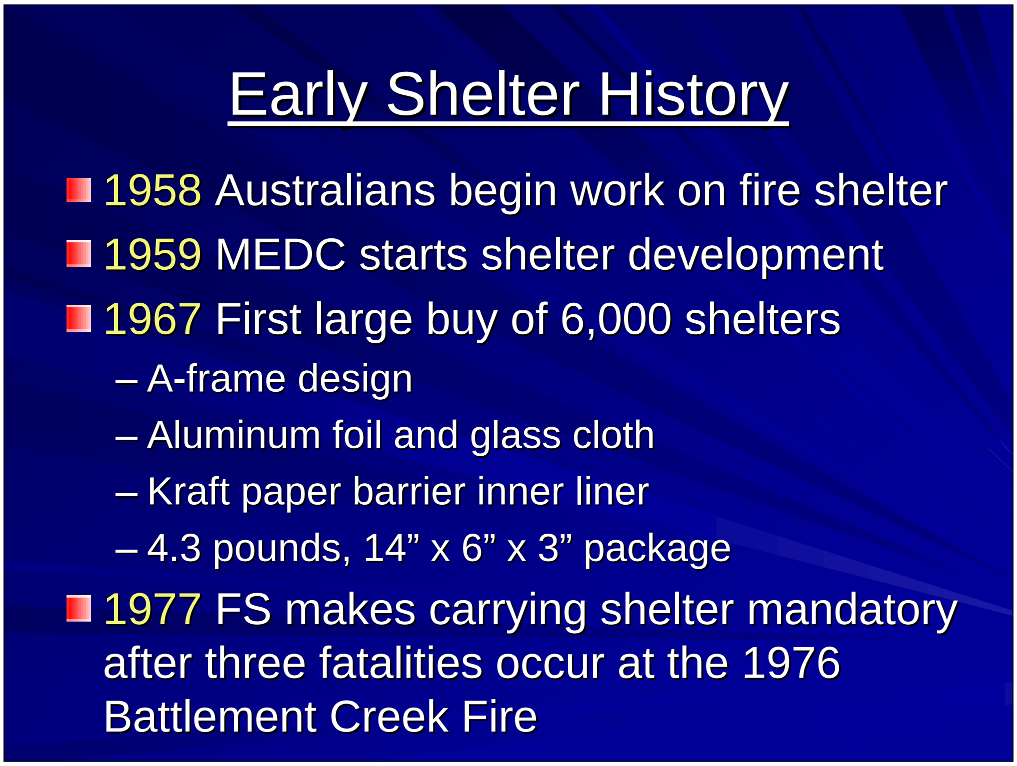


Slide 2:

The following quote from Captain William Clark’s journals is an early documentation of the use of a covering to shelter from wildland fire:

***October 29, 1804, William Clark*.**

“*The Prarie got on fire and went with Such Violenc & Speed as to Catch a man & woman & burn them to Death, Several escapd. among other a Small boy who was Saved by getting under a green Buffalow skin….They say the grass was not burnt where the boy sat”*

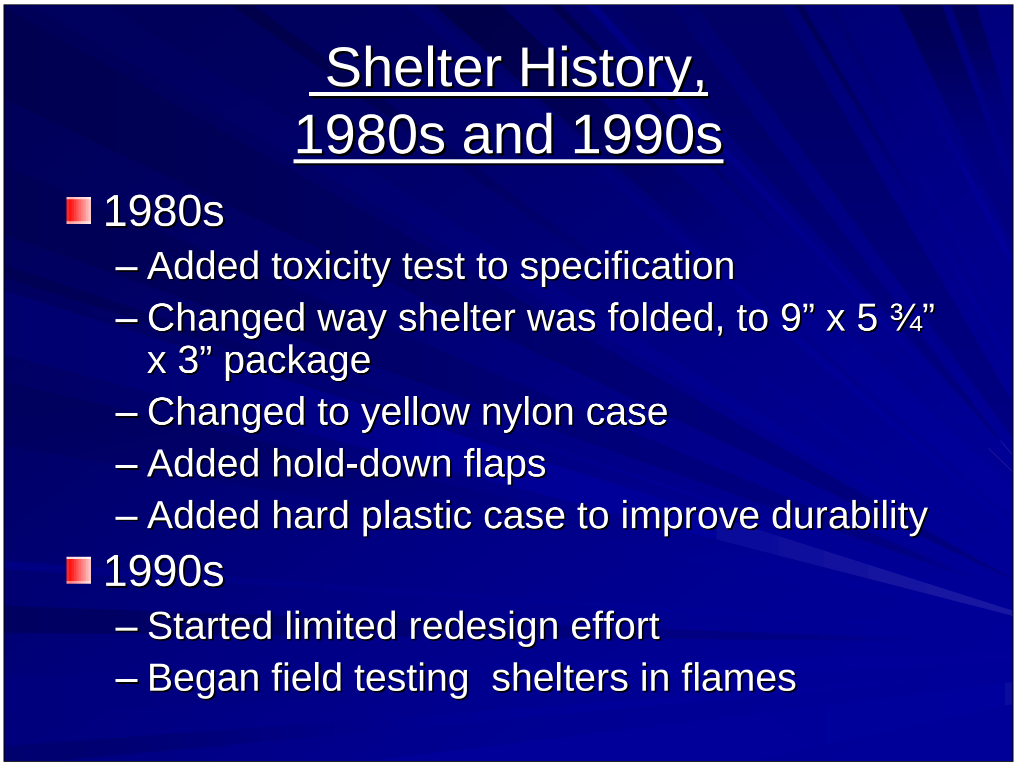


Slide 3:

Modern fire shelter development began in Australia in 1958 with work on a bell-shaped shelter made of a laminate of aluminum foil and glass cloth. In 1959, the Australians abandoned the bell-shaped design in favor of an A-frame design. That same year, the Forest Service's Missoula Equipment Development Center (MEDC, now known as the Missoula Technology and Development Center, MTDC) began development of a fire shelter.

Over the next few years, MEDC and the Australians shared ideas and shelters. In 1967 the Forest Service made its first large purchase of 6,000 fire shelters through the General Services Administration (GSA). These shelters were made of an aluminum foil and glass cloth laminate with a kraft paper barrier inner liner. The shelter had an A-frame shape, weighed 4.3 pounds, and was accordion folded into a 14- x 6- x 3-inch package. It had an orange case and attached belt for carrying. The kraft paper liner was eliminated in 1974.

The Forest Service made carrying the fire shelter mandatory in 1977 after three firefighters without shelters were killed on the Battlement Creek Fire in Colorado in 1977.



Slide 4:

In 1981 a toxicity test was added to the fire shelter specification. The way in which the shelter was folded was changed to a package measuring 9 x 5 ¾ x 3 inches. The case was changed from orange canvas to yellow nylon. Hold down flaps were added to shelter.

In 1989 a hard plastic case liner was added to improve the shelter’s durability.

In 1991 MTDC began a limited shelter redesign effort. The center was not given direction or resources to make significant changes in the shelter, only to work on minor improvements in performance, packaging, etc.

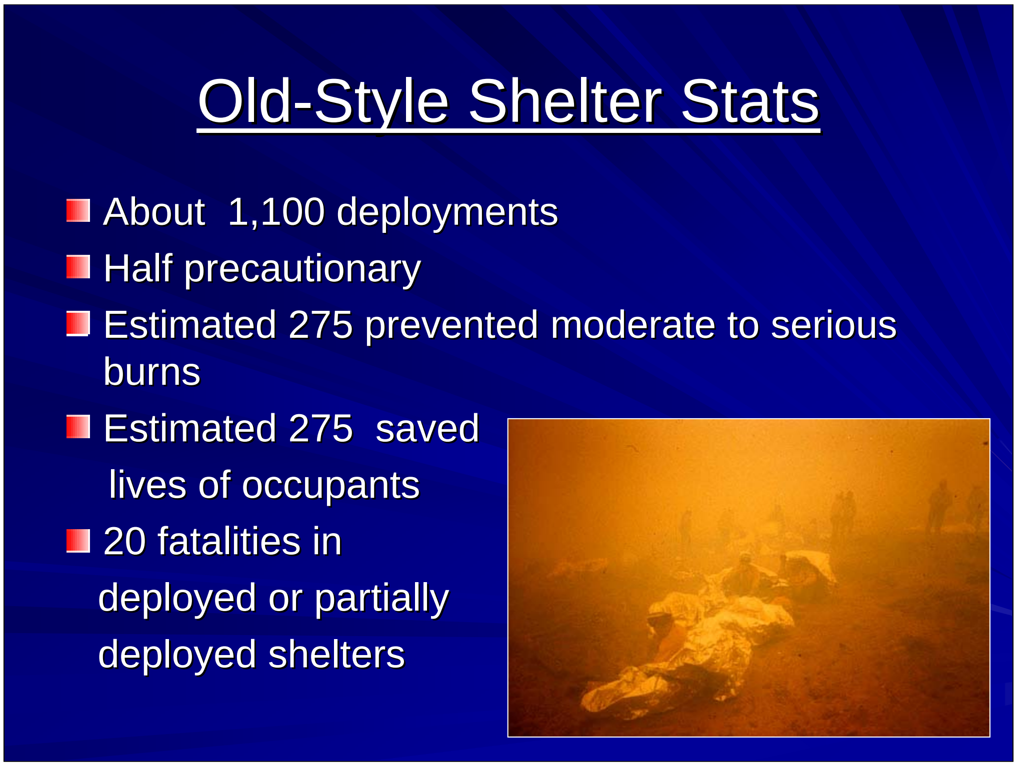
Field testing of fire shelters in flames began in the mid-1990s.

Old-Style Fire Shelter

- Designed to reflect radiant heat and trap breathable air
- Laminate of fiberglass and aluminum foil
- Adhesive selected to withstand high temperatures without being toxic
- Rapidly damaged by flames

Slide 5:

The old-style shelter was designed to reflect radiant heat and to trap breathable air. The aluminum foil layer reflected radiant heat away from the shelter. The fiberglass backing provided strength and stiffness to the aluminum foil. The adhesive was selected to withstand high temperatures without being toxic. The old-style shelter was *not* designed to withstand flame contact and is rapidly damaged by flames.



Slide 6:

There have been about 1,100 deployments of the old-style fire shelter. Roughly half of these deployments have been precautionary, meaning that the people involved would probably not have sustained significant injury even without the shelters. An estimated 275 of the deployments are considered to have prevented moderate to serious burns and an estimated 275 are considered to have saved the lives of the occupants. Twenty people have died in fully or partially deployed fire shelters. Some victims did not get into their shelters in time; others left their shelters too soon. In some cases the conditions were too severe for the shelters to provide adequate protection.

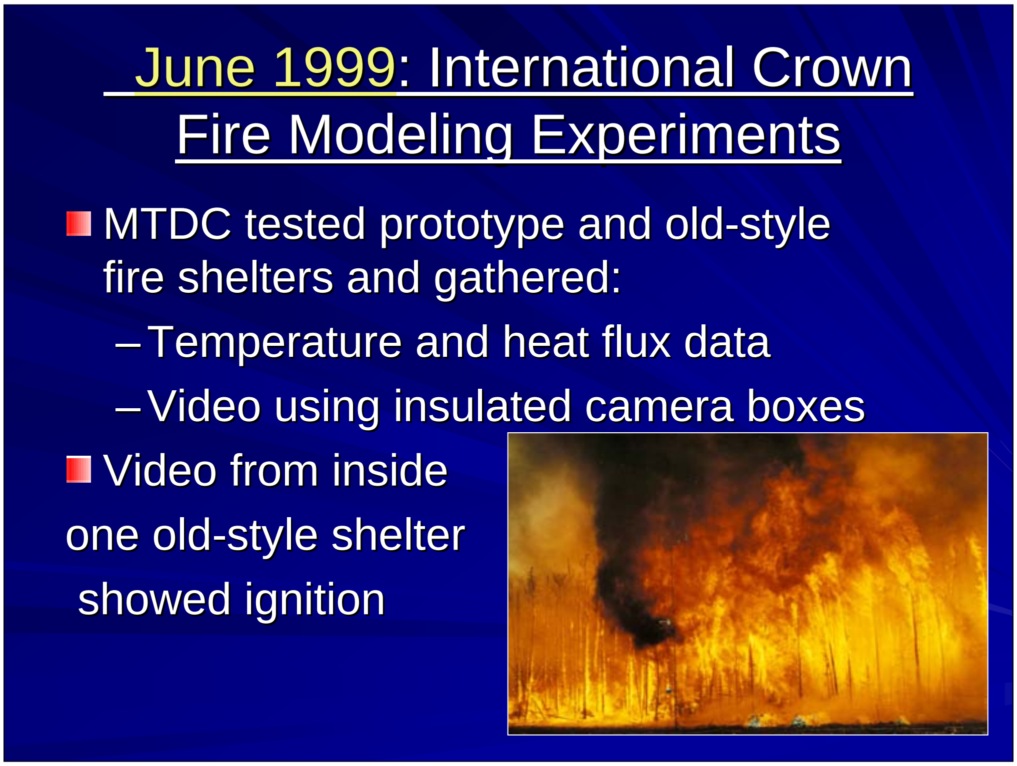
December 1998: Shelter Testing Meeting

Participants:

- Underwriters Laboratories
- Storm King Mountain Technologies
- SGS-US Testing
- University of Alberta
- USFS Missoula Fire Sciences Lab
- USFS-NIFC
- BLM-NIFC
- USFS MTDC

Slide 7:

In December 1998, MTDC hosted a meeting to discuss testing options for the fire shelter. A variety of specialists with expertise in wildland fire behavior research, personal protective equipment testing, and fire toxicity testing were asked to share their knowledge of tests that could be used to evaluate fire shelters. The conclusion of that meeting was that there were no appropriate tests for evaluating full-scale fire shelters. The experts determined that tests could be developed if data were available on the fire conditions shelters would face in the field. Present at the meeting were representatives from Underwriters Laboratories, Storm King Mountain Technologies, SGS-US Testing, the University of Alberta, USDA Forest Service Missoula Fire Sciences Lab, the National Interagency Fire Center (with representatives of both the Forest Service and the Bureau of Land Management), and the Missoula Technology and Development Center.



Slide 8:

MTDC was involved in the International Crown Fire Modeling Experiments in Canada's Northwest Territories in 1997, 1998 and 1999. MTDC performed tests of prototype and old-style fire shelters. Data were gathered on temperature and heat flux. Heat flux is a measure of the rate of energy transfer. Video was taken both inside and outside of the shelters using insulated camera boxes. In 1999, video from inside one of the old-style shelters, viewed in slow motion, showed an ignition inside the fire shelter.

Photo: Fire shelter testing at Plot #9 Test Burn of 1999. Average heat flux was measured at 80 to 100 kW/ m^2, while peak heat flux was over 200 kW/ m^2. Maximum temperatures exceeded 2400 °F

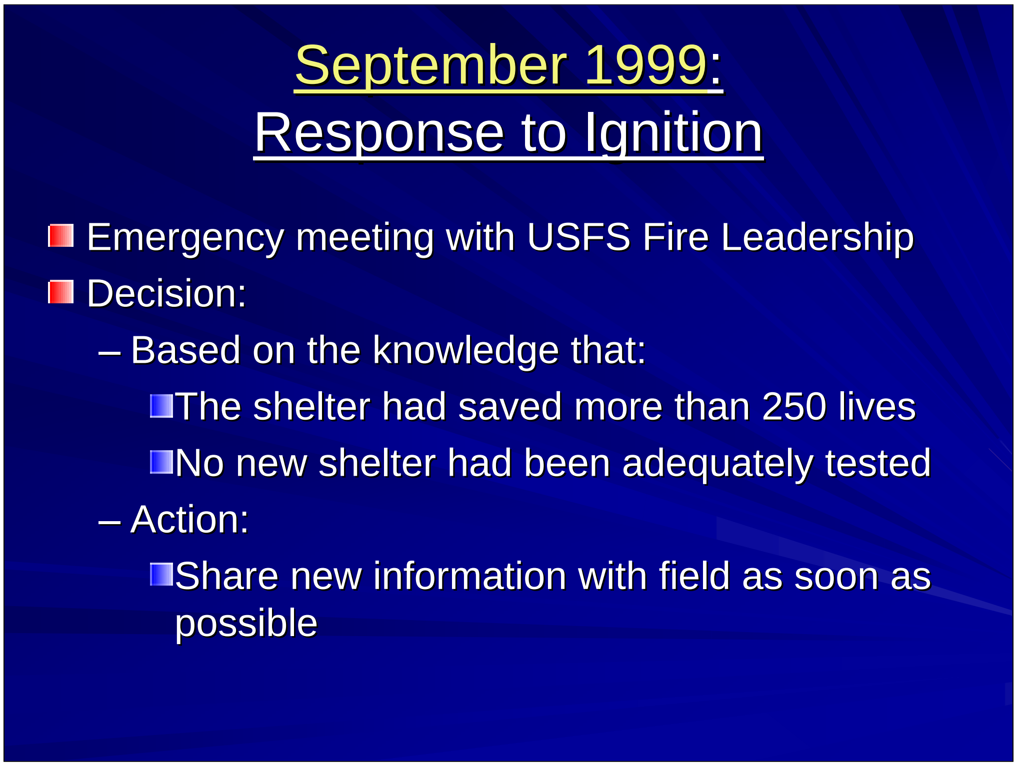
Slide 9:

Photo: Gasses ignite inside the smokey shelter.

The Forest Service immediately contracted with the Department of Mechanical Engineering at the University of Alberta (UA) to determine the cause of the ignition. The tests at UA showed that when the shelter cloth was heated to a temperature of 450 to 500 ºF, the adhesive used to bond the laminate would begin to turn into gas. This gas could pass easily through the fiberglass cloth and collect inside the shelter. If the gas reached a concentration that was high enough and was then heated to ignition temperature, the gasses inside the shelter could ignite. This sequence was most likely to occur if the shelter was exposed to direct flame.

The University of Alberta tests showed that flames on the inside of the shelter would not sustain themselves. When the heat source outside the shelter was removed, the flames inside the shelter went out.

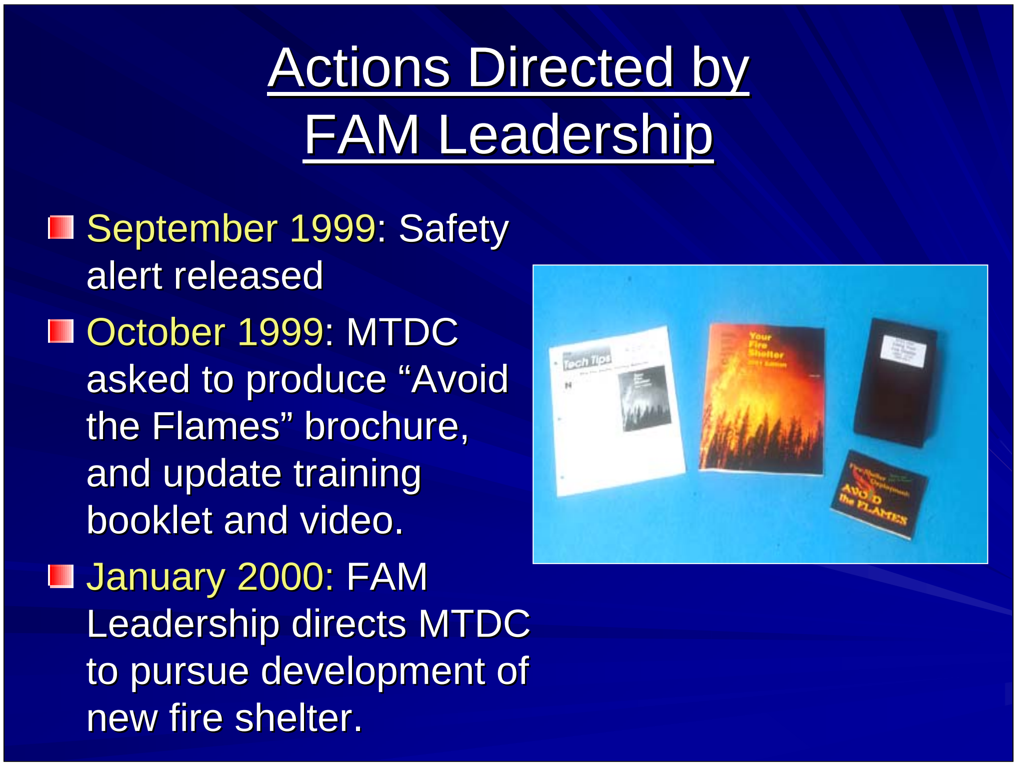
The concern about the flames inside the shelter was that they might injure a firefighter, might cause a firefighter to panic and abandon his or her shelter, or might lead to more rapid failure of the fire shelter.



Slide 10:

In September 1999, equipment specialists from MTDC met with the Forest Service's Fire and Aviation Management (FAM) Leadership to discuss the findings and the appropriate response.

Based on the knowledge that fire shelters had saved over 250 lives by then, and that no new shelter had been adequately tested, Forest Service FAM Leadership determined that the most important action was to share the new knowledge about the performance limits of the shelter with firefighters as soon as possible. For years, firefighters had been warned to keep fire shelters out of flames, but all concerned felt it was critical to share this new information and to reinforce the importance of limiting flame contact with the shelter.



Slide 11:

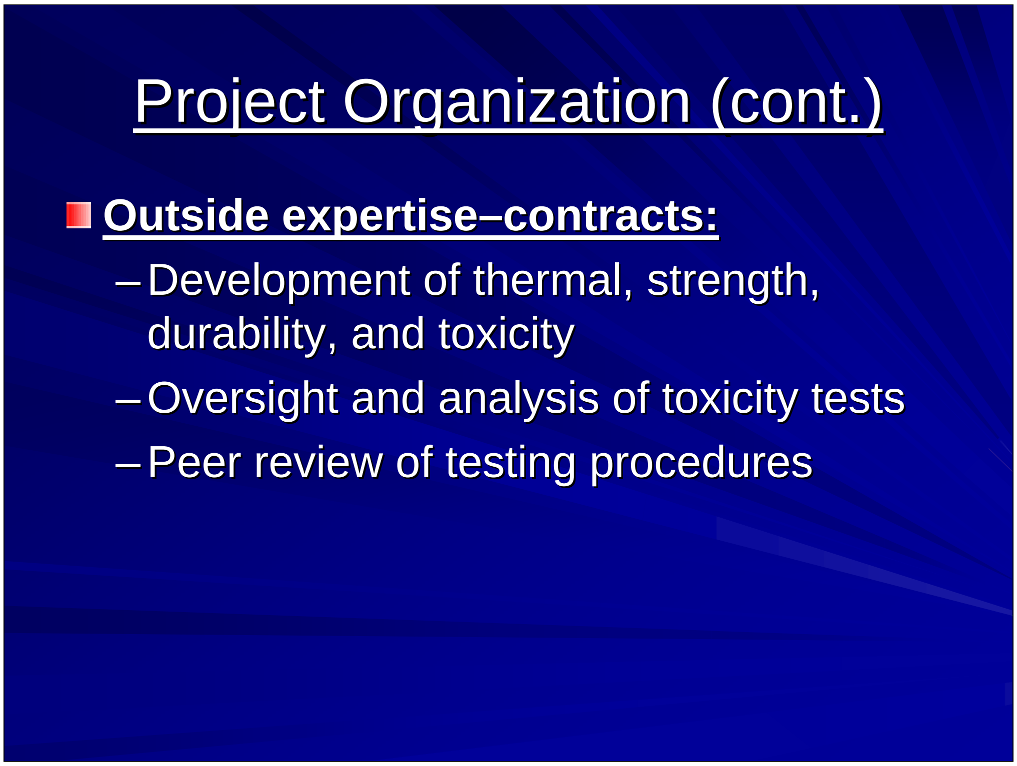
FAM Leadership immediately released a safety alert and asked MTDC to produce a brochure describing the new information about the limits of the fire shelter. The brochure “*Avoid the Flames*” was published the following month. MTDC was also asked to update the pamphlet and video used by firefighters in fire shelter training. The updated video, “*Using Your Fire Shelter,*” and pamphlet, “*Your Fire Shelter 2001 edition,*” incorporated this new information.

In January 2000, MTDC was directed by Forest Service FAM Leadership to pursue development of a new fire shelter.

Slide 12:

Project Organization:

The fire shelter development project involved expertise from inside and outside the Forest Service. MTDC provided a project leader, a mechanical engineer, and a design specialist as well as support from MTDC photographers, editors, publications staff, and machine shop staff. The MTDC team made many contacts in private industry, the military, academia, and Forest Service and other Federal research organizations such as the Forest Service's Missoula Fire Sciences Lab and the National Institute of Standards and Technology.



Slide 13:

MTDC contracted for outside expertise in developing the thermal, strength, durability, and toxicity tests, for oversight and analysis of toxicity tests, and for peer review of testing procedures.

Slide 14:

The goals of the shelter development project were to:

•Maintain the protection in radiant heat that was offered by the old-style shelter

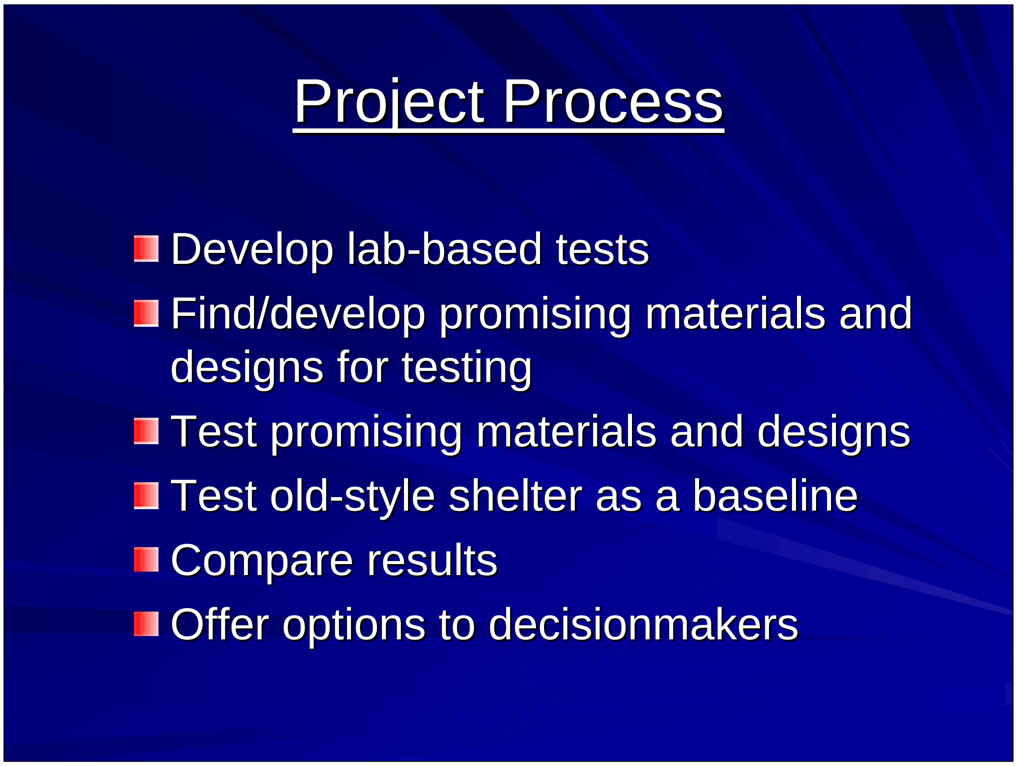
•Improve the protection in flames

•Maintain the requirement that the occupant not be exposed to dangerous toxic compounds from the shelter

•Provide an acceptably strong and durable shelter

•Prevent flammable gasses from collecting inside the shelter.

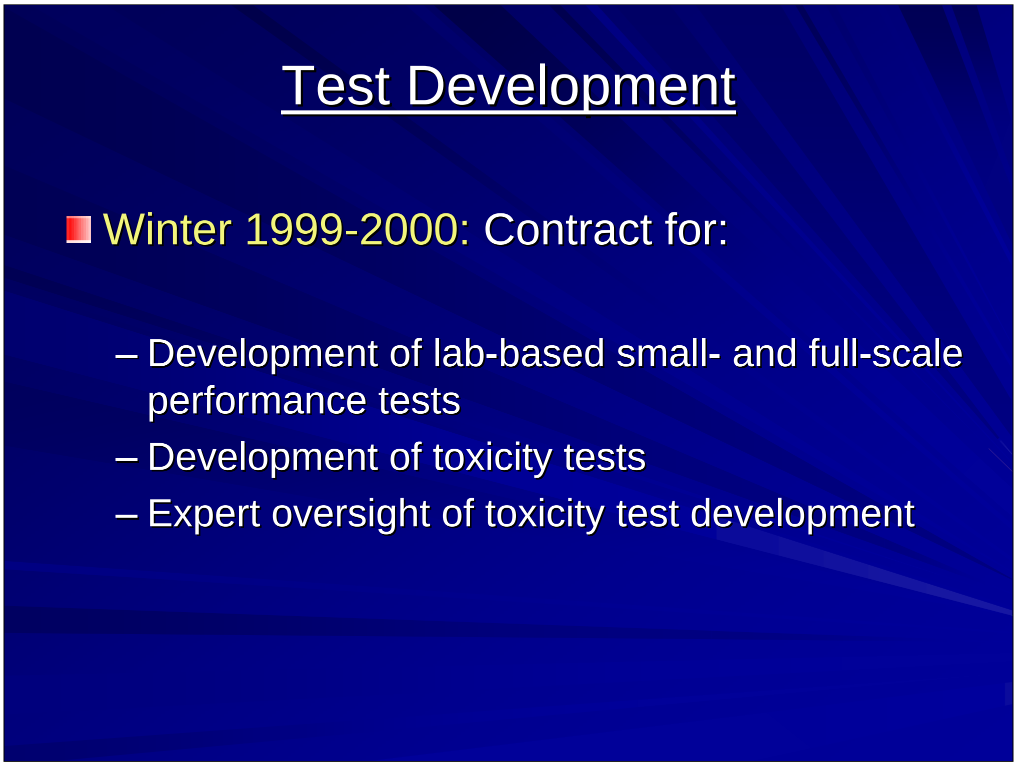
•Consider weight, bulk, and cost.



Slide 15:

The process used to develop the shelter included:

- Developing lab-based tests.
- Finding and/or developing promising materials and designs for testing
- Testing the promising materials and new designs
- Testing the old-style shelter for baseline comparisons
- Comparing the results for the new materials and designs to those for the old-style shelter
- Offering options to decisionmakers who would select the final design



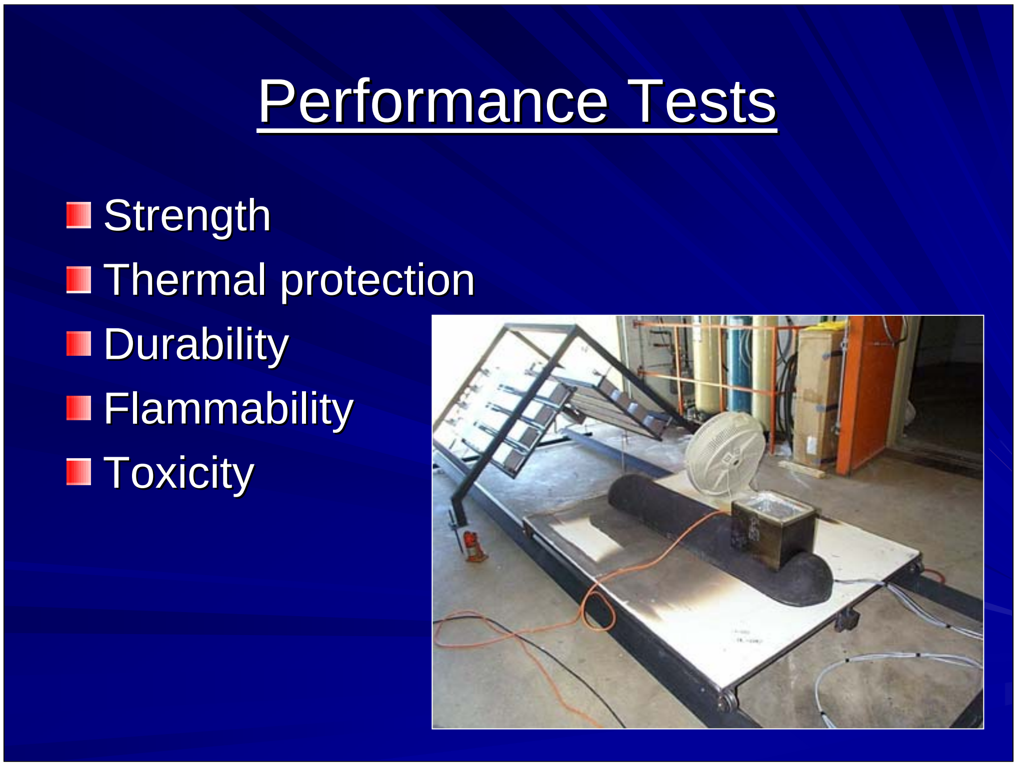
Slide 16:

Test Development:

- Though much has been learned through field tests, these tests have inherent shortcomings. First, the tests are not repeatable. The heat exposure of shelters from one test to the next is not the same. For that matter, two shelters several feet away from each other in the same field test will not be exposed to the same amount of heat.

  Second, field tests are very difficult and expensive. It would not have been possible to do the number of tests necessary to adequately test the new shelters in the field. Lab-based small-and full-scale tests were needed. MTDC contracted with the University of Alberta for the development of the small- and full-scale performance tests.

- The toxicity test that had been used on the old-style shelter since the early 1980s was not appropriate for new materials and designs. A new toxicity test was needed. Recognizing that it did not have the expertise inhouse to properly oversee a contract for the development of a toxicity test MTDC contracted with an expert in fire toxicity. The Center, with the expert's oversight, then contracted with a testing laboratory to develop the toxicity tests.



Slide 17:

The following types of tests were developed:

•Strength (a variety of small-scale tests)

•Thermal protection (small-scale and full-scale, radiant and flame tests)

•Durability (a full-scale test)

•Flammability (small-and full-scale tests)

•Toxicity (small- and full-scale tests)

Photo: The apparatus used for the full-scale radiant heat test.

Slide 18:

Materials:

While the lab tests were being developed, MTDC focused on collecting materials for testing. Private industry was very interested in the project and provided many materials. MTDC did preliminary tests on dozens of different materials and combinations of materials.

The preliminary review included a general gauge of acceptability for strength, bulk, weight, and cost, and a quick test for the presence of flammable or noxious gasses. In the summer of 2001, as soon as the small-scale tests were ready to be used, the 40 most promising materials were shipped to the University of Alberta for small-scale testing. Some materials showed excellent performance in some areas and weaknesses in others. Although timeframes were short, several companies were allowed to reengineer their products.

Photo: Preliminary tests performed with a small torch.

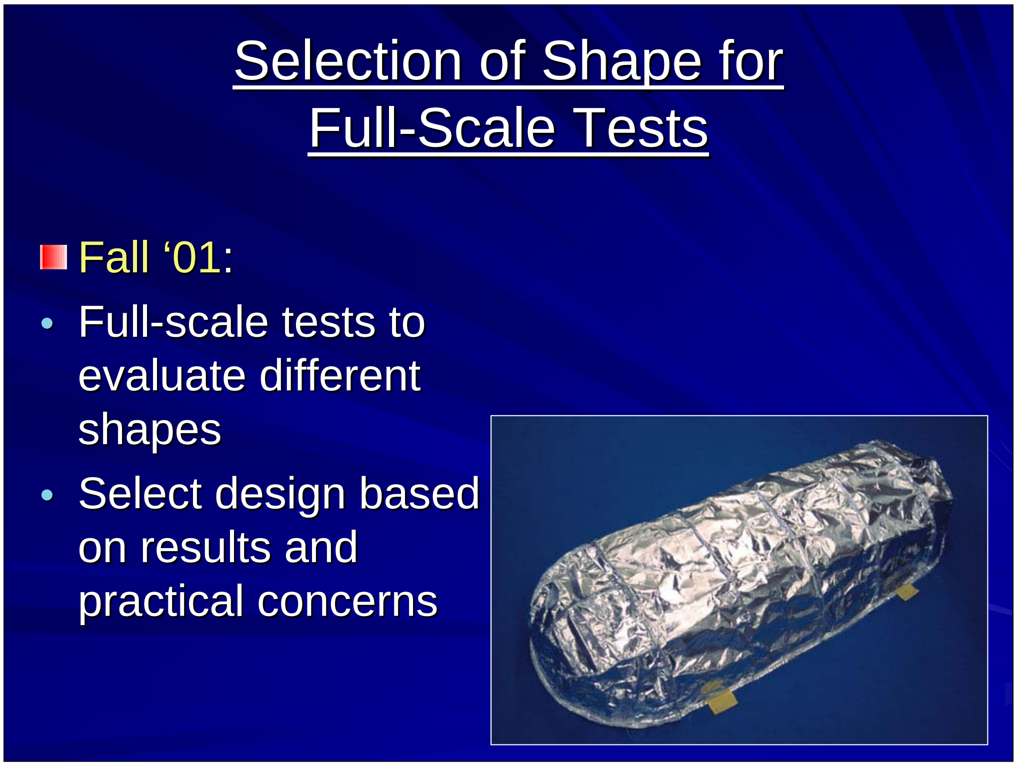
Slide 19:

MTDC Shelter Design:

As noted, private industry was very interested in the project and sent many materials to MTDC for examination. Most of these companies had no background in fire shelter design, so a design was needed for full-scale testing of promising materials. Several features were needed in the new design:

- More efficient use of material. All of the promising materials were at least twice as heavy as the old shelter material. It was important to find a design that used less material to limit the weight and bulk of the new shelter.
- A shape was needed that would minimize the absorption of radiant heat. Computer modeling showed that the ideal shape would have a low surface-area-to-volume ratio. The ideal shape would be a dome.
- The new design had to allow a person inside to lie face down on the ground. Testing had shown that the lowest temperatures were next to the ground. Lying prone on the ground protects the underside of the body and allows the occupant to breathe the cooler air closest to the ground.
- Testing also had shown that the flat triangular face on the ends of the old-style shelter could reflect the radiant heat from an approaching flame front directly onto fuels beside the shelter. In some cases this would start fire next to the shelter before the flame front arrived. Similar flat surfaces needed to be avoided in the new design.

- Photo: Some of the different shapes that were tested.



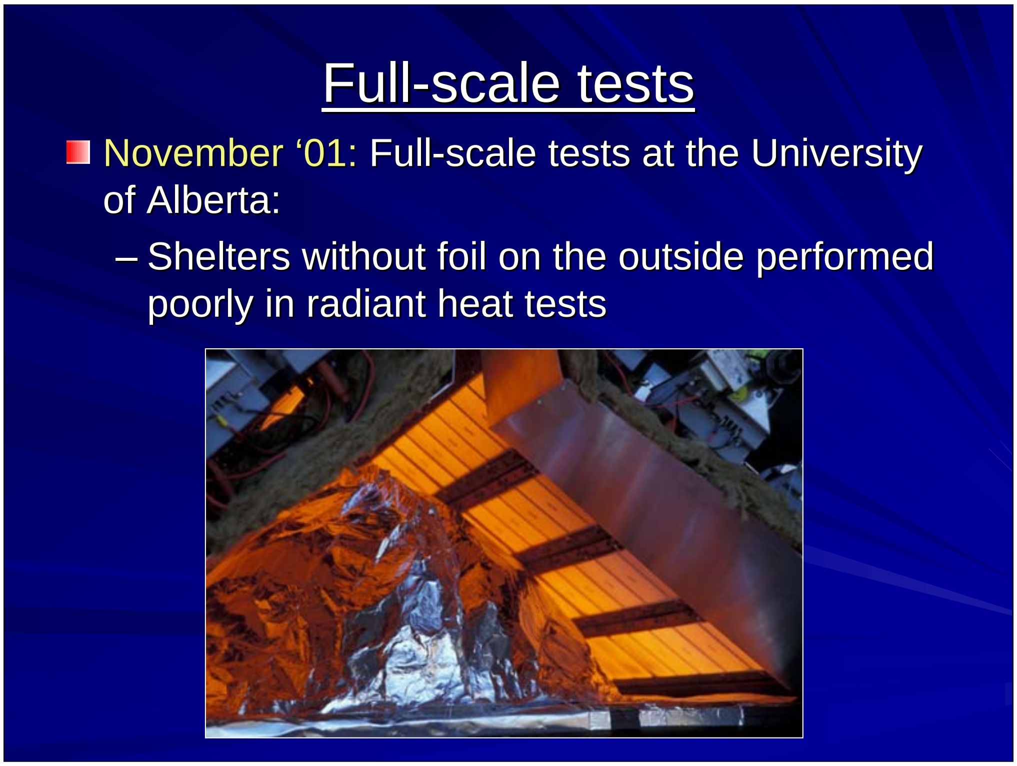
Slide 20:

In fall of 2001, MTDC had full-scale tests run on shelters of several different shapes, all made from the same materials. A design for testing new materials was selected based on the results of these tests and some practical concerns. The design selected was a half cylinder with rounded ends. Stretching the “ideal” dome shape into a longer, rounded shape resulted in a shelter that had an improved surface-area-to-volume ratio, used much less material per shelter, and still allowed a firefighter to lie prone on the ground.

Rounding the ends of the shelter allowed radiant heat to be scattered instead of concentrated onto a small area near the shelter. This feature reduces the likelihood that fire will start beside the shelter before the flame front arrives.

Slide 21:

While most of the new materials that came to MTDC from private industry were tested using the design just described, one manufacturer, Storm King Mountain Technologies (SKM), submitted samples of materials for small scale testing and fully-designed shelters for full scale testing. Those shelters were tested as they were received from the manufacturer.

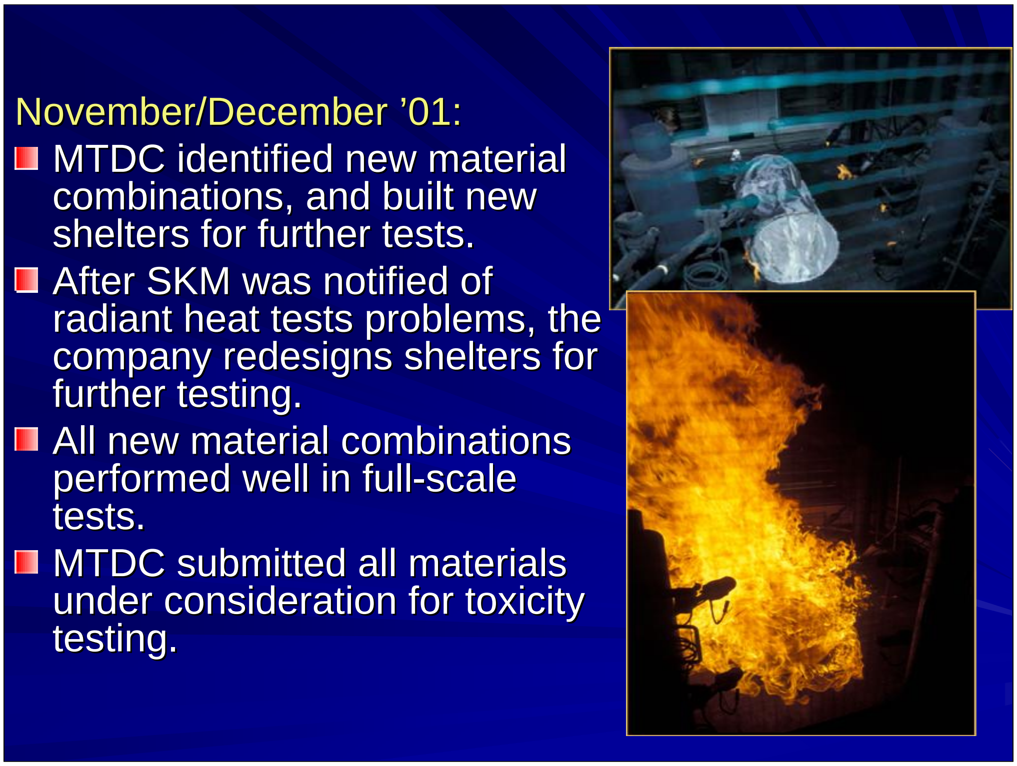


Slide 22:

Photo: Radiant heat test at the University of Alberta in Edmonton.

In November 2001, MTDC personnel traveled to the University of Alberta to observe full-scale tests on the six most promising material combinations. Four of these prototypes were constructed using the MTDC design; two were Storm King Mountain Technologies designs. One important finding was that shelters without aluminum foil as an outer layer performed poorly in radiant heat.

The old-style shelter provided about twice the protection in radiant heat as the new shelters that had no foil outer layer. Some of the shelters that performed poorly in radiant heat performed well in direct flame tests. This prompted MTDC to inquire about the relative importance of providing protection from radiant heat. Dr. Bret Butler from the Forest Service's Fire Sciences Laboratory in Missoula responded: "It is generally accepted that energy transfer in high-intensity fires is dominated by thermal radiation. For this reason it is important that new fire shelter designs preserve the current fire shelter's ability to reflect radiant energy away from the occupant." Dr. Butler went on to say that fire shelters may also be exposed to high convective energy transfer rates as well, so any new shelter should also provide a high level of protection from convective energy transfer during direct contact by flames.

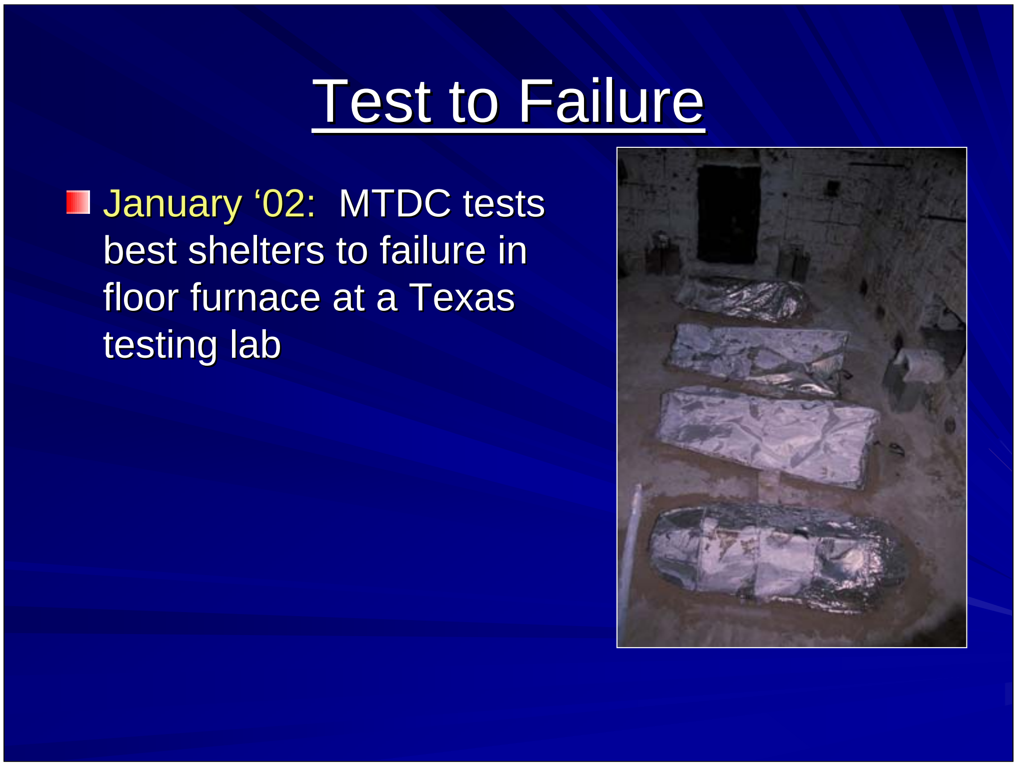


Slide 23: Photos: The direct flame test used at the University of Alberta. Top, test preparation of torches and bottom, test in process.

Based on the results of the full-scale tests, new combinations of the promising materials were identified to improve full-scale performance. After Storm King Mountain Technologies was notified of the problems seen in the radiant heat tests the company added a laminated foil layer to the outside of the shelters submitted for testing.

With a deadline for providing options to decisionmakers looming in February, emergency shipments of materials were ordered, additional sets of shelters were built at MTDC, and shelters were sent to the University of Alberta for additional full-scale testing. All new shelters performed well.

Though development of the toxicity test had been delayed significantly by the contractor, the test was finally ready for use in December of 2001. The materials that were still under consideration were sent off for toxicity testing. All the materials tested were determined to be safe for use.



Slide 24:

January 2002: When the full-scale test at the University of Alberta was designed, it easily exceeded the operational limits of the old-style shelter. To test the newest prototypes to failure however, longer or more severe exposures were needed. Arrangements were made to perform full-scale tests in a large floor furnace at a testing lab in Texas. These tests allowed all of the shelters to be pushed to the point of failure. With the aid of insulated camera boxes, the tests allowed the development team to view the entire failure sequence and to ensure that no ignitions were taking place inside the prototype shelters.

Photo: Test set-up of shelters in the Texas lab.

February '02: 10 shelter options presented to Interagency Fire Directors

- 6 MTDC designs, 4 SKM designs
- Council selects four designs for further testing and analysis: 2 MTDC, 2 SKM
- Council requests peer reviews of test methods
- Time constraint does not change

Slide 25:

February 2002: MTDC presented 10 fire shelter options to the Interagency Fire Director's meeting so they could select a final shelter. The options presented included shelters of different bulks, weights, and levels of performance. No final selection was made. The group identified four shelters for further testing and analysis, and requested peer review of the test procedures used. The "final four" shelters included two Storm King Mountain Technologies' fire shelters and two shelters designed by MTDC. The group did not extend the deadline of June 2003 for getting a new shelter to firefighters.

Selection of Shelter

Spring '02:

- Final intensive round of testing carried out on four final options
- Test methods peer reviewed
- Fire Directors unanimously select new shelter design on June 2, 2002

Slide 26:

A final intensive round of full- and small-scale testing was carried out on the final four fire shelter options. Test methods were peer reviewed. Results were presented to Fire Directors on June 2, 2002. The group unanimously selected one of the final shelters designed at MTDC as the new shelter for all firefighters.

Slide 27: Photo: Outer and inner layers of the shell as well as seams of the shelter.

The “New Generation” fire shelter as it is now called is made of two layers of laminated material. The outer layer is made of woven silica laminated to aluminum foil. The foil on the outside reflects radiant heat. The silica material slows the rate of heat transfer to the inside of the shelter. The inner layer is made of woven fiberglass material laminated to aluminum foil. In this layer the foil faces the inside of the shelter. The foil prevents heat absorbed by the inner layer from being reradiated inside the shelter. It also provides a barrier to prevent flammable gasses from entering the shelter. The small gap between the two layers provides additional insulation.

The seams of the shelter provide support and limit damage to the shelter if the outer foil layer begins to delaminate in the heat. On the old-style shelter, once the foil begins to delaminate, wind can easily peel the foil away from the fiberglass layer, leaving little protection from radiant heat. Testing has shown that the seams on the new shelter impede the peeling of the foil, limiting the damage.

The new design has shake handles that allow the shelter to be opened rapidly with a few quick shakes.

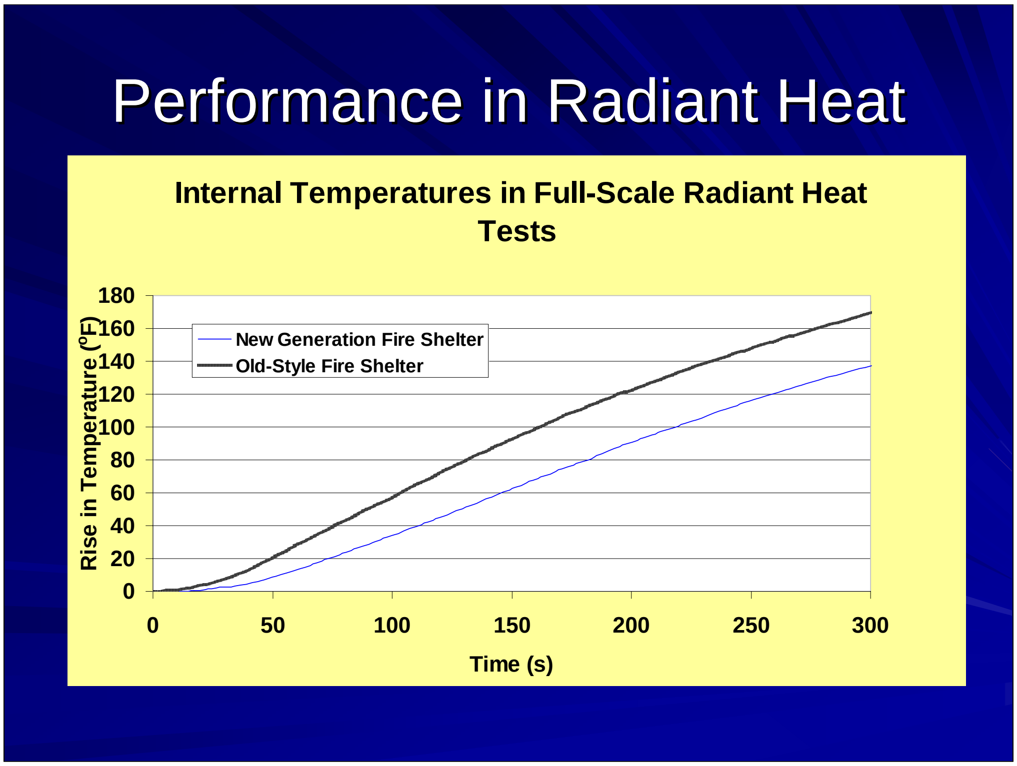
New Generation Fire Shelter

- Weight (without case):
  - New shelter: 4.4 lbs.
  - Old-style shelter: 3.4 lbs.
- Folded size (without case):
  - New shelter: 210 cubic inches
  - Old-style shelter: 145 cubic inches

Slide 28:

The new shelter weighs 4.4 pounds without the case or hard plastic liner compared to 3.4 pounds for the old-style shelter.

The folded size of the new shelter (without the case or plastic liner) is 210 cubic inches compared to 145 cubic inches for the old-style shelter.

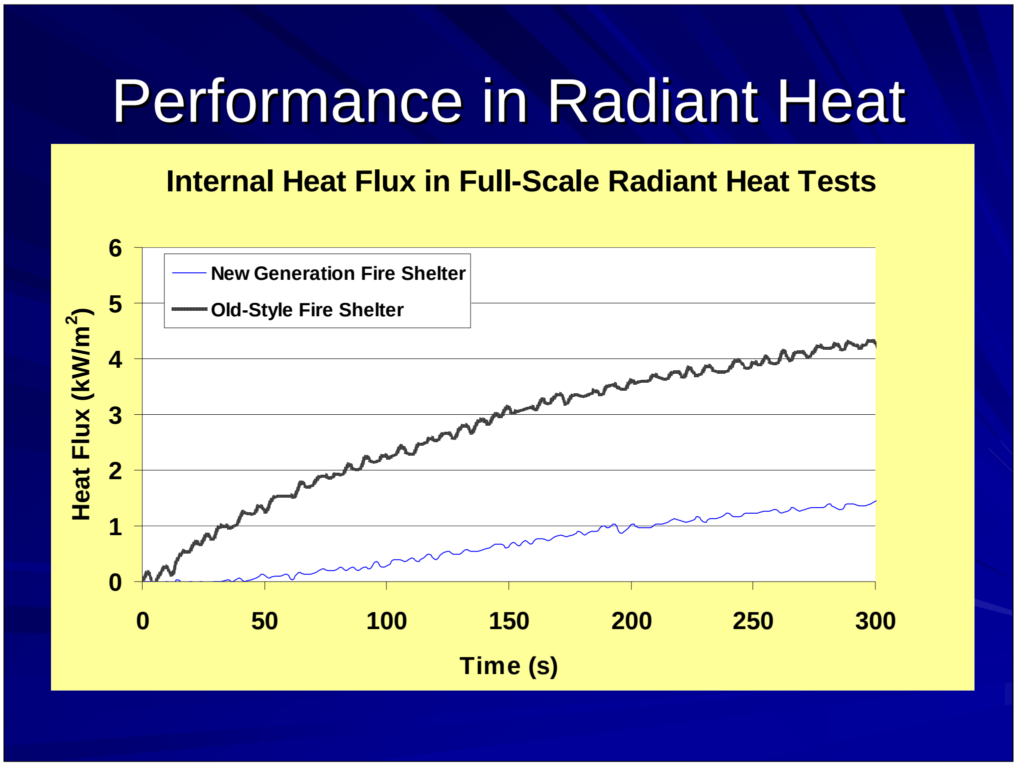


Slide 29:

Performance in radiant heat as measured by temperature:

In a 300-second full-scale radiant heat test, the temperature inside the New Generation Fire Shelter rose 137 °F from the starting temperature. The temperature in the old-style shelter rose 175 °F. These values reflect the *rise* in temperature, not the actual temperature.

With actual temperatures, 300 °F is understood as the maximum survivable breathing temperature for a short period of time.



Slide 30:

Performance in radiant heat as measured by heat flux:

In the 300-second, full-scale test in radiant heat, the average maximum heat flux in the new shelter was 1.5 kW/m^2 ("kilowatts per meter squared") compared to 4.3 kW/m^2 for the old-style shelter.

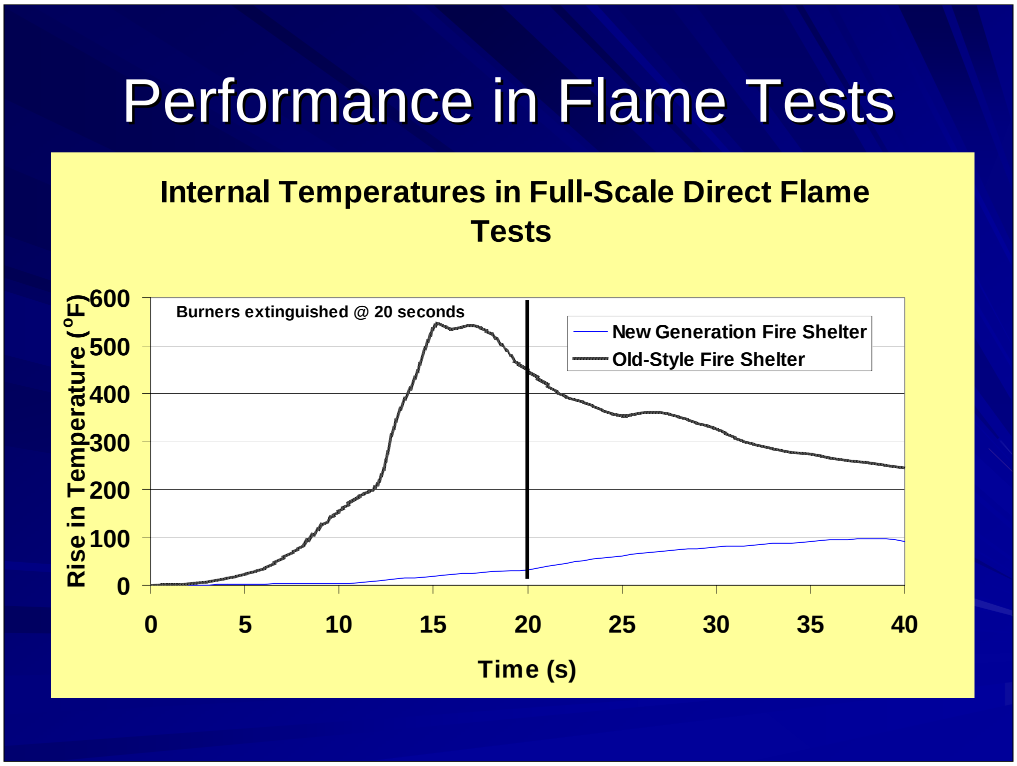
Consider:

•A heat flux of 1 kW/m^2 is equal to the maximum radiant heat transfer on a clear sunny day on the Earth's surface.

•A heat flux of 5 kW/m^2 can cause second-degree burns in about 40 seconds.

•A heat flux of 10 kW/m^2 is predicted to cause death for about 1% of victims after 40 seconds.

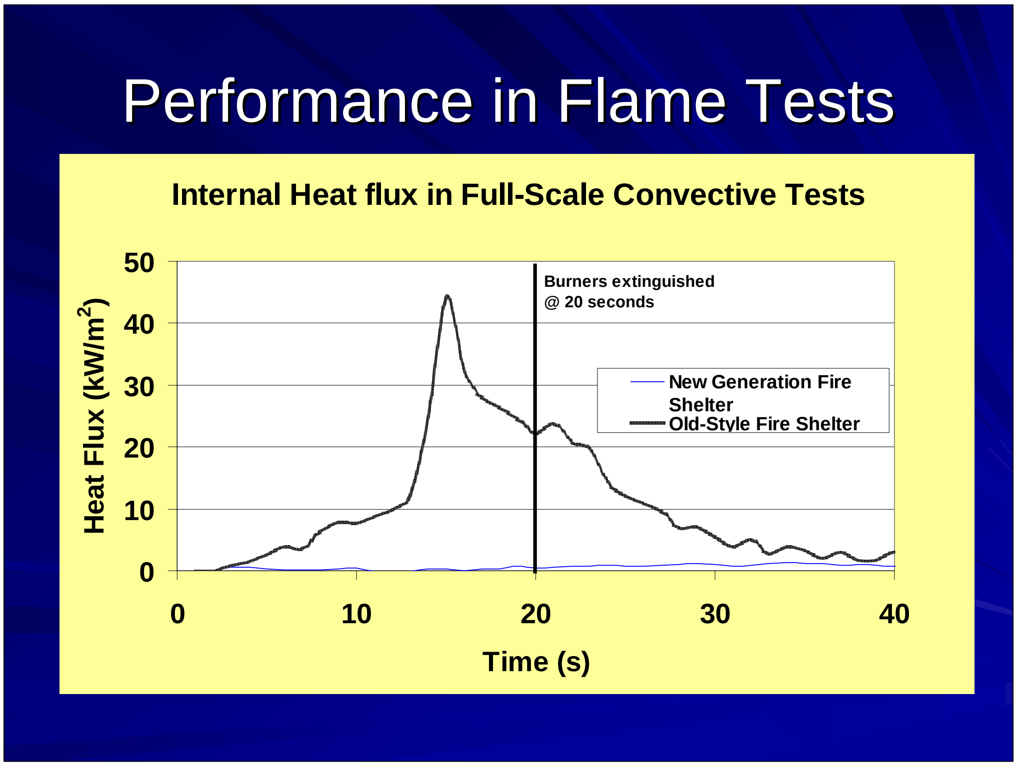
•A heat flux of 14 to 18 kW/ m^2 is predicted to be fatal for 50% of victims after 30 seconds.



Slide 31:

Performance in flame tests as measured by temperature:

Due to test facility limitations in these tests, the flames were extinguished after 20 seconds and temperature continued to be measured for an additional 20 seconds for a total of 40 seconds. In the flame tests, the material of the New Generation fire shelter remained intact, while the material of the old-style fire shelter burned through, which allowed flames to enter the shelter. The temperature inside the New Generation Fire Shelter rose 102 °F from the starting temperature. The temperature in the old-style shelter rose 540 °F from the starting temperature. These values reflect the *rise* in temperature, not the actual temperature.



Slide 32:

Performance in flame tests as measured by heat flux:

In the flame tests the maximum heat flux in the New Generation Fire Shelter was 1.3 kW/m^2. The maximum heat flux in the old-style shelter was 44.1 kW/m^2. A heat flux of 14 to 18 kW/ m^2 is predicted to be fatal for 50% of victims after 30 seconds.

Note: Even though the New Generation Fire Shelter performs better than the old-style fire shelter, firefighters should still deploy shelters in the location that offers the best chance of survival from heat and flames.

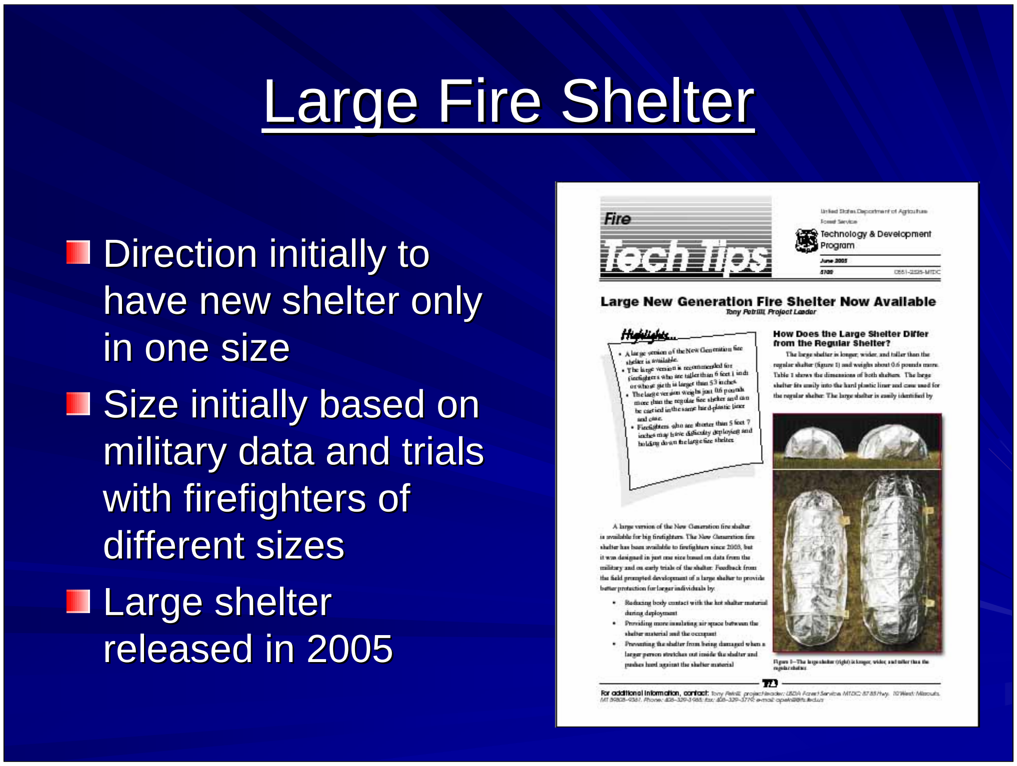
Slide 33:

During the last half of 2002 MTDC developed specifications and drawings to be used by the General Services Administration (GSA) to contract for manufacture of the new shelters. MTDC also developed a training video and booklet, both titled, “The New Generation Fire Shelter”.

In 2003 MTDC worked with the manufacturers to ensure the specifications were being met. The new shelters were made available to firefighters in June of that year. Almost immediately, MTDC and the manufacturers began to look for ways to further improve the new shelter. For example, tests were initiated to approve material with a treatment called “Silane” that made both the cloth and the laminate bond stronger. Approval of these materials required a full round of strength, toxicity, and thermal performance tests.

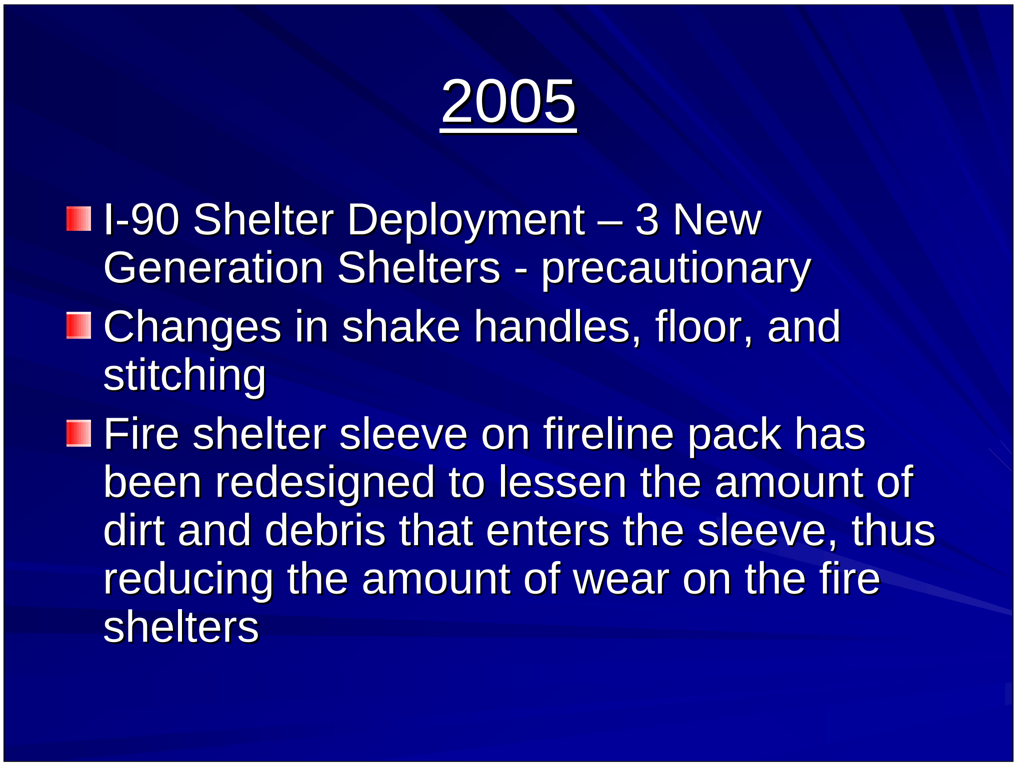
Slide 34:

In 2004, tears were discovered near the shake handles during practice deployments of some new shelters. Tests showed that about 13% of the shelters would tear when they were shaken to open. The tears were in the floor material near the shake handles. Production was halted. Shelters were recalled. A retrofit was developed and implemented. Because the problem was found solely in the floor material made from base cloth from one cloth manufacturer, the use of that manufacturer's base cloth was discontinued. MTDC and the company that laminated the base cloth to foil researched and evaluated a new strength test that would better assess the cloth's strength. The specifications were changed to include these new requirements.



Slide 35:

When the new shelter was first designed, Fire and Aviation Management directed that the shelter be made available only in one size. The final design was selected as the best compromise for both small and large firefighters, based on height data from the military and physical tests with firefighters of various sizes. Once the new shelter was out, however, feedback from the field indicated that a larger size was needed for taller firefighters. With approval from Fire and Aviation Management, MTDC designed a new large-size shelter. The new large shelter and practice shelter, along with a Tech Tip describing their appropriate use, were released in 2005.



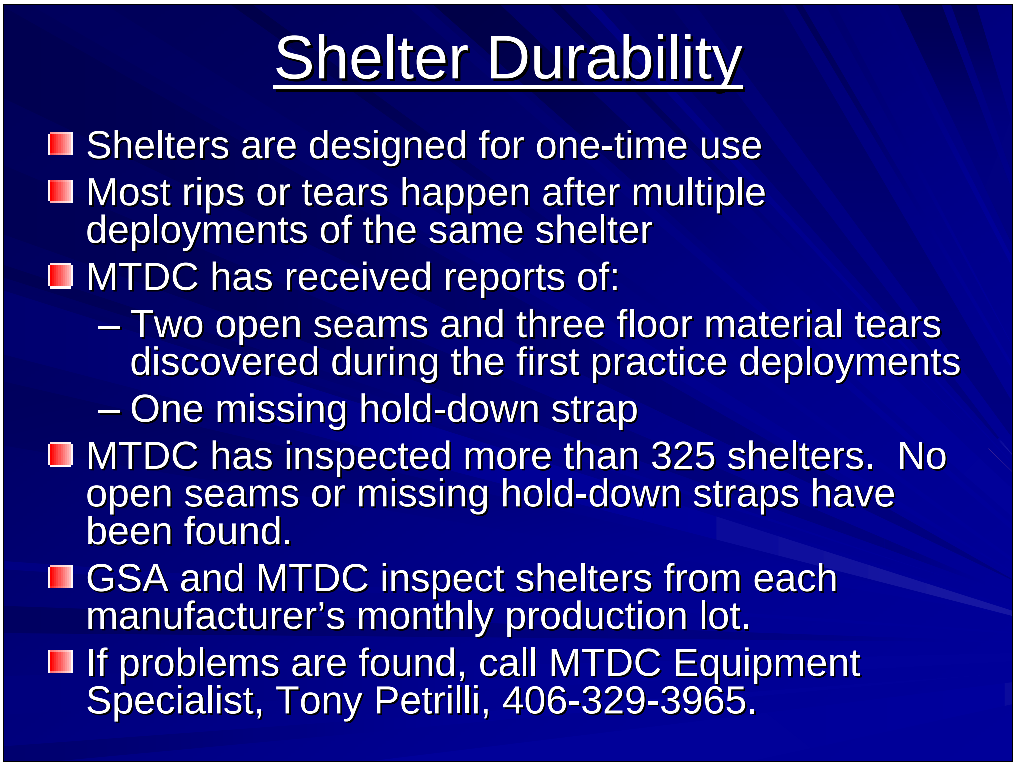
Slide 36:

Additional improvements made to the shelter in 2005 include:

- Making the shake handles easier to hold onto by enclosing short sections of plastic pipe in the handles to provide a more solid grip.
- Taking advantage of the stronger floor material now available to make the shelter less bulky and easier to manufacture. Much of the seam tape was removed from around the floor seam.
- Adding a second line of stitching using fiberglass thread to most of the seams, strengthening the seams in moderate temperatures. The quartz thread used in the shelter is one of the strongest available for very high heat conditions.
- Redesigning the fire shelter sleeve of the Fireline Pack to reduce the amount of dirt and debris that enters the sleeve. Dirt and abrasion can reduce the service life of the fire shelter.
- I-90 Shelter Deployment. This is the first know deployment of the New Generation shelter. One dozer operator and two dozer bosses made a precautionary deployment on a road switchback.

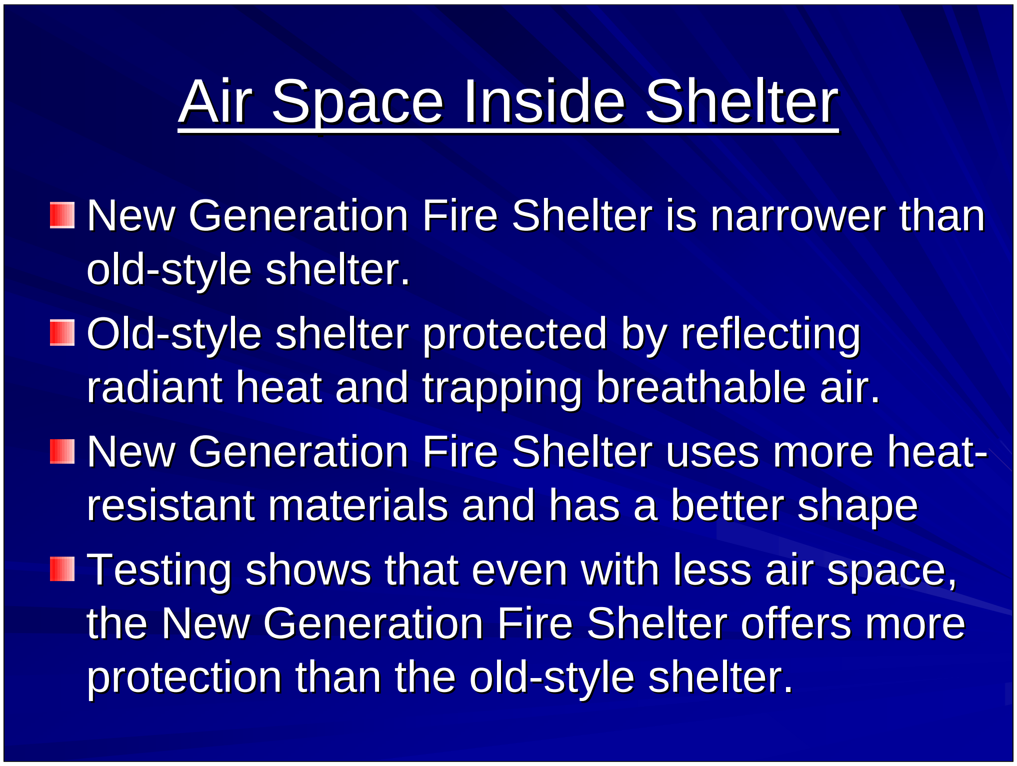
Slide 37: Photos: Pull strap reinforcement process, refer to the Tech Tip for instructions.

The PVC shelter bag pull strap was designed to help extract of the shelter from its pack during a shelter deployment. The pull strap design was initially incorporated into the packaging of the old-style fire shelter in 1999 and was brought forward to the New Generation Fire Shelter design. There have been no reports of the strap detaching from the old-style shelter. However, during shelter deployment drills performed by firefighters and during tests done by MTDC, the pull strap detached from the shelter bag when it was jerked abruptly. A Tech Tip titled *What's New With the New Generation Fire Shelter?* outlining a method for field units to strengthen this handle connection on bags made before June 2005. All bags manufactured since then have a new reinforced design.



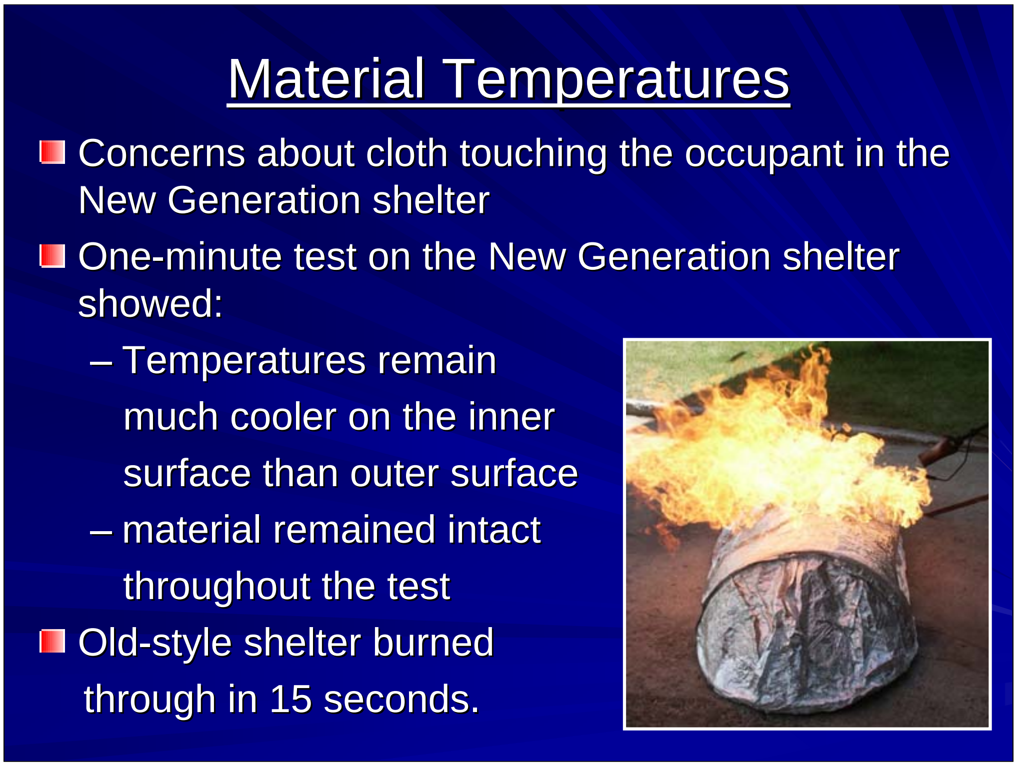
Slide 38:

The fire shelters are designed for one-time use. For more realistic training, many units practice deployments with actual shelters. Some rips or tears have occurred after these deployments. Most rips or tears occurred after multiple deployments of the same shelter. MTDC has received reports of five shelters that were found to be damaged the first time they were opened or after they had been deployed once for practice. Two of the shelters had open seams in the shelter shell and three had tears in the floor material. There has been one report of a missing hold-down strap. MTDC has inspected more than 325 shelters. No open seams and no missing hold-down straps have been found. The manufacturer has increased its quality assurance/quality control and manufacturing inspection by GSA and MTDC has been increased to meet the goal of zero defects. If you encounter a problem with a New Generation Fire Shelter, contact MTDC equipment specialist Tony Petrilli at 406–329–3965.



Slide 39:

The New Generation Fire Shelter is narrower than the old-style shelter. Some firefighters have been concerned that the reduced air space inside the new shelter means less protection. The old-style shelter protected firefighters by reflecting radiant heat and providing airspace. The New Generation Fire Shelter protects in this way as well and uses more heat resistant materials and a shape that is more aerodynamic and better suited to reflect radiant heat. Testing has shown that even though it has less air space the New Generation Fire Shelter offers significantly more protection than the old-style shelter.



Slide 40:

Photo: Material temperature test.

As with the old-style fire shelter, some firefighters are concerned that hot shelter material of the New Generation fire shelter may touch the occupant during deployment. Testing sponsored by MTDC was conducted in May 2005 by the Protective Clothing and Equipment Research Facility of the University of Alberta in Edmonton. The New Generation Fire Shelter was exposed to a single-burner propane flame to get some indication of the interior and exterior surface temperatures. The burner was set so that flames would impinge on the surface of the shelter. Flame temperatures were 1470 to 1650 ^{o}F. After 7 seconds of flame, the outer surface temperature was 376 ^{o}F, while average inside surface temperature was 187 ^{o}F. After 18 seconds of flame exposure, the outer surface temperature was 590 ^{o}F, while the average inner surface temperature was 318 ^{o}F.

The material of the New Generation Fire Shelter remained intact and provided 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 within 15 seconds, allowing flame to enter the shelter. Although the hot material of the New Generation fire shelter may touch the occupant, this test suggests that the New Generation fire shelter offers more protection than the old-style shelter.

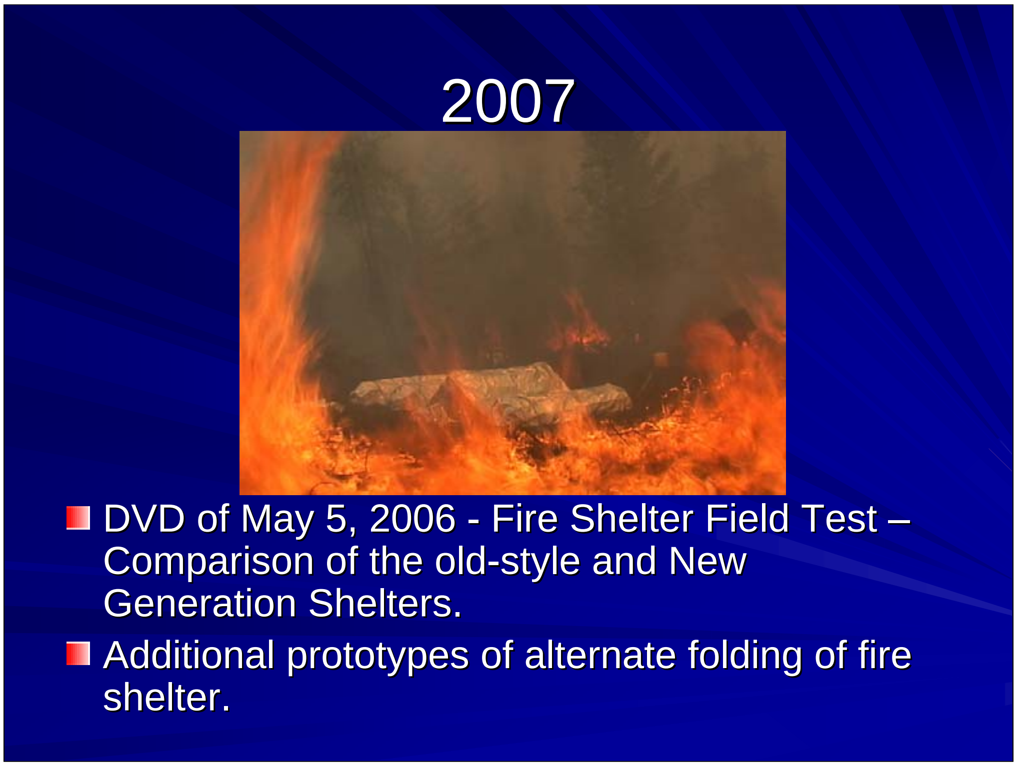
Slide 41:

Photo: Examine new packaging design - Prototype fireline pack with prototype alternate folded fire shelter.

•During the development process, various systems to support the shell were evaluated. No acceptable systems were found. MTDC will examine ways to make the shelter stand up better without making deployment of the shelter more difficult.

•MTDC will examine new packaging designs. Decisions on investing in new packaging designs will have to be made by Fire and Aviation Management.

•MTDC will conduct additional field testing of the shelter to learn more about its performance.



Since the introduction of the New Generation fire shelter, the Missoula Technology and Development Center has used a variety of methods to continue learning about the shelter and improve its design. In this program, you will see a fire shelter field test conducted on May 5, 2006, near Missoula, MT. This test compared the performance of the old-style fire shelter and the New Generation fire shelter.

Slide 42:

Agencies are transitioning to the New Generation fire shelter. All firefighters are encouraged to carry the New Generation fire shelter. GSA has stock available of the regular size shelter and the manufacturer's supply is catching up to demand for the large size shelter.

According to the National Fire and Aviation Executive Board, the target dates for transition to the New Generation Fire Shelter are December 31, 2008 for federal agency firefighters and December 31, 2009 for all other firefighters. Fire and Aviation Management is working to speed the transition.

Firefighters need appropriate training prior to carrying the New Generation Fire Shelter to include at a minimum: reading the new training pamphlet, viewing the new video or DVD, and practicing deployments with the new practice fire shelter.

Training materials:

The New Generation Fire Shelter, pamphlet, (NFES #2710)*;*

The New Generation Fire Shelter, video and DVD, (VHS - NFES #2711, DVD-NFES #2712)

Spanish versions are also available:

El Refugio de Proteccion Nueva Generacion, pamphlet, (NFES #2736)

El Refugio de Proteccion Nueva Generacion, video (NFES #2735)

Training materials can be ordered through the Great Basin Cache located at NIFC. All fire shelter training materials are contained within PMS 411. For more ordering information, go the NWCG publications Web site: http://www.nwcg.gov/pms/pubs/pubs.htm

Fire shelter and practice fire shelters can be purchased through the GSA Wildland Fire Equipment Catalog

New Generation Practice Fire Shelters

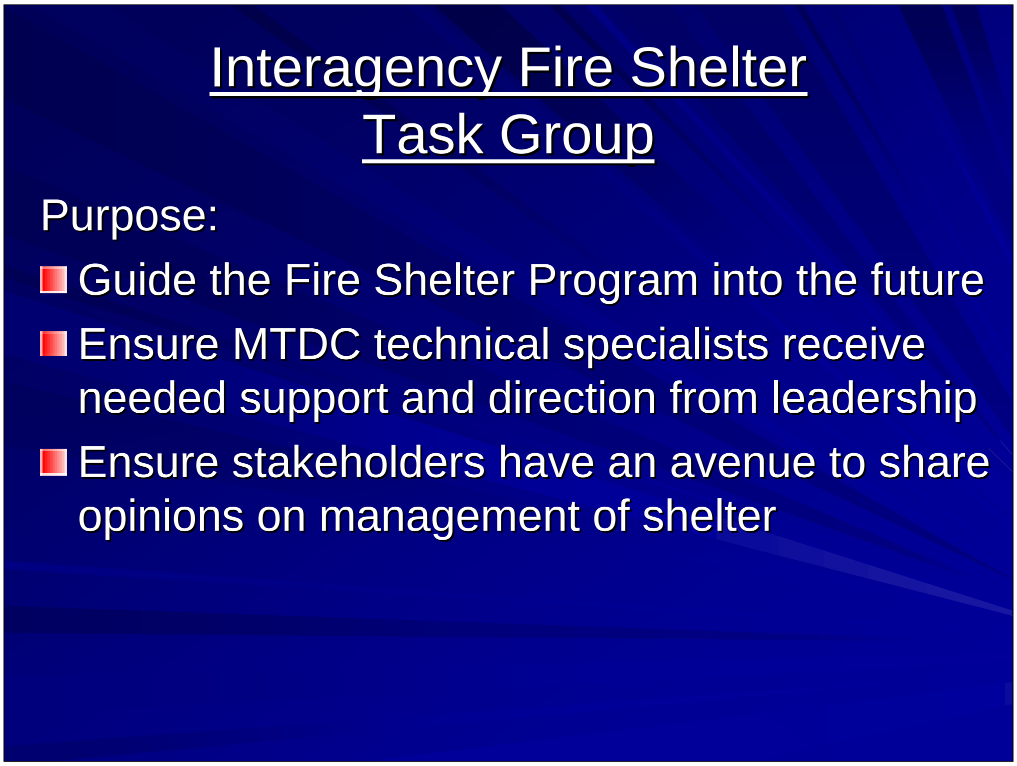
Regular-size, complete (NSN: 6930-01-499-0605), shelter only (NSN: 6930-01-499-0608)

Large-size, complete (NSN: 6930-01-529-8807), shelter only (NSN: 6930-01-529-8805)

New Generation Fire Shelters

Regular-size, complete, (NSN: 4240-01-498-3194), shelter only (NSN: 4240-01-498-3190)

Large-size, complete, (NSN: 4240-01-527-5248), shelter only (NSN: 4240-01-529-8804)



Slide 43:

A new Interagency Fire Shelter Advisory Board has been formed. The purpose of the board is to guide the Fire Shelter Program into the future. Further objectives are to involve the numerous 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.

Board members include a wide variety of agencies and job titles. A list of Board Members and contact information can be found on a future website.

Further Information

- ***Remember***, fire shelters are not fail safe, carrying a fire shelter should never be considered as an alternative to safe firefighting.

- If you have questions about the information in this presentation, please contact MTDC equipment specialist Tony Petrilli:

  apetrilli@fs.fed.us