# FIRE MANAGEMENT NOTES

SUMMER 1978 Volume 39, Number 3

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FIRE MANAGEMENT NOTES

*An international quarterly periodical devoted to forest fire management*

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## The Cover

Ghostly in appearance, the cover picture shows a tractor covered with heat-resistant foam. Use of this foam forms a cocoon which could save thousands of dollars in lost resources. The lead article discusses this innovation by the Texas Forest Service.

*Smokey Says:*


**Fire out of control is an enemy —carefulness makes the difference!**

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**Bob Bergland,** *Secretary of Agriculture*

**John R. McGuire,** *Chief, Forest Service*

**Henry W. DeBruin,** *Director, Aviation and Fire Management*

**David W. Dahl .,** *Managing Editor*

# Texas Snow Job

*Pat Ebarb*

Numerous emergency safety devices have been employed on the standard fire suppression equipment, such as tractors, in the South. Often these safety items have met with limited success. Light crawler tractors often become incapacitated while operating in close proximity to the fireline, thus endangering the operator as well as the unit itself.

Currently, there is no standard safety device in use that is universally effective as well as practical to protect this equipment. Some units are equipped with 5-gallon back-pack pumps, others with 20-gallon reservoirs, still others with commercial fire extinguishers—while others remain completely unprotected. Major drawbacks to those standard devices mentioned include limited suppressant and operating time and inconvenience or inaccessibility when the operator is under stress.

The Fire Control Department, Texas Forest Service, has developed an experimental water expansion system for tractor and operator protection that looks practical and effective and may have application as a ground tanker system.

## The System

The system comprises two pressure vessels, one for water/surfactant storage, the other for compressed air or gas. The vessels are plumbed together and mounted as an integral unit on the rear of the tractor's standard roll-over frame. The unique function of the system is to increase the effectiveness and operating time of available water (25 gallons) by expanding its volume as a foam output. The average liquid to foam expansion ratio is 10:1, thus there is an effective output of 250 gallons of

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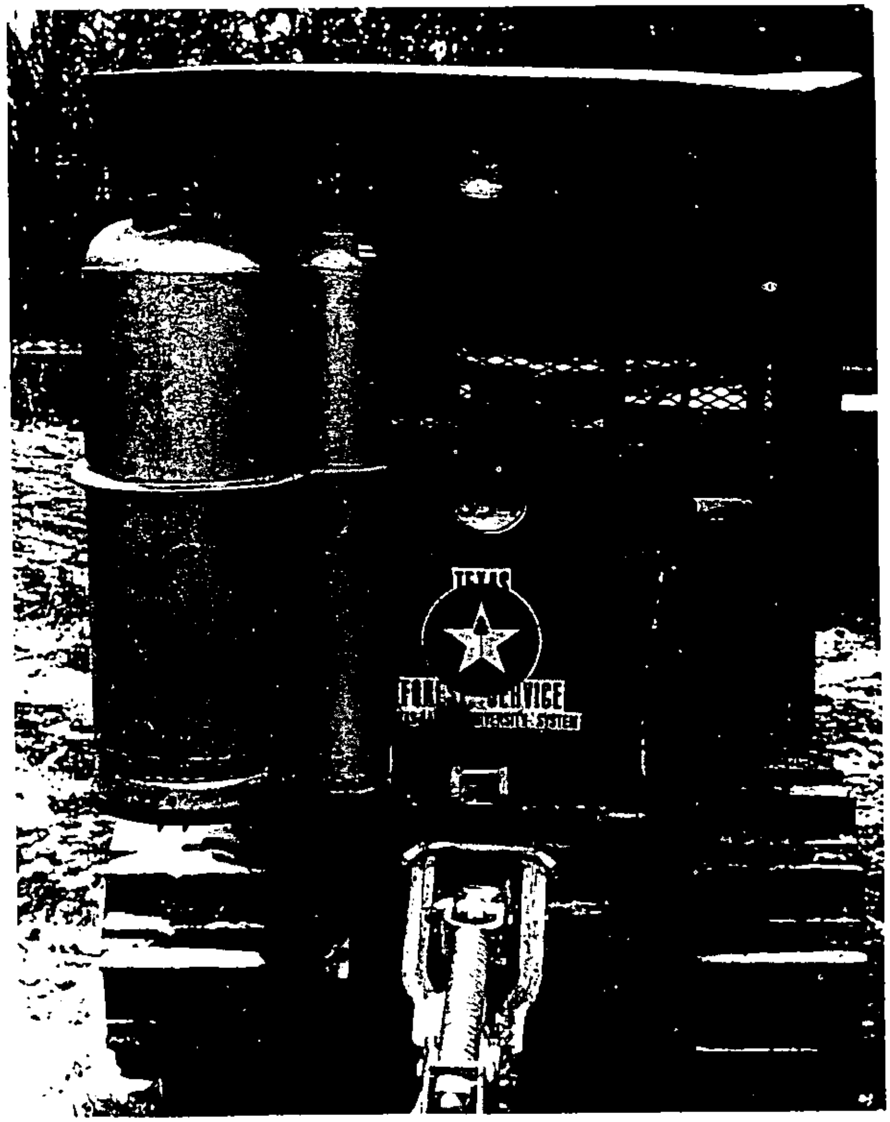

**Figure 1.—Tractor with "Texas Snow Job" protection unit.**

*Pat Ebarb, head of the Fire Control Department of the Texas Forest Service, Lufkin, Tex.*

TEXAS SNOW JOB
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foam. At a discharge rate of 25 gallons per minute (gal./min.), the unit as described will operate continuously for 10 minutes.

## Foam Density

Foam density can range from complete fluidity to the consistency of shaving cream by altering the "initial charge" ratio of water to foaming agent. It appears at this point that dense foam offers the most efective protection to the operator and equipment—while a more fluid condition may be more useful in line holding and in mopup work.

## Other Potential

Potential does exist for this foam system to be used in line holding so long as it is not evaluated in terms of a direct attack device. The average small tractor could accommodate two complete units with the configuration shown in figure 1 (one on each side of the fire plow). This would provide for 20 minutes of continuous operating time, which is considerably longer than most small water tankers can operate at the same output (25 gal./min.).

The Texas Forest Service has equipped several excess property vehicles with the "Texas Snow Job." The system has been designed for a jeep, and for a 5/4-ton military truck. The 5/4 carries its own compressor, thus eliminating the need for the compressed air bottle. The truck, as shown in figure 2, carries a 250-gallon pressure vessel and can operate continuously for 1 hour. This design is being evaluated for use in Central and West Texas where water is scarce and where response time with heavy, water-laden units is unacceptable.

Three such units have been placed in the field with selected volunteer fire departments. Enthusiastic response has been received from these users. The cost differential is also significant since a foam unit can be installed for under $2,500 and the installation of a standard tank on a truck costs two or three times as much.

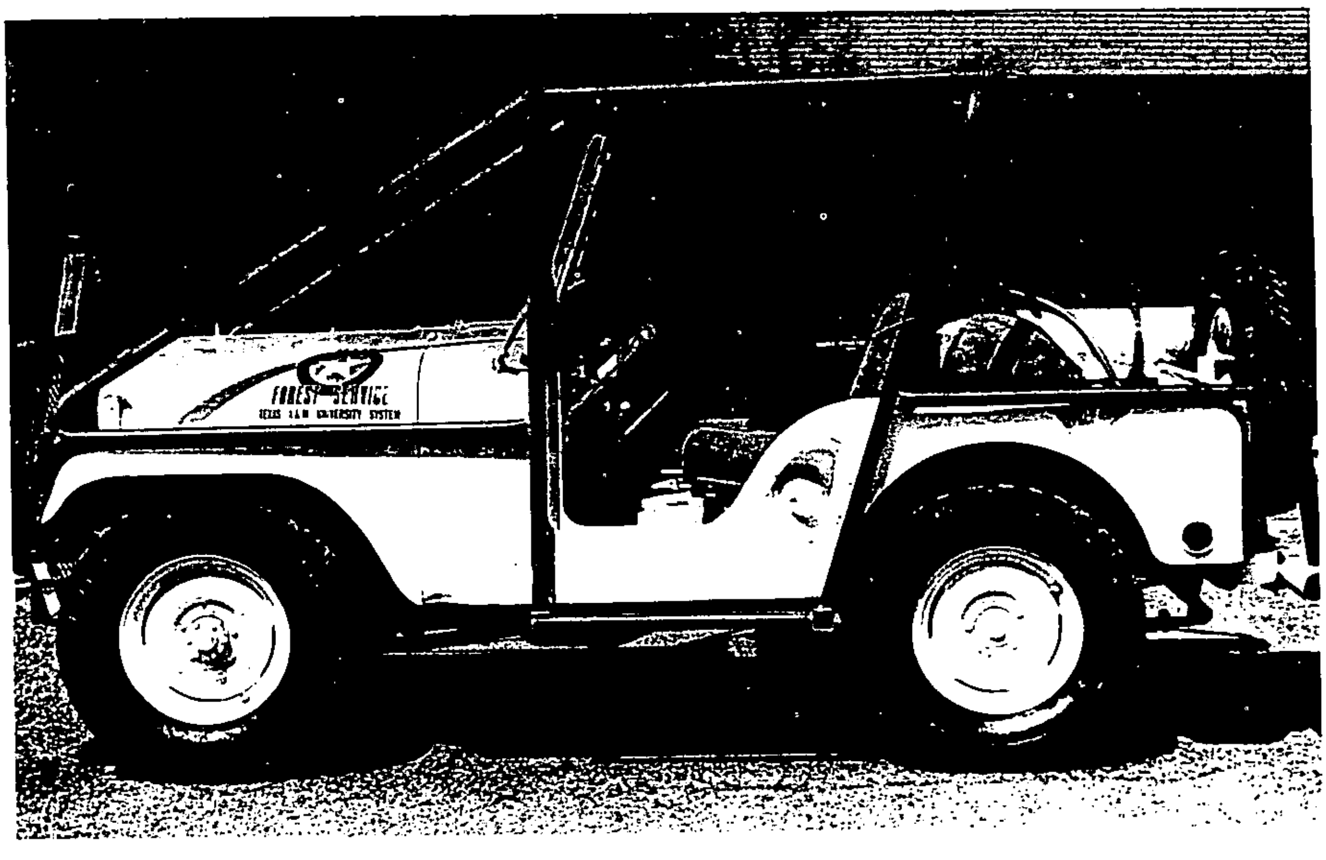


Figure 2.—Excess military "jeep" with the "Texas Snow Job."


Figure 3.—Excess military 5/4 truck with "Texas Snow Job."

## Advantages

After very preliminary evaluation, the major advantages of the system appear as follows:

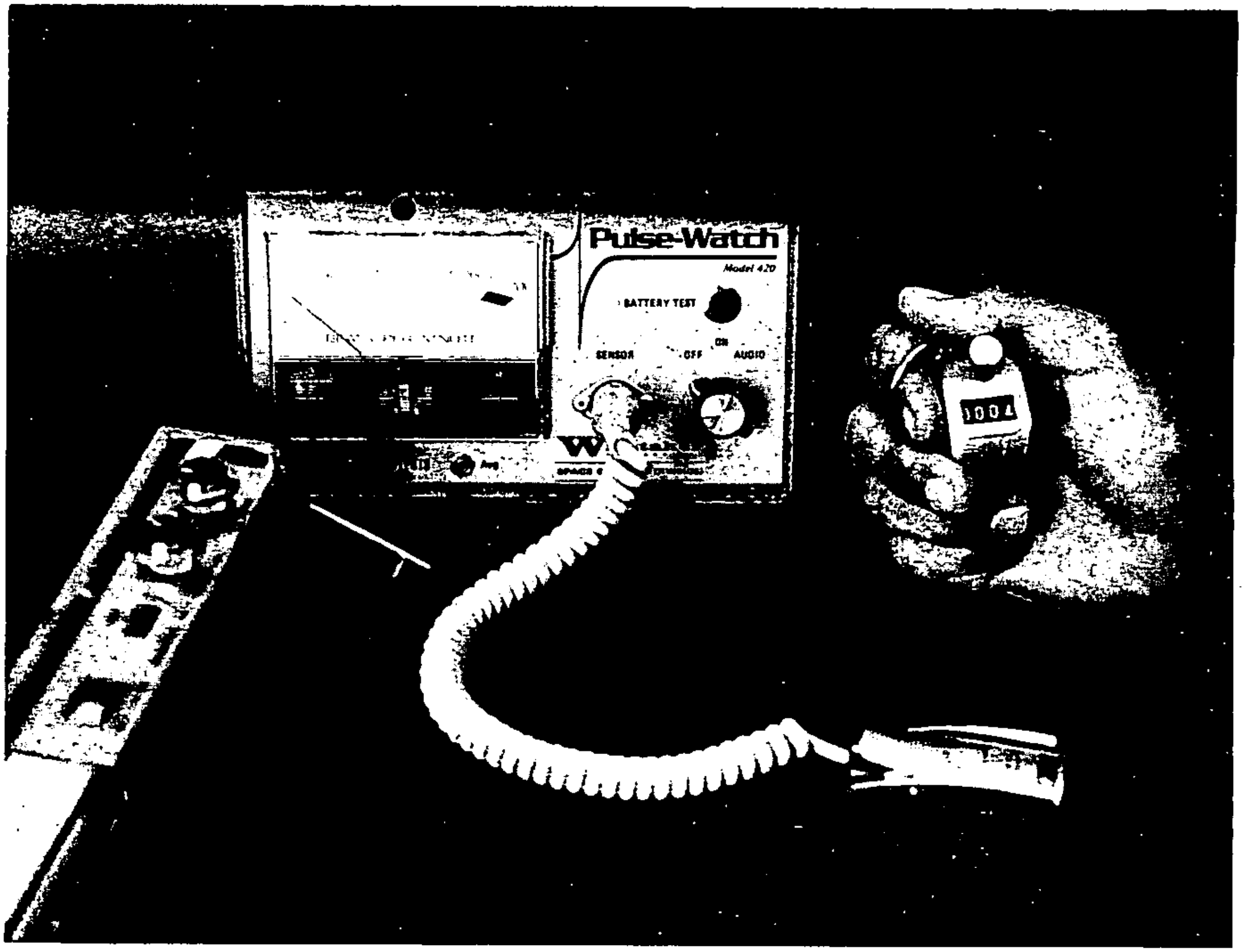
1. Extremely effective for suppressing fires ignited in accumulated debris on the tractor.
2. Dense, heat-resistant foam "cocoon" can be quickly applied by the operator to himself and to the cab interior if he is in danger of being overrun by fire.
3. Reasonably effective in line holding, mop up work, protection of improvements.
4. Reasonably effective on direct attack of small, routine grass fires, and small fires on highway rights-of-way, etc.
5. Major components of the system are readily available and can be outfitted in most shops.
6. System is passive, requiring little or no maintenance.
7. Relatively inexpensive to rig out and mount.

Several types of foaming agents have been used in the system with varying results in water retention and in lasting characteristics. Additional tests with popular retardants may show increased effectiveness and reduced costs when expanded in the system.

FIRE MANAGEMENT

# Mechanizing the Step Test

Jim Dukes




One of the most critical problems a step test administrator must face is the pulse count. If an error in counting of just one pulse beat is made, the test result may be several points off. Accurate pulse counting is not always easy.

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*Jim Dukes, Fire Management Assistant, Kisatchie National Forest, Pineville, La.*

## Finding Pulse

Concentration and skill is needed to locate the "hard to find" pulse beats. It is especially difficult to find the pulse in thick, stout wrists. The test administrator is under pressure following the 5-minute exercise period to locate immediately the subject's pulse and begin counting within 15 seconds. A few seconds delay in finding the pulse and establishing the rhythm can result in an erroneous score. This could be especially critical with individuals who are near the breakpoint on the score.

## Distractions

If the metronome is allowed to continue ticking during the 15-second counting period, the rhythmic sound creates a distraction that can cause a miscount. The metronome can be shut off, of course, but this uses up some of the 15 seconds or requires that the tester have someone to assist him.

## Metronome Accuracy

When a metronome is stopped and restarted, it must be checked frequently to make sure the rate setting has not changed. Also, wind-up metronomes will run down in the middle of a test unless careful attention is paid to keeping them wound. This is easily overlooked when a large number of people are being tested and the test administrator is pressed for time.

## Better Way

There is a better way. The following equipment can replace the metronome, stop watch, clumsy fingers, and lack of concentration:

1. An electronic pulse counter
2. A portable cassette tape player
3. A tally meter

## Procedure

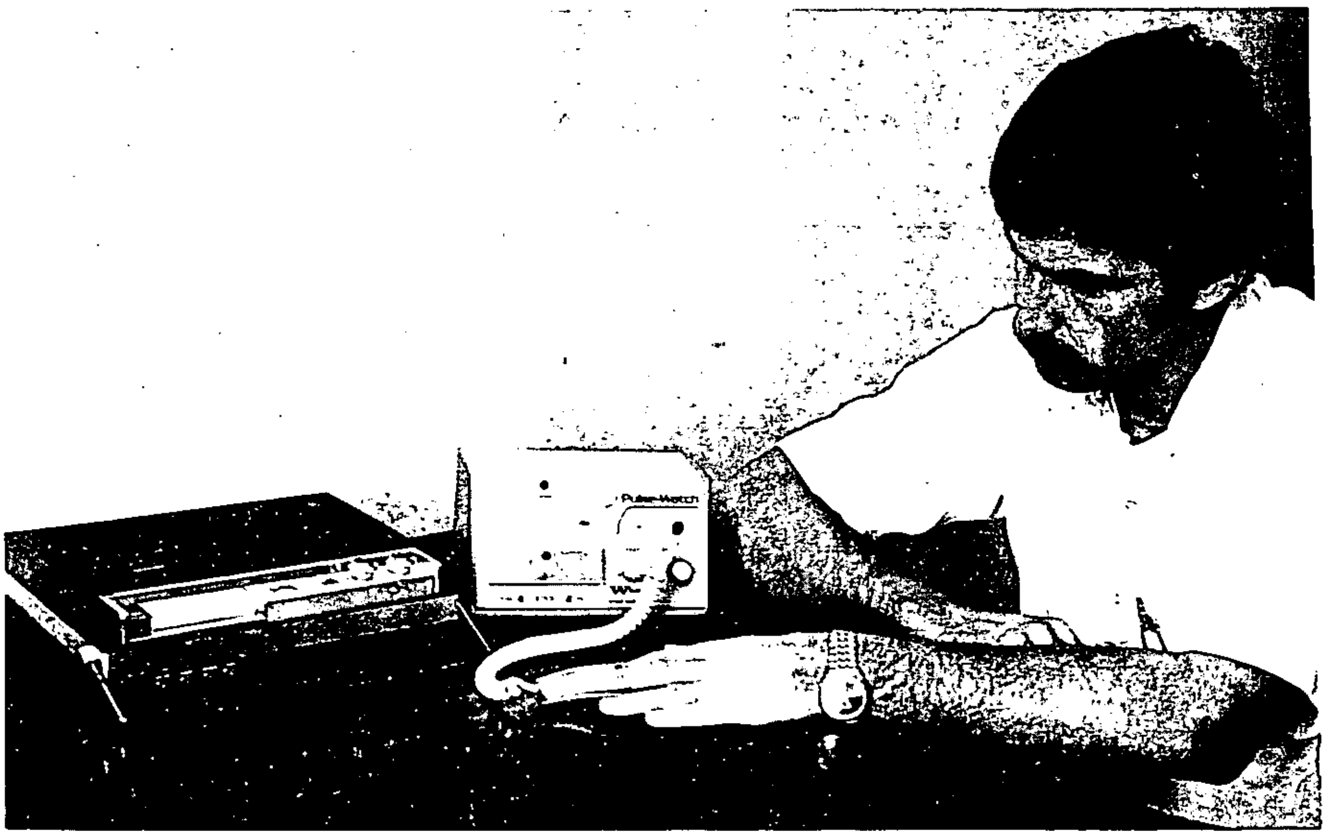
Use the tape recorder to replace the individual use of the metronome and stop watch. Record on the tape in the following order:

1. A 15-second preparatory warning signaling the beginning of the test.
2. Five minutes of the metronome sound calibrated to the right speed.
3. A 1-minute spot warning of the time remaining and a warning of the last 15 seconds.
4. A verbal "stop" to signal the test's end.
5. A tone sound at the end of 15 seconds and 30 seconds after the "stop."

Conduct the step test in the normal manner except use the above tape in lieu of the metronome and stop watch.

At the end of the 5-minute metronome sounds the step test administrator has the person being tested insert his finger in the electronic pulse counter. This device displays the pulse rate in 3 ways: by a rate meter, a flashing red light, and an audible "beep" signal. The pulse beats, indicated by the flashing red light and "beep" signal between the 15-and 30-second tones, are counted using a tally meter. In this way a test administrator can double check his subconscious count and not worry about lapses in memory caused by distractions during or immediately following the count.

By following the above procedure accuracy is increased, uniformity and fairness is maintained, and time is saved by reducing the number of aborted tests caused by delay in pulse location, forgotten counts, or miscounts resulting from double heartbeats or irregular heart rhythms.



# How to Learn the Frequencies and Ecological Roles of Historic Fires

*Stephen F. Arno*

Forest managers and fire management specialists are seeing a greater need for using fire in fuel management, wildlife habitat management, silvicultural improvement, and natural area management. To meet these needs an effort must be made by managers to evaluate and understand the role that fire *has* played in their forests in the past. A recent USDA Forest Service publication (Arno and Sneck 1977) outlines a method that managers or staff specialists can use to answer some important questions about fire history, namely, (1) the average, minimum, and maximum intervals between fires in various forest habitats, (2) sizes and intensities of fires, (3) effects of past fire on forest vegetation, particularly stand composition and age-class structure, and (4) effects of modern fire suppression.

The technique employed to determine this history is to identify and correlate fire dates from fire scars on trees, as well as to identify fire-initiated age classes of trees in the forest. The method was developed from fire history studies in several areas of western and northern North America. Manpower and equipment needs for compiling a detailed fire history are not extensive. For example, areas ranging from 100 to 10,000 acres require, respectively, about 1 to 8 weeks of the investigator's time, with help from a technician.

## Field Study

First, the manager should identify the area for which fire history is needed. If it is relatively small and has generally similar patterns of forest types throughout, then a single study area having representative topography and forest types can be chosen within it.

Conversely, if the manager wants to obtain fire history results that can be extended to a large area, for example a million acres, three or more small study units (having representative topography and forest types) should be set up in different parts of the area.

A network of field transects is laid out on a topographic map of each study area. These transects are placed to sample representative amounts of terrain and forest types on all aspects and elevations. Roads and trails may be incorporated in the transects to increase efficiency. Fire-scar dates are obtained from cross sections sawn from trees and stumps along these transects. Small cross sections of scar tissue can often be taken without seriously damaging large trees.

Age classes of trees are determined from increment borings for analysis of fire history. Habitat type or potential forest type and data on current stand composition are gathered along the transects. Habitat and forest types provide a means for relating the results to other forested areas.

## Data Analysis

Fire scars on individual trees and stumps are dated by counting annual rings. These records are then correlated to derive a master fire chronology extending back a few centuries. Individual tree samples within the same forest type are grouped into stands based on proximity to each other. Historic fire dates are then recorded by stand; this information serves as the basis for calculating fire frequencies (average, maximum, and minimum fire-free intervals) by habitat type or forest type. Frequencies are also compared throughout the historic record to detect possible changes during periods of early settlement, modern fire suppression, etc.

Age classes of trees are identified and related to historic fires or other probable causes. The extent of each fire is mapped by inspecting the

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*Stephen F. Arno, Research Forester with the Intermountain Forest and Range Experiment Station, USDA Forest Service, Ogden, Utah; located in Missoula, Mont.*

locations of fire-scarred trees and stumps and corresponding age-class data. Intensity of the fire is interpreted from the composition and age-class structure of residual stands. Thus, a picture of the patterns and effects of historic fires is gained from field data coupled with use of aerial photos, modern fire records, and timber types maps.

## Application Of Results

This method was successfully used in areas with average fire-free intervals ranging from 7 years to greater than 150 years. The method has been used in several western forest types and also different fire pine, interior Douglas-fir, western larch, lodgepole pine, Engelmann spruce, subalpine fir, and whitebark pine. Results have revealed some very different fire histories in the various forest types and also different fire histories on various environments within the same forest type.

Information gained from this kind of study can be used to document the effects of historic fires on forest composition and stand structure on different sites. Correlations with fuel inventories, insect and disease information, wildlife-habitat trends, etc., will permit estimation of effects of various fire management practices. Knowledge of historic fire frequencies, intensities, and effects can also be used in selecting reasonable goals and methods for fire and fuel management.

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# Ground Tanker Retardant Application for Prescribed Burning Line Construction

*D.D. Devet and Eddie E. Graves*

About 5,000 acres are prescribed-burned annually on the Sumter National Forest in South Carolina. Much of this area contains fragile piedmont soils that require expensive stabilizing of plowed control lines. Stabilizing involves waterbarring, fertilizing, and seeding. This requirement necessitated the

**Figure 1.—Four person crew with tractor, slip-on pumper-tanker unit mounted on stoneboat trailer enroute to prescribed burning site.**

**Figure 2.—Househandler following the tractor-trailer unit applies retardant to shoulders of skid trail. About a 2-foot-wide strip sprayed with retardant. About 5 gallons per chain (66 feet) were used (132 sq. ft.).**

development of a method to construct control lines without disturbing the soil surface.

On the Long Cane Ranger District a technique of utilizing a ground retardant applied from a slip-on pumper unit mounted in a stoneboat trailer (a heavy duty trailer designed to be towed along roads or dragged through the forest with a tractor without causing damage) was used. The trailer, towed by a Case 450 crawler tractor, proved to be a possible substitute to plowed lines under certain conditions.

During March 1978, an interior control line in a 300-acre prescribed burn was constructed by utilizing PHOS-CHEK 259R (1½ pounds per gallon of water). The retardant was applied on shoulders of an old overgrown skid road. A line 2 feet wide and 40 chains long was constructed. The area where the retardant was applied consisted of dead broomsedge grass, pine needles, and hardwood leaves estimated to be about 4 tons of available fuel per acre.

A pumper operator following the trailer applied the retardant with a standard nozzle. At the edge of the red-colored retardant line, about 70 feet behind the pumper unit, the fuel was ignited with a drip torch. All burning was done against the wind. A

**Continued on next page**

*D.D. Devet, Fire Staff Officer on the Francis Marion and Sumter National Forests, Columbia, S.C.*

*Eddie E. Graves, Biological Technician (Wildlife) on the Long Cane Ranger District of the Sumter National Forest, Columbia, S.C.*

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mopup-patrol completed the four-person crew.

About 200 gallons of retardant were used to construct the 40 chains of line. The line was constructed and burned out within an elapsed period of less than 2 hours.

The fire weather readings utilizing fuel Model E were:

- Fire fuel moisture .........7.5%
- Ignition component ........48
- Burning index .............5
- Class day .................C
- Wind ...........5-7 mph SW
- Relative humidity ........ 29%
- Air temperature .......... 65° F

The overstory consisted of small sawtimber and the understory of pine seedlings and saplings. Fuel load was relatively light but flashy.

The cost of the retardant application was a little less than the cost of plowing and stabilizing the exposed soil.

The lessons learned so far are:

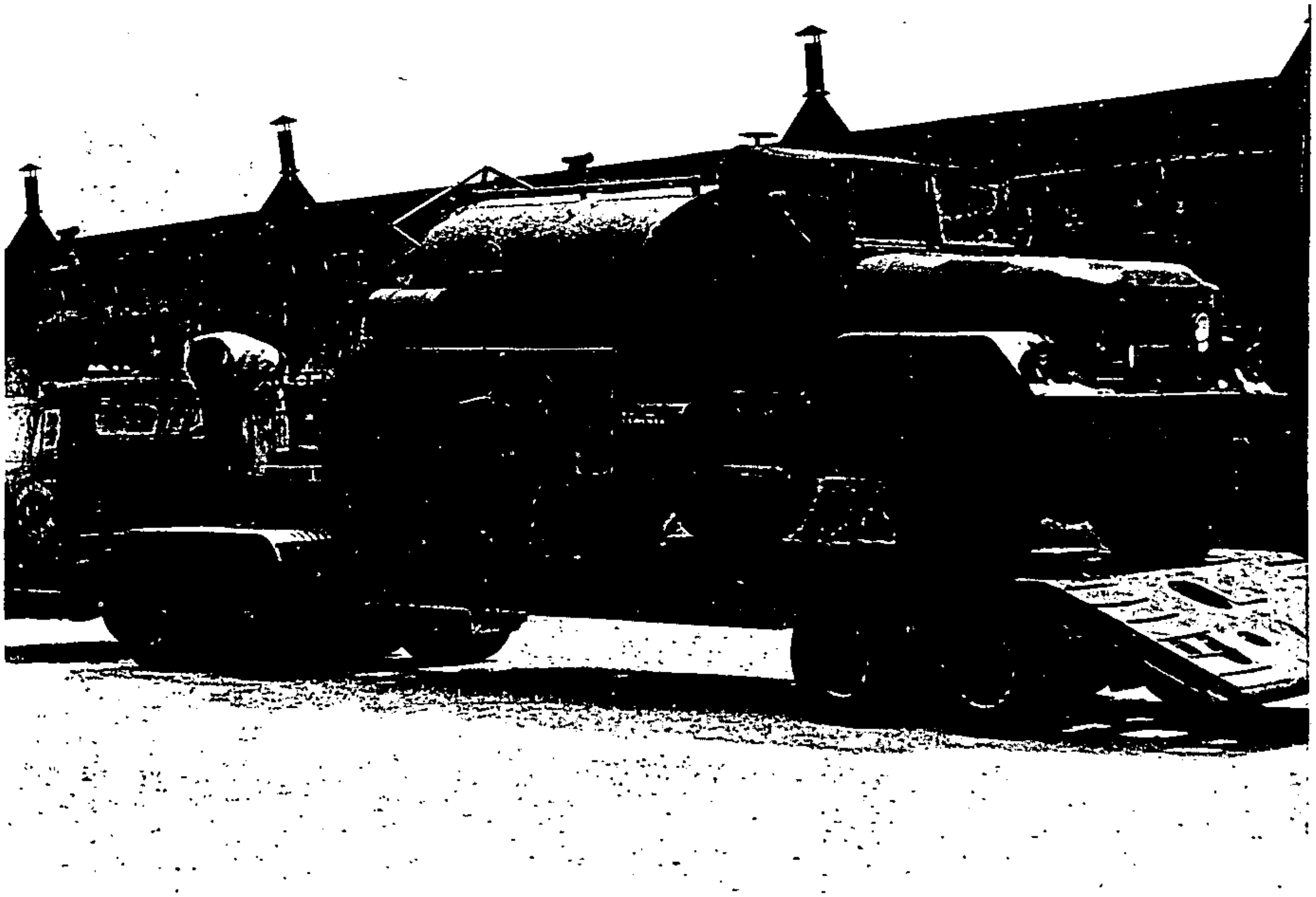
1. Whenever the fuel contains a high percentage of dead leaves. more pressure is needed in the pumper unit to dislodge leaves and apply retardant underneath the leaf litter.
2. The width of the line should exceed the height of the grass and brushy vegetation in the event the wind direction changes for short periods.
3. Retardant lines hold best when ignited shortly after application —the longer the delay is the chance of fire creeping across or under the line.

There is much to be learned about the application of the retardant for different fuels. This technique permits the construction of lines wherever a tractor can go and eliminates the erosion problems associated with exposed soils.

**Figure 3.—Control line, identified by red dye, is ignited about 60 feet behind the tractor-trailer unit applying the retardant. Note how retardant is holding fire.**

# Federal Excess Property in the Rural Fire Department

*James C. Sorenson*



How much use is left in a jeep after the U.S. Army no longer needs it? The answer to that question can be supplied by hundreds of fire managers across the country. These managers are among the many who have received Federal excess property on loan from their State forester. They have shown that, with a lot of imagination and a little money, they can increase their firefighting equipment, thus improving the level of fire protection in their communities.

*James C. Sorenson, Staff Specialist, Southeastern Area State and Private Forestry, Atlanta, Ga.*

## Procedure

Various Federal laws encourage the use of excess Federal property for fire protection in rural America. The General Services Administration provides the mechanism for transferring this property from the owning agency (usually the military) to the USDA Forest Service. The Forest Service, in turn, *lends* the equipment to State forestry agencies.

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The State foresters can either use the property in their own fire control programs, or can *lend* it to cooperating rural fire departments.

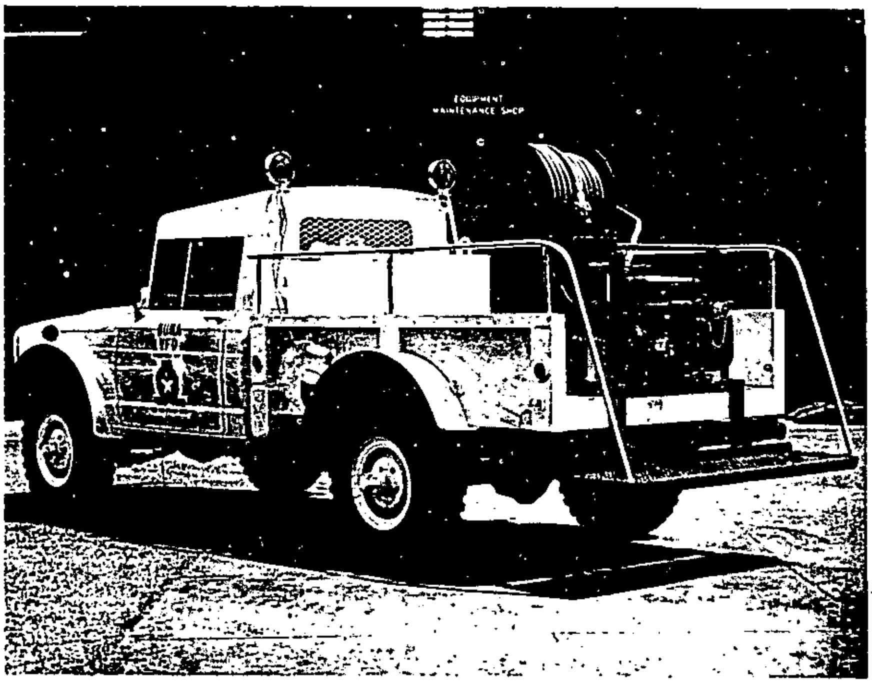

## Conversion

In some cases the work of converting an olive-drab, 2½ ton cargo truck into a shiny red tank truck is done by State forestry personnel, before the truck is given to a rural fire department. When this is done, uniformity of design within a State usually results.

In other cases, the fire department members go as far as to pick the vehicle up at the military base and haul it home on a trailer. Then, with volunteers working into the nights, they sand, weld, cut, pound, and paint until they have an operational tanker or brush-buggy sitting in the fire house. When conversion is done in this manner, some interesting looking vehicles can result. Despite their looks, these vehicles meet the needs of the fire department that made the conversion.

## Vehicle Limitations

Military vehicles are very sturdily built, but they do have limitations. Some departments make unreasonable demands on the chassis and braking systems. Sometimes tanks that are much too large are placed on these trucks. Anyone acquiring an excess truck with the idea of converting it for firefighting should consult with people who have previously made such modifications. Several designs are available, and the State forester's office is a good place to start looking.



## Other Excess Items

Vehicles receive the most attention when excess property is discussed, but often other items are available. These items, too, can help stretch a fire department's budget. Portable pumps and generators, fire hose and nozzles, light bars and sirens, and fire coats and boots are just some of the items loaned to fire departments over the years.

## A Beginning

The Federal Excess Property Program has breathed new life into many rural fire departments and has made it possible for some communities to form fire departments where none existed before. No one tries to claim that a converted "deuce and a half" is as good as a custom built pumper from one of the equipment manufacturers.

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# New Portable Weather Instrument Shelter Performs Well

William C. Fischer

A portable weather instrument shelter made of lightweight aluminum has been a popular piece of field equipment in the Northern Rocky Mountains since its development at the Northern Forest Fire Laboratory in the early 1960's (USDA FS 1964). The dozen or so prototype shelters built at that time have received frequent use by researchers and fire managers alike. Many of the original shelters are still in use.

*William C. Fischer, a Research Forester with the Intermountain Forest and Range Experiment Station, USDA Forest Service, Ogden, Utah, located at the Intermountain Station's Northern Forest Fire Laboratory, Missoula, Mont.*

The most common uses are to measure temperatures and relative humidity at field study sites for forestry research and to monitor preburn weather conditions in areas scheduled for prescribed burning (fig. 1). The shelters have also been used to obtain onsite weather measurements at large wildfires and to evaluate

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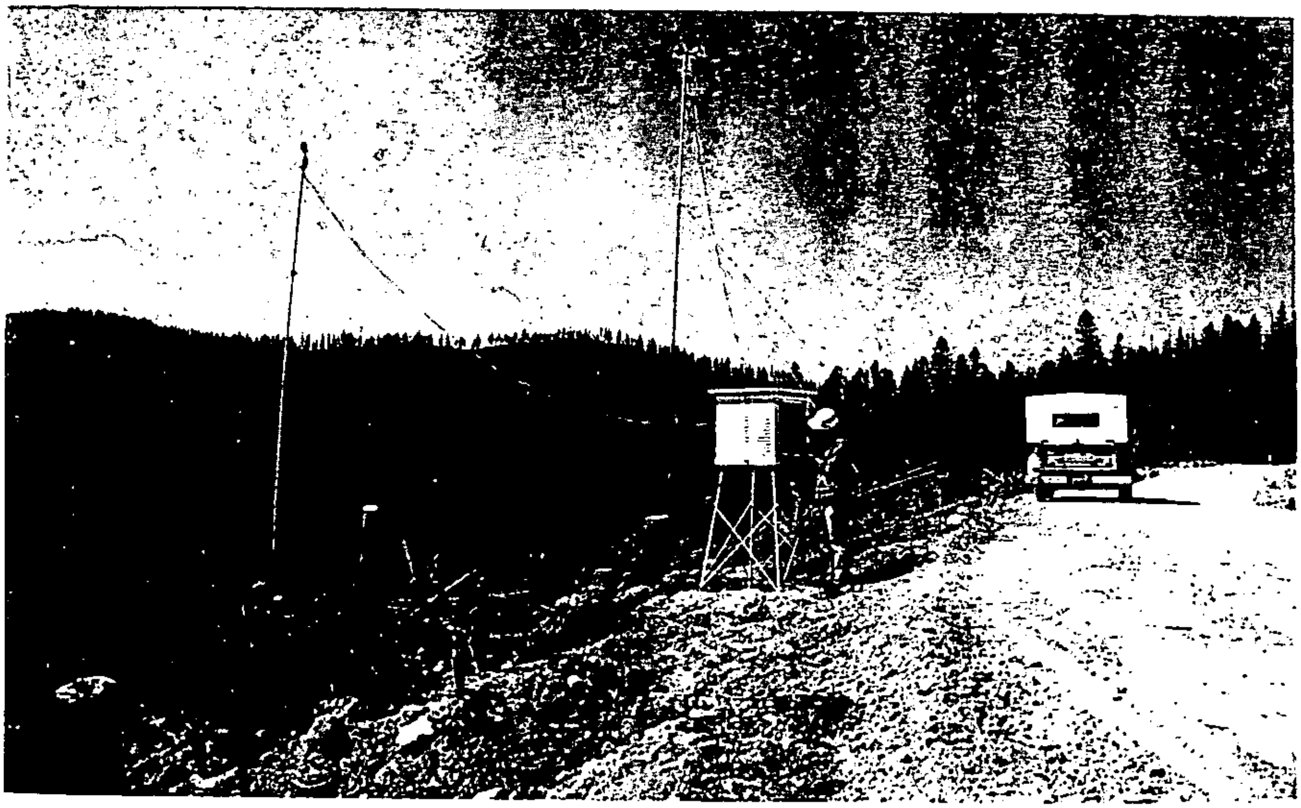

**Figure 1.—The portable shelter in use at the site of a planned prescribed burn.**

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potential fire weather stations sites.

In recent years, the demand for shelters has far exceeded the limited supply. Consequently, the San Dimas Equipment Development Center (SDEDC) improved the original design and wrote specifications for a production model. In February 1977 this project was essentially completed when SDEDC issued Interim Specification 5100-00470, October 1976, "Shelters, Weather Instrument, Aluminum, Portable," along with four supporting drawings, TM-14-01 through TM-14-04.

## The Shelter

The size and shape of the aluminum shelter (fig. 2) are almost identical to those of the standard, wood "Cotton Region" shelters used at National Weather Service climatological stations. The Cotton Region Shelter is also used at many fire danger rating stations operated by fire control and fire management agencies across the Nation.

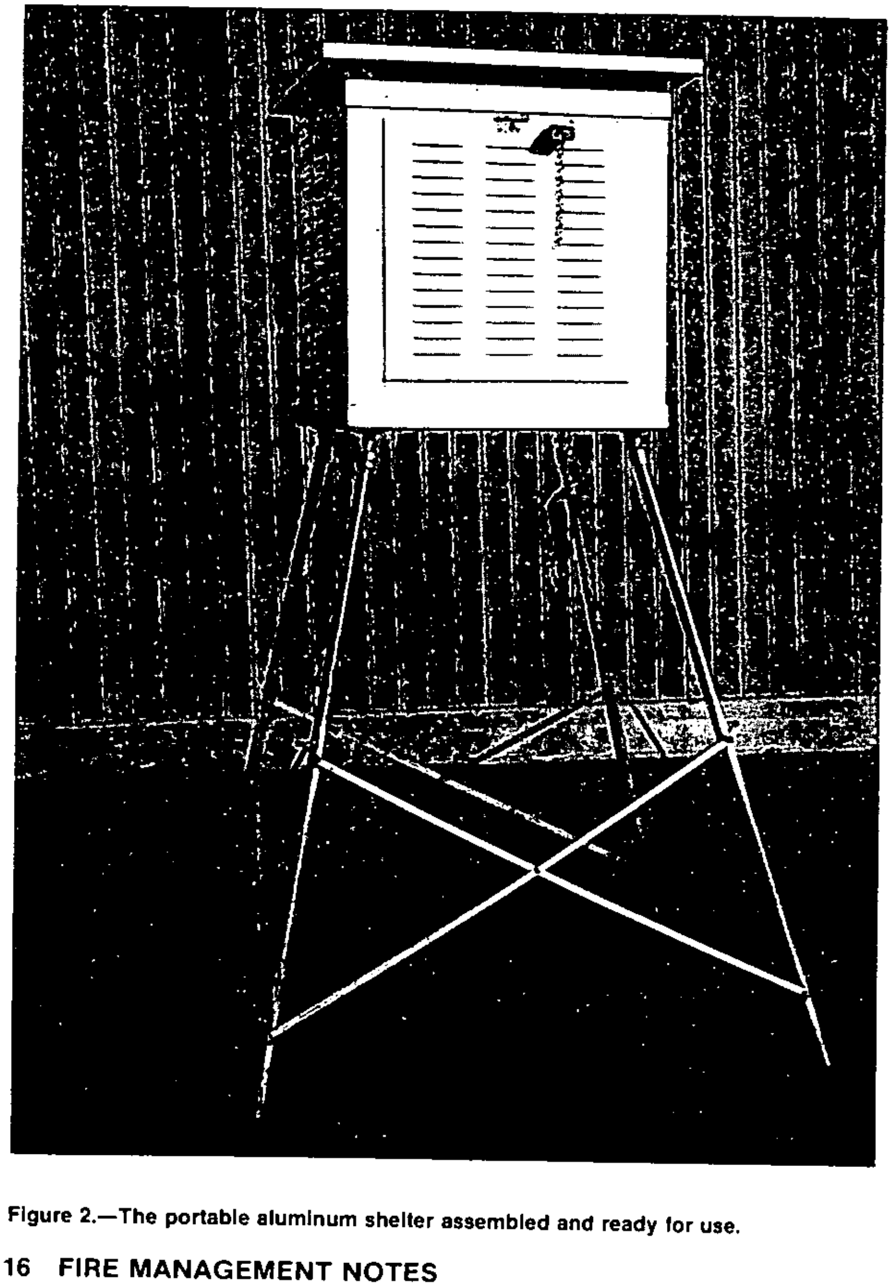

Figure 2.—The portable aluminum shelter assembled and ready for use.

Portability is the chief attribute of the aluminum shelter. The shelter and its legs fold and stack into two fairly compact packages (fig. 3), with a total weight of about 40 pounds (about 18 kg). Not only does the shelter require less vehicle space than a wood shelter, but when it reaches its destination it can be easily unloaded and carried by one person.

Another feature of the aluminum shelter is ease of assembly and disassembly. The shelter knocks down into eight parts—the four sides, the top and bottom, the center post, and the leg assembly (fig. 4). Wherever possible, thumbscrews and captive nuts are used to reduce the chance of losing these fasteners. A screwdriver and pliers are the only tools needed. With normal handling and use, the aluminum shelter should be relatively maintenance free.

## Performance

Results of a year-long test by Arnold I. Finklin (manuscript in preparation, Intermountain Station) at the Northern Forest Fire Laboratory near Missoula, Mont., show that the new aluminum shelter compares favorably with the standard wood shelter. Test results also show that the new aluminum shelter performs better than the original model aluminum shelter. Errors in maximum temperature are about half of those that occur in the original design, while minimum temperature errors are about the same.

Monthly average daytime maximum temperatures were between 0.3° and 1.4° F (0.2° and 0.8° C) higher in the new aluminum shelter when compared to those from a standard wood shelter. The larger average differences occurred during sunny summer months, while the smaller differences occurred during cloudy autumn and winter months. These average differences, attributed to radiation

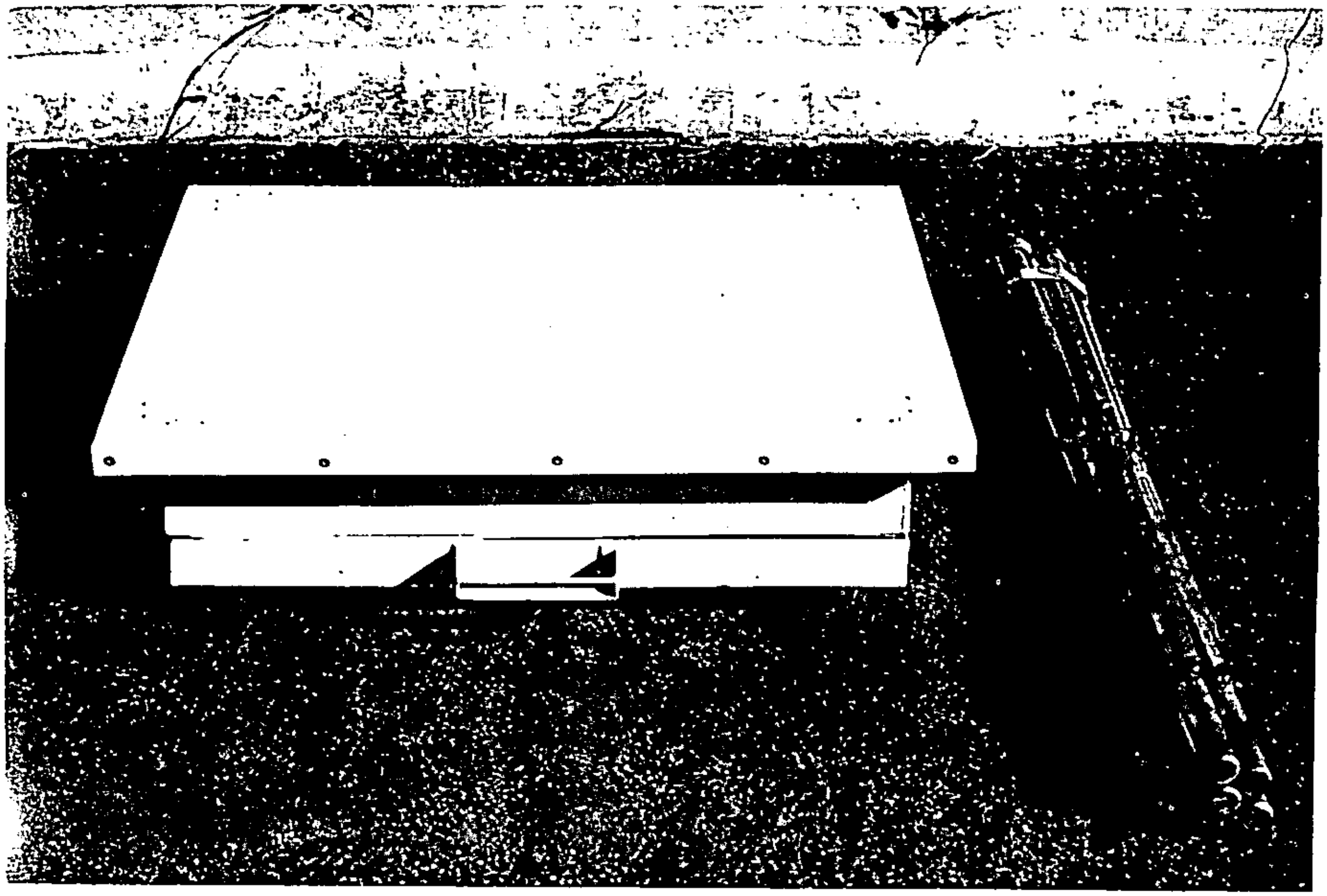

**Figure 3.—The portable aluminum shelter knocked down and ready for transport.**

effects, depend in part on the number of sunny days. Maximum temperature errors as large as +1.5° to +3.0° F (0.8° to 1.7° C) did occur occasionally on individual days throughout the year. Such extreme errors were usually associated with clear skies, no wind, and a reflective snow cover.

Overnight minimum temperatures from the aluminum shelter averaged 0.5° to 1.0° F (0.3° to 0.6° C) less throughout the year than those from the wood shelter. Extreme errors between -1.5° and -2.0° F (-0.8° and -1.1° C), attributed to outgoing radiation effects, were occasionally recorded.

The average errors assumed for the new aluminum shelter are within the tolerance (± 1° F or about 0.6° to 0.8° C) the National Weather Service specifies for the official temperature at its airport stations. The fire manager, therefore, need not be concerned about the comparability or accuracy of temperature and relative humidity readings obtained in the new aluminum shelter. Of course, the shelter must be exposed properly, the instruments must be in good operating condition, and correct observation procedures must be followed (Fischer and Hardy 1976).

## Conclusions

A portable aluminum weather instrument shelter, built to recently developed specifications, can be a useful piece of fire management equipment. Its light weight and portability make it ideal for obtaining

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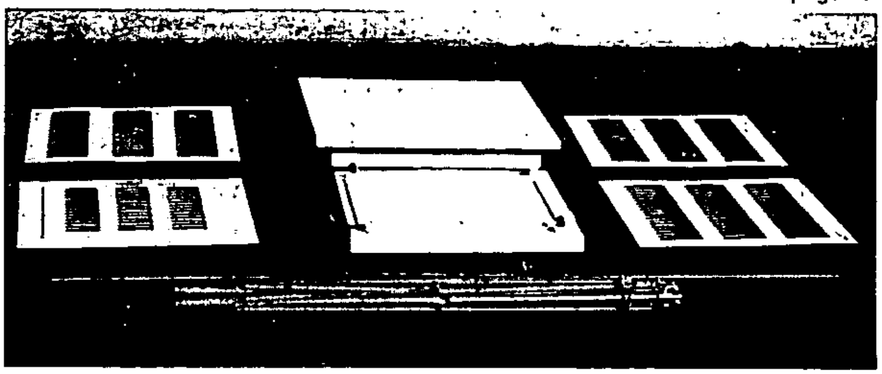

**Figure 4.—Major components of the portable aluminum shelter.**

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accurate temperature and relative humidity readings at the scene of wildfires and prescribed fires alike. Fire weather meteorologists, fire behavior officers, and prescribed burners are encouraged to consider its use. The aluminum shelter is not commercially available but has been built by local sheet metal shops. Perhaps a commercial source of supply will develop in the future.

For more information on shelter performance, contact the author or Northern Forest Fire Laboratory, Drawer G, Missoula, MT 59806. For copies of Interim Specification 5100-00470, October 1976, and drawings TM-14-01 through TM-14-04, contact San Dimas Equipment Development Center, 444 East Bonita Avenue, San Dimas, CA 91773.

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## EXCESS PROPERTY
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However, that surplus 2½-ton truck may give a community fire protection it could not otherwise afford.

Excess property, therefore, provides a nucleus around which a financially struggling rural fire department can build support. Some of the most effective rural fire departments in the country can look back to the day, not too long ago, when all they had was an old Army jeep with a 50-gallon tank on the back. Now these rural fire departments find themselves on the edge of an urban community, protecting thousands of families.

In some cases, while they welded the sheet metal together on the new tank truck, they also were welding a group of farmers, store owners and others into a unit with a common goal fire—protection for their families and friends.

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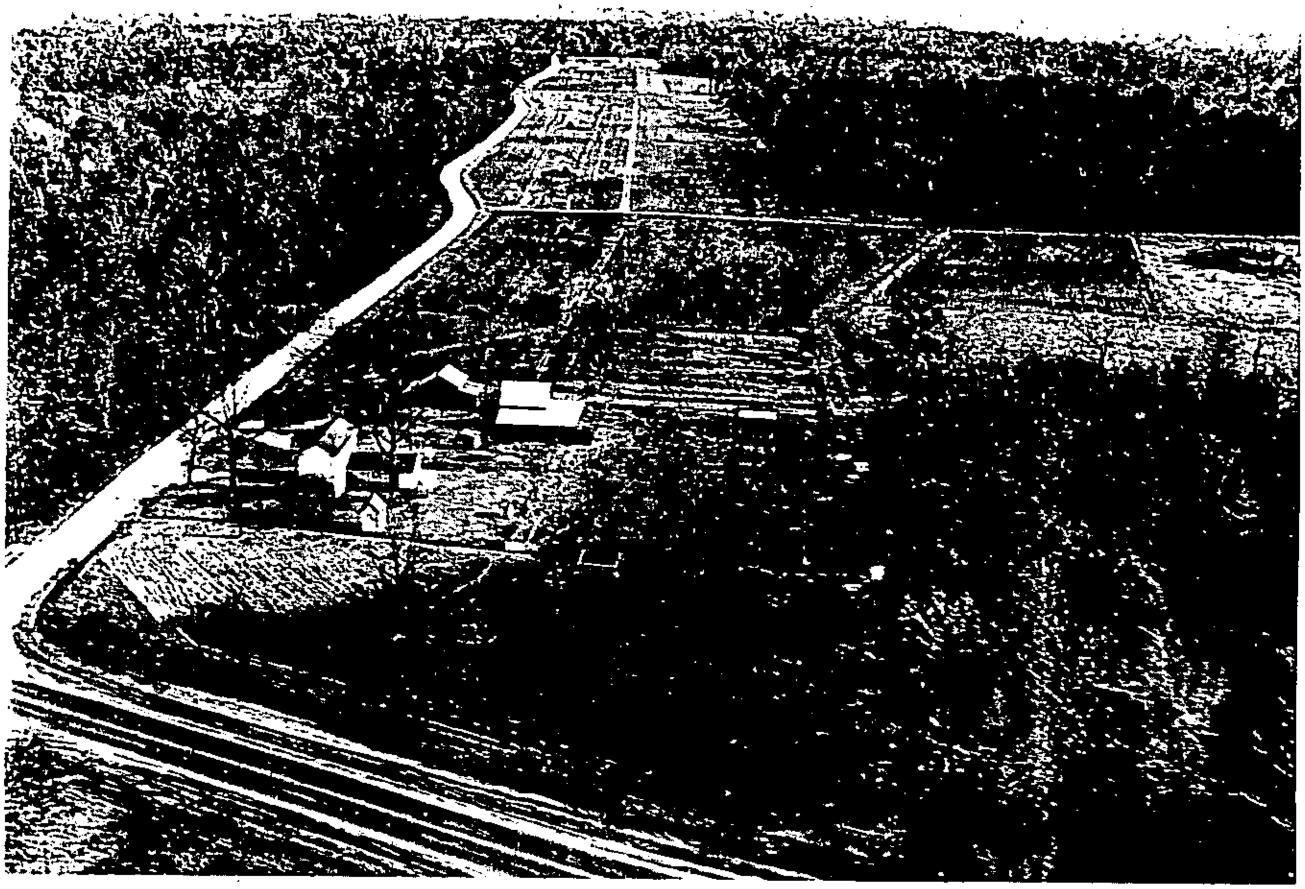

**". . . the fundamental ideal of forestry is in the perpetuation of the forests by use. Forest protection is not an end in itself; it is a means to increase and sustain the resources of the country and the industries which depend on them."**

*President Theodore Roosevelt, announcing a program that set aside 132 million acres of public land as forest reserves, 1901.*

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