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**Forest Service**

# Fire Management Notes

Volume 51, No. 2
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# Fire Management Notes

An international quarterly periodical devoted to forest fire management

United States Department of Agriculture

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## Contents



### Short Features



**Front Cover:** Firefighters rest in lingering smoke and haze from the 1985 Butte Fire on the Salmon National Forest in Idaho. Caught by a firerun up Wallace Creek, the 73 firefighters survived the ordeal lying facedown for an hour and a half in their fire shelters while firestorms passed over them three times. For a full story of this event, read Gary Turbak's article, "To Hell and Back in a Pup Tent," in *American Forests*, September 1986, p. 29ff. Photograph: Ron Yacamello.

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# Safety—Take Heed!

**Jerry L. Monesmith**

*Branch chief for safety and training, USDA Forest Service, Fire and Aviation Management, Washington, DC*

It's been a tough fire season in a year of continuing drought over much of the West. Southern California recorded the driest winter in 133 years—and that comes after its fifth year of drought. By October 1, 1990, 60,956 fires were reported and 4,575,846 million acres (1.9 million ha) burned. But worst of all, 14 firefighters had lost their lives: 2 suffered heart attacks, 1 was struck by a falling limb, 3 died in an aircraft accident, and 10 burned fatally in fire entrapments. Twenty others survived injuries received in fire entrapment situations.

### To Reinforce What We Already Know About Safety

There is little firefighters can do to change the weather, but firefighters and their crew leaders can do a lot for themselves on the fireline. After eight fatalities occurred when firefighters were entrapped by fire on June 26 and 27, 1990, the National Wildfire Coordinating Group (NWCG) issued a Fireline Safety Gram and distributed it to wildland fire protection agencies. That Safety Gram underscored the importance of going back to basics when it warned:

> These accidents reinforce the need for being continually alert to the "Situations That Shout Watch Out" and ensuring that all of the "10 Standard Fire Fighting Orders" are followed *before initiating tactical operations*. This is particularly important in areas that are experiencing severe burning and weather conditions. [Emphasis added.]

Also in the Safety Gram is a hot tip from hotshot crew superintendent, Paul Gleason. Superintendent Gleason shares his safety strategy, simply outlined with his easy-to-remember acronym, L.C.E.S., meaning Lookouts, Communications, Escape Routes, and Safety Zones. He explains: "If a fire crew has these four areas established and understood, then they can look forward to a safer assignment." Following L.C.E.S. is basic to fire crew safety.

**Know your shelter; know the "Watch Out" Situations; follow Fire Orders.**

### Fire Shelters—What We Learned

"Your life may depend upon it!" It's common knowledge among firefighters that fire shelters save lives. Each firefighter is equipped with one; each firefighter has experience deploying it. But out of the classroom, in an actual crisis with its confusion and unpredictability, use of the shelter to the best advantage needs to be improved. Our understanding of shelter use keeps growing. Recently, Ted Putnam, equipment specialist at the Missoula Technology and Development Center, concluded his examination of the Accident Investigation Report on each incident where there were fatalities from entrapment. His findings add to our understanding on how to use the fire shelter in an emergency. He concludes that the actions described in the following paragraphs will improve the survival chances of firefighters who become entrapped by wildland fires:

1. Carry your fire shelter where it can be easily reached and removed without taking off your pack. Never carry a shelter inside a pack.
2. Once an entrapment becomes likely, protect your airways above all else while attempting to escape or deploy shelter.
3. First, attempt escape where success is likely.
4. Before a flame front arrives, the air is often very turbulent. It takes longer to deploy a shelter in these conditions. Hold your shelter very tightly so it is not blown away or damaged, and allow extra time to deploy.
5. When escape is questionable, first—and this is your top priority—take your fire shelter out of the carrying case, and remove the polyvinyl bag by pulling the red ring. Carry the folded shelter in your hands ready for quick use. While trying to escape, partially open the shelter to use as a heat shield against radiant heat. Do not use the shelter as a shield against hot gases or a flame front because your airways would be unprotected. When extra speed is essential for escape, get rid of all your tools, saws, packs, or other encumbering equipment to travel as light as possible.
6. Whether trying to escape or finding and improving deployment sites, leave sufficient time to get under your shelter before hot gases or the flame front arrives.

This is critical. Remember—if you must make a choice—it is better to be on the ground before the hot gases and flame front arrive than to be in your shelter.

If hot gases and a flame front arrive before you can get into your shelter and reach the ground, finish shelter deployment on the ground as rapidly as possible. Again for emphasis, do not expose your airways. If you only get partially deployed, protect your head and airways with your shelter as your number one objective. That is best done on the ground.

7. Once you deploy, stay under the shelter. No matter how bad it is under the shelter, the heat can be 10 to 20 times worse outside the shelter. Movement of people after they deploy but prior to dissipation of thermal and smoke hazards is contributing to the number of fatalities and seriousness of injuries.
8. If entrapped without a shelter, lie face down with your arms curled around your head and, no matter how bad your back is being burned, stay there. This is your best chance to survive. It is always hotter off the ground than at ground level so keep your nose and body pressed to the ground and stay there.
9. If you are under the fire shelter and the inner layer of glass cloth starts to separate from the aluminum foil, the glass cloth may burn you but it will cool off rapidly. If this occurs—and this is critical—remain under the shelter and keep movement to a minimum, because the foil can now be torn easily. Even if the foil breaks open and flames enter, it is still worse outside the shelter. When conditions are so extreme that the fire shelter starts to fail, severe injury and death are very likely if you leave the shelter. Stay under the shelter—you can still survive.
10. Practice, at least once, removing your shelter with all your gear on in the same way you will carry it on the fireline while running and walking fast. Practice also getting into your shelter while lying flat on the ground. ■



## Cooperative Agreements for the Use of FEPP

The cooperative agreement is the grease that keeps the wheels of the USDA Forest Service Federal Excess Personal Property (FEPP) lending program from squeaking. FEPP use requires cooperative agreements between the lender and the user.

### The Essential Cooperative Agreements

The USDA Forest Service has the authority to loan FEPP to a State Forester for fire protection. To use this authority to lend FEPP, the Forest Service must have a cooperative agreement with the State Forester. In turn, the State Forester, in assigning FEPP to a fire cooperator, must also draw up a cooperative agreement with the cooperator.

Those borrowing FEPP should be in at least one of the following categories:

- Fire protection
- Preparation of FEPP for fire protection (maintenance and modification contractors, the National Guard, or vocational-technical schools)

The kinds of organizations eligible to use FEPP are as follows: volunteer fire departments, rural fire districts, other State agencies with fire responsibilities, county fire organizations, State prisons, vocational-technical schools, timber protective associations, and State contractors.

### Cooperative Agreements Are Beneficial

A cooperative agreement helps eliminate misunderstandings and defines the role of each party to the relationship. The agreement can help settle disputes and foster the mutual benefits for which it was designed. ■

**Francis R. Russ,** *property management specialist, USDA Forest Service, Fire and Aviation Management, Washington, DC*

# Model for Diversity—Now Flying

**Harry Croft**

*Budget coordinator, USDA Forest Service, Fire and Aviation Management, Washington, DC*

Nearly 3 years ago, Deputy Chief for State and Private Forestry, Al West, formed a group of interested fire people to figure out what could be done to improve the role of Fire and Aviation Management in achieving workforce diversity. The initial product was known as "A Model for Workforce Diversity" or simply the "model." From that document, 15 recommendations were adopted for implementation. The attitude the model grew out of was simple: Let fire folks solve their own problems; they know best what those problems are and have the most at stake in an upbeat resolution. The model focused on reasonable actions that would accomplish as much as possible within a short period of time.

### Taskforce Recommendations

What were those recommendations fire people thought needed attention first to make a difference in workforce diversity in the fire community? Briefly outlined here are the recommendations selected for immediate attention and background sketches of the circumstances that inspired them. Many of these recommendations have been completed or are well underway. The "can-do" ability of firefighting people has long been recognized. We are not done with our work, however, but we have made a good beginning.

1. *Annual Funding for Special Projects.* Problem: Creativity in recruitment, development, retention, and advancement of minorities and women suffered from lack of adequate funding.

   Recommendation: Designate annual funding of $580,000 per year for special project proposals.
2. *Identification of Hiring Goals.* Problem: To meet Forest Service 1995 workforce diversity goals, Fire and Aviation Management must first know the breakdown of its current staffing. (Fire and Aviation Management employees make up 10 percent of the total Forest Service workforce.)

   Recommendation: Increase hiring in underrepresented groups.

**The work outlined in the model is not complete. . . .Perhaps you can volunteer to take an active part.**

3. *Hiring Strategies.* Problem: It has been difficult to increase ethnic groups' representation in the workforce because their populations are unevenly distributed throughout the country.

   Recommendation: Develop hiring strategies at the national level bolstered by regional strategies to increase minority employment.
4. *Recruitment Guide and Video.* Problem: Supervisors and employees need to improve recruitment skills and techniques.

   Recommendation: Develop a recruitment desk guide and recruitment video providing the following: the qualities of a good recruiter, how to reach specific groups and build a networking system with those groups, the latest information on hiring authorities, the kind of information to give prospective recruits, sources of recruits within the agency or related agencies, and retention of employees.
5. *Interagency Hotshot Crew (IHC) Detailer Advertisement.* Problem: There is little information about the IHC Detailer program outside the regions in which they are now functioning.

   Recommendation: Publicize the program and distribute information more widely.
6. *Recruitment Specialist Skills.* Problem: More recruitment skills are needed to achieve workforce diversity goals.

   Recommendation: Create a position description for a Fire and Aviation Recruiter/Career Counselor/Trainer.
7. *Cross-Training Specialist Skills.* Problem: It is difficult for interested employees to move from other functional areas to fire management because they lack knowledge and experience.

   Recommendation: Develop a program that trains employees in fire management through on-the-job training and formal courses.
8. *Promotional Campaign "You Make the Difference."* Problem: Inappropriate behavior significantly reduces the retention of women and minorities in the Fire and Aviation Management workforce.

   Recommendation: Develop a "You Make the Difference" program that promotes mutual respect, diversity, teamwork, and appropriate behavior.

9. Fire Management Notes *Articles.* Problem: Firefighters need to be informed through an easily accessible source about what is inappropriate behavior and hear the stories about those who operate successfully in a diverse workplace.

   Recommendation: Publish articles about what is inappropriate behavior, positive and proactive management principles, and successful experiences in the workplace.
10. *Human Resource Specialist Positions.* Problem: In the intensity of the emergency incidents, it is easier to overlook an individual's civil rights than in the less-pressured situation.

    Recommendation: Assign a Human Resource Specialist to all fire incidents with 300 or more people in a camp situation.
11. *Civil Rights Training Packages.* Problem: See Number 10.

    Recommendation: Develop a civil rights training package to be included in all I- and S-course fire training.
12. *ICS Course Development Direction.* Problem: The ICS course materials need to be as sensitive as possible to the civil rights of all participants.

    Recommendation: Include women and minorities in an assigned cadre to develop or revise ICS courses.
13. *Accountability for Appropriate Behavior.* Problem: Accountability for appropriate behavior of the incident commander and line officer and crew and individual has not been adequate.

    Recommendation: Direct policy statement about civil rights and equal opportunity to all incident personnel responsible for incident performance ratings, a policy statement to line officers and incident commanders, and an incident evaluation form for incident personnel to provide feedback to overhead teams.
14. *Master Performer List.* Problem: Progress in workforce diversity is slowed when employees have little access to career information from people who have experience with the jobs they seek.

    Recommendation: Create a list of qualified Fire and Aviation Management employees who can provide good, sound career counseling.
15. *Twenty-Four Hour Dependent Care:* Problem: Single-parent or dual-career employees find it difficult to participate in fire management without reliable dependent care.

    Recommendation: Make available dependent care for extended periods up to 30 days for dual-career or single-parent employees.

**The Good Work Goes On**

Many of us over the years have participated in numerous taskforces to solve major issues only to see them recirculate years later. One of the principles followed in the model was to institute as many of the action items as possible—make them part of the way of doing business. Just as Incident Commanders are concerned with safety issues, they are similarly concerned with diversity issues.

One of the major issues is sexual harassment. Sexual harassment still dogs us in everyday life, not just Forest Service activities. The model recognized that some problems go far beyond the workplace, but the bottom line was to require a safe working environment for all employees. Both the Fire and Aviation Director L.A. (Mic) Amicarella and Deputy Chief West are proud to recognize the hard work of the Human Resource Specialists (HRS) aggressively dealing with human behavior issues in the fire camp setting. Sexual- or minority-related incidents caused by a few detract from the firefighting heroism exhibited by the thousands.

The HRS cannot do it alone, however. Just as we would warn a coworker about a falling tree, all of us must regard protecting human rights and dignity as an important responsibility. Just think of the pain many proud people have endured by a single individual's indiscretion.

The work outlined in the model is not complete. The written parts are done, the actions to be taken identified—no one I have met has disagreed with the intent and the recommendation—but as with other efforts like this, ours will not be longlasting unless it is used, displayed on the front desk rather than collecting dust. There are and there will be many other diversity taskforces within the Forest Service as the agency struggles with difficult staffing issues. As Deputy Chief West recently said, "Fire and Aviation Management has unique situations that need unique solutions. It is entirely appropriate for us to take the lead and propose solutions."

*Deputy Chief Al West signs off on the publication of "Workforce Diversity: A Model for the Future" along with Doug Bird, Region 4 fire director and chairperson for the "Model."*

### To Learn More—a Publication

Background about the model, the taskforce recommendations, and some of the products of this workforce diversity effort have been recently published in "Workforce Diversity: A Model for the Future." More than 2,000 copies are being distributed to Forest Service units, from the Washington Office to the ranger district. There is still a lot of followup and oversight needed over the next several years. Perhaps you will be asked to help in some of the remaining tasks or refinements. Perhaps you should even volunteer to take an active part if you have good suggestions in need of development. Let's not let this plan gather dust. As we do for safety issues, be informed, keep a sharp lookout, and act decisively. ■

## Take a Hike!

Whenever I investigate woods or grass fires that occur along a road or trail, I walk along and scrutinize both sides of the road or trail for at least 1/4 mile (0.4 km) in each direction from the main fire.

Often, firebrands of the type that caused the main fire fail to ignite combustible vegetation and, if they do, may only burn a very small spot. This allows an intense search of the small burned area. I can then return to the main fire and search the general origin area with a better idea of what may have caused the fire.

This method often helps me solve the fire mystery.

Here are some of the things I may find and what they could mean:

- Greasy carbon particles—improperly tuned diesel engine.
- Small bits of metal—improperly towed vehicle or farm equipment or mechanical failure of some sort.
- Matches—a deliberately set fire along the road (a fire near which one match is found may be an accident, but more than one match causing separate fires is no accident).
- Incendiary device—many times these devices do not work well or they fail to land on vegetation and they can be found nearly entirely intact.
- Small burn spots with no apparent cause—several burned spots with no obvious causative agents in the burned area may mean that someone set the fires and still has the device, such as a cigarette lighter, in his or her pocket.
- Remnants of paper—sometimes to set fire, individuals drop burning tissue or paper out of their slow-moving vehicles.
- Fresh footprints, car tracks, or a horse's hoof prints—someone may recently have been in the area who has information about or been involved in the fire.

All of this, or any part of it, may be the evidence needed to help determine the cause of the main fire. So the next time you have a fire along a road or trail, take a hike. You may find the trip informative. ■

**Earl N. Meyer,**[1] *retired chief of the Prevention and Forestry Law Enforcement Unit, Wisconsin Department of Natural Resources.*

[1]Currently, Mr. Meyer is with Meyer Private Investigations, Sun Prairie, WI.

# A Trend Analysis of Fireline "Watch Out" Situations in Seven Fire-Suppression Fatality Accidents

**Gene A. Morse**

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## Introduction

Under the auspices of the National Wildfire Coordinating Group's (NWCG) Fireline Safety Committee, seven events resulting in nine firefighter fatalities were analyzed. Common to all the fatalities was the use of tractor-plow units. The tractor plow is the primary equipment used for forest and wildland fire suppression activities in the South and the East.

The events were well documented with extensive details, photographs, and maps. They provided an adequate background of the events and factors leading to the deaths of the nine firefighters. A careful analysis, it was believed, might reveal a pattern of unsafe actions that could be changed in the future to avoid a recurrence of these tragic events.

A first reading of the fatality reports indicated no common factors in fuels or topography. Some similarities were noted in weather patterns, but it was difficult to draw definitive conclusions based on the weather factor alone.

## Approach

The decision was made to apply the process developed in the NWCG Standards for Survival training program as the criteria for analyzing these events. The Standards for Survival focus on the 18 "Watch Out" Situations and the Standard Fire Orders. The "Watch Out" Situations and Fire Orders (see box) have gained widespread use as aids to safety among forest and wildland fire suppression agencies.

Practical application of the Standards for Survival training on an incident centers around identifying a potentially dangerous fireline event, linking it to a "Watch Out" Situation on the Survival Checklist, and then taking a positive action (observing the appropriate Fire Order) to eliminate or minimize the possibility of firefighter injury or death. One response from one of the fatality reports of the seven events illustrates how a "Watch Out" Situation was identified but the Fire Order was not observed:

- *Potentially Hazardous Event*—"It had been jumping our lines.... the thing [fire] had already jumped a 60-foot canal...."

### Standards for Survival: "Watch Out" Situation Survival Checklist

____ 1. Fire not scouted and sized up.*
____ 2. In country not seen in daylight.
____ 3. Safety zones and escape routes not identified.*
____ 4. Unfamiliar with weather and local factors influencing fire behavior.
____ 5. Uninformed on strategy, tactics, and hazards.*
____ 6. Instructions and assignments not clear.
____ 7. No communication link with crew members or supervisor.
____ 8. Constructing fireline without safe anchor point.*
____ 9. Building fireline downhill with fire below.
____ 10. Attempting frontal assault on fire.*
____ 11. Unburned fuel between you and the fire.
____ 12. Cannot see main fire, not in contact with anyone who can.
____ 13. On hillside where rolling material can ignite fuel below.
____ 14. Weather is getting hotter and drier.
____ 15. Wind increases and/or changes direction.
____ 16. Getting frequent spot fires across line.
____ 17. Terrain and fuels make escape to safety zones difficult.
____ 18. Taking a nap near the fireline.

### Fire Orders

**F** **Fight** fire aggressively but provide for safety first.
**I** **Initiate** all action based on current and expected fire behavior.
**R** **Recognize** current weather conditions and obtain forecasts.
**E** **Ensure** instructions are given and understood.

**O** **Obtain** current information on fire status.
**R** **Remain** in communication with crew members, your supervisor, and adjoining forces.
**D** **Determine** safety zones and escape routes.
**E** **Establish** lookouts in potentially hazardous situations.
**R** **Retain** control at all times.
**S** **Stay** alert, keep calm, think clearly, act decisively.

*These items were added to the 13 original "Watch Out" Situations after analysis of numerous accident investigations indicated firefighters were not aware these situations contributed to the accidents.

- *"Watch Out" Situation*—No. 16: Getting frequent spot fires across line.
- *Fire Order Not Observed*—1: Initiate all action based on current and expected fire behavior.

In analyzing these events, it was apparent that, in each instance, a single overlooked "Watch Out" Situation appeared to be the major contributing factor. Simply following that reasoning process a step further leads to the conclusion that if the dominant positive action—Fire Order—to counteract that negative situation had been immediately observed, then a tragic situation may have been avoided.

## Are firefighters becoming complacent about the "Watch Out" Situations and Fire Orders?

Perhaps some readers might say that the method used in this analysis is too simplistic—that overlooking common threats to safety is too basic to be neglected. In this response lies a pitfall: The "Watch Out" Situations—commonly occurring during a fire event—are hazardous situations. It is hard, when a fire seems routine, to believe that it could become threatening. But a fire event has the potential to develop a "Watch Out" Situation quickly. Danger is inherent in a fire event. To develop "scotoma" in regard to these dangers is a major contributing factor to many fireline fatalities.

What is scotoma and how does it apply to fireline fatalities? Scotoma, a medical term, has direct relevance to this analysis. Scotoma is, literally, a blind spot. In a psychological sense, it is that condition which occurs when a person tends to block out from his or her consciousness anything considered not important—or critical—to survival.

The significance of scotoma in fireline suppression operations is dramatically emphasized by this statement found in the fatality reports: "Personnel on the fire considered it to be routine ... until the fire blew up" (figs. 1 and 2). Although it was phrased differently in several reports, this same type of comment surfaced repeatedly. The meaning is clear: It was "just another fire" to the firefighters.

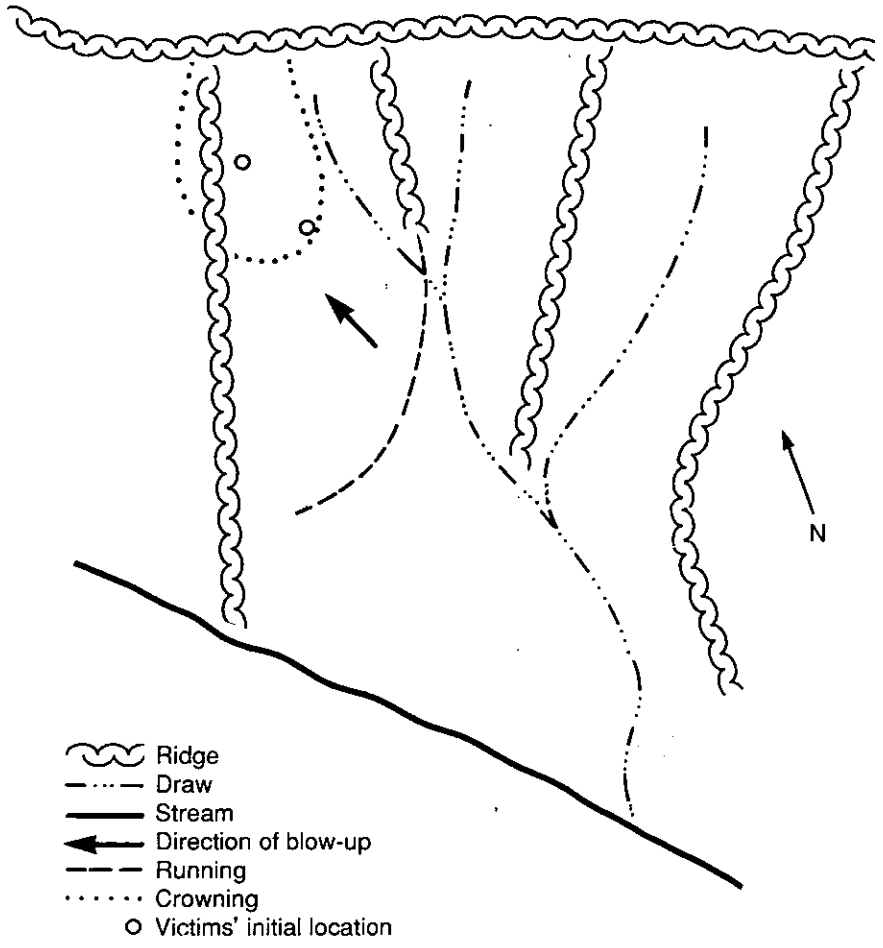


**Figure 1**—*A number of "Watch Out" Situations were present when a fire tragedy occurred in this mountainous region, resulting in two firefighter deaths. The familiar statement, "personnel on the fire considered the situation to be routine until fire blew up" was contained in the fire report. Note victims' location, on the windward side of the ridge, adjacent to a draw. Mild drought conditions existed, with 30-mile-per-hour (48 km/h) winds.*

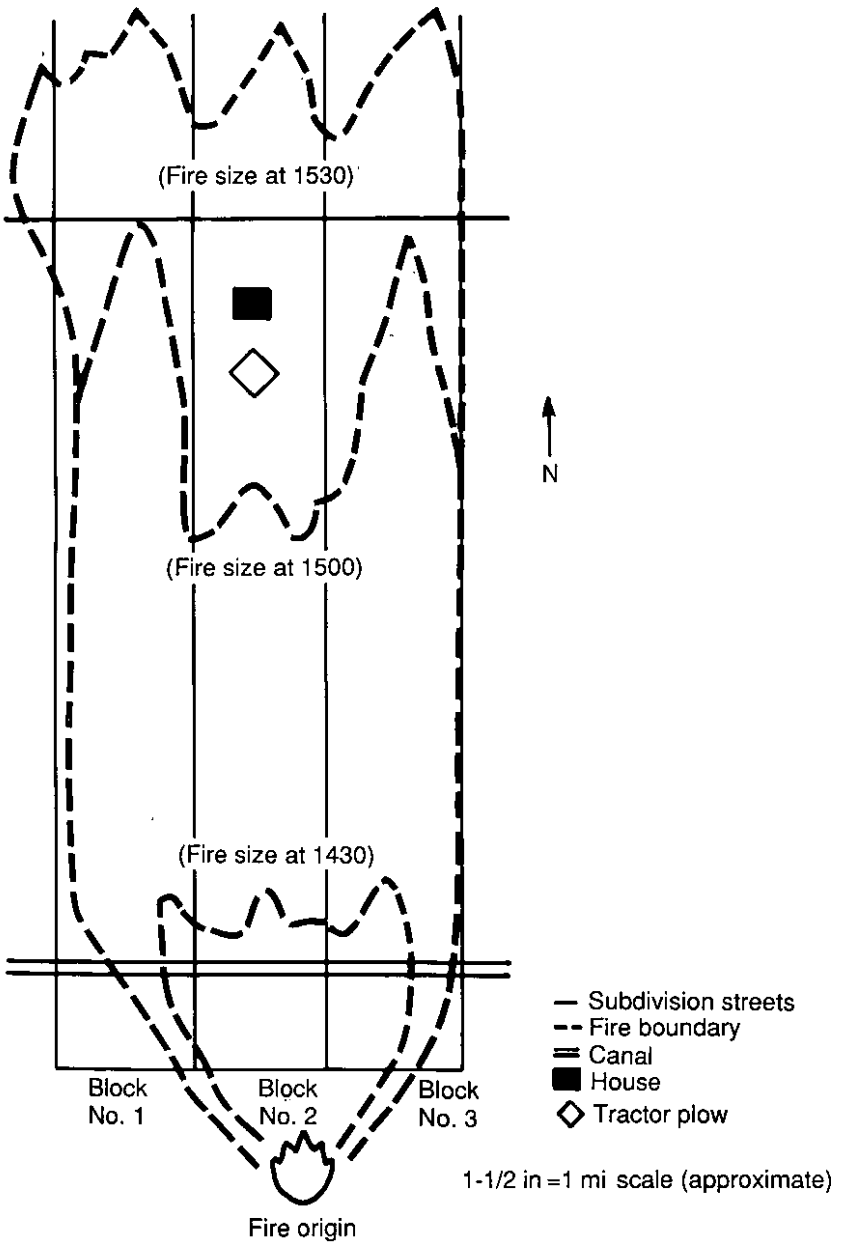


**Figure 2**—*This sketch of a fatality scene, prepared by a fire behavior analyst, illustrates a dangerous fireline condition. It shows the fire with three separate heads, burning in three subdivision blocks, part of a huge, largely unpopulated subdivision with heavy fuel loading. Mild drought conditions existed. Note the firefighter's tractor is located in a "pocket," with the fire heads on either side advancing more rapidly than the fire in Block No. 2. Personnel on this fire considered it to be "routine"—until it blew up.*

Scotoma had taken hold and blocked out sensitivity to hazardous events or conditions present in the fire environment.

The prevalence of this attitude or mindset was best expressed by a veteran firefighter recently during a fireline safety training session when he commented, "I know those things ["Watch Out" Situations] are out there on the fire, but I've seen them so many times I'm not really aware of them now."

## Trends and Conclusions

This analysis—to identify hazardous conditions or events in the fatality reports and then link them to the NWCG Survival Checklist—aimed at determining significant trends. The findings established that there were 84 separate hazardous conditions or events in the fatality reports. Some specific examples drawn directly from the reports, linked to the Survival Checklist, and the appropriate dominant Standard Fire Order are outlined in figure 3.

An analysis of the 84 hazardous conditions or events, when linked to the Survival Checklist, revealed the following trends:

- Twenty-two were tied directly to Survival Checklist Situation No. 4: *(Unfamiliar with weather and local factors influencing fire behavior)*
- Thirteen were linked closely to Survival Checklist Situation No. 7 *(No communication link with crew members or supervisor)*
- Twelve were connected directly to Survival Checklist Situation No. 15 *(Wind increases or changes direction)*

| | Hazardous condition or event | Survival Checklist | Fire Order |
|---|---|---|---|
| 1. | Initial instructions to the firefighter: "Grab the first piece of fire you come to—and do the best you can." | No. 6: Instructions and assignments not clear. | E: Ensure instructions are given and understood. |
| 2. | "[The fire] looked like one of those waves in Hawaii, like when you shoot the waves on a surfboard. The smoke was going up; it looked like an explosion." | No. 4: Unfamiliar with weather and local factors influencing fire behavior. | I: Initiate all action based on current and expected fire behavior. |
| 3. | Q: "What radio traffic did you get after _____ offloaded and started plowing?" A: "None ... I never heard any." | No. 7: No communication link with crew members or supervisor. | R: Remain in communication with crew members, your supervisor, and adjoining forces. |
| 4. | Q: "Had there been any briefings? Weather briefings? Fire behavior briefings? Safety briefings? A: "Not to my knowledge...." | No. 5: Uninformed on strategy, tactics, and hazards. | R: Retain control at all times. |
| 5. | "There was no apparent briefing with the crew on a plan of attack and escape, if necessary." | No. 3: Safety zones and escape routes not identified. | D: Determine safety zones and escape routes. |
| 6. | "Heavy palmetto growth prohibited penetration to safety only 60 feet away." | No. 17: Terrain and fuels make escape to safety zones difficult. | D: Determine safety zones and escape routes. |
| 7. | "[He] began initial attack by plowing lines across the head of the fire." | No. 10: Attempting frontal assault on fire. | F: Fight fire aggressively but provide for safety first. |
| 8. | "[He] noticed a space 50 to 100 feet long on the line that was not tied together." | No. 11: Unburned fuel between you and the fire. | O: Obtain current information on fire status. |
| 9. | "It [the wind] blew from the east, southeast, south, southwest, west, and then back again without warning." | No. 15: Wind increases and/or changes direction. | R: Recognize current weather conditions and obtain forecasts. |

**Figure 3**—*Nine examples of hazardous conditions listed on the Survival Checklist for which there is a Standard Fire Order.*

- Eleven were linked to Survival Checklist Situation No. 16 *(Getting frequent spot fires across line)*

What does this analysis of the deaths of nine firefighters establish? With 13 conditions or events associated with communication, it is obvious that poor or nonexistent communication placed the firefighter in a vulnerable position. No one can question the paramount necessity of maintaining close, effective communication with other personnel in the hostile fire environment.

But it is even more revealing to note that *more than half* of the hazardous conditions or events identified in the analysis relate to some aspect of fire behavior. Specifically, the relationship is clearly established between fireline fatalities and a lack of awareness or sensitivity to significant changes in fire behavior.

## Recommendations To Improve Safety

What recommendations can be made on the basis of this trend analysis to reduce scotoma on the fireline and ensure firefighter safety? Listed below are some specific action items that NWCG agencies may wish to consider:

- Besides the established national courses in fire behavior (Introduction to Fire Behavior; Intermediate Fire Behavior; and Advanced Fire Behavior), develop more localized fire behavior training focused on individual State or regional fuel types.
- Teach firefighters about fire science—the relationship between fuels, weather, and topography and fire—and how to transfer fire behavior knowledge into the most prudent application of tactics that will get the fire suppression job done without compromising firefighter safety. Followup classroom instruction in fire behavior training courses with simulated fire exercises in the field, where firefighters would be required to demonstrate safe, effective firefighting tactics in different fuel, weather, and topography conditions. Evaluate critically to determine if participants had made the right tactical decisions.
- Determine a fuel condition threshold (possibly fuel moisture) for their local area in which going beyond a certain level would signal the mandatory establishment of a safe anchor point, posted lookout, and designated escape routes and safety zones to ensure safe tactical operations in the event of

unexpected changes in weather and fire behavior.

- Give high priority to fireline safety training, such as the NWCG Standards for Survival course.

Agencies with few materials available for fireline safety training should obtain a copy of the recently prepared "Fireline Safety and Health Resources." This publication was developed by the NWCG Fireline Safety Committee listing materials available for sharing by all NWCG agencies.

Requests for copies of this publication should be sent to the Chairman, NWCG Fireline Safety Committee, USDA Forest Service, Post Office Box 96090, Washington, DC 20090–6090 ■


## Special Authority For Forest Service FEPP

The USDA Forest Service has special authority to lend Federal Excess Personal Property (FEPP) to State forestry agencies for fire protection. This special exemption is one of five under Public Law 94–519 (40 U.S.C. 483). It permits a Federal agency to lend FEPP to a non-Federal cooperator without paying the 25 percent surcharge (25 percent of the acquisition cost) to the U.S. Treasury.

Fire protection is an important mission of the State Foresters and the USDA Forest Service and our authority to obtain FEPP to use in that mission must be protected so that we do not lose it.

Federal and State employees who screen, order, manage, or use FEPP should keep in mind and remind others of the following FEPP requirements:

- The only authorization to acquire FEPP in this program is for fire use (FEPP must be used 90 percent for fire protection).
- Nonfire FEPP must be obtained through another program.
- It is O.K. to screen FEPP and not freeze anything!
- Property in this program must be identified as Federal property.
- FEPP must be inventoried and State and Federal records reconciled every 2 years.
- Cannibalization of FEPP must have Forest Service approval before any part of the property is removed.
- Disposal of FEPP must be done with Forest Service approval.
- There must be an approved air operations plan to obtain FEPP aircraft; potential use on Federal land is not a justification for acquisition.
- Nonaccountable FEPP control must be established and maintained.
- FEPP clothing that is nonfire protective can not be acquired.
- FEPP vehicle-storage areas should be neat and orderly.
- Unneeded FEPP should be returned to the Forest Service for disposal.
- Use of FEPP for fire by a State agency other than the State Forester must be covered by a cooperative agreement.
- Nonfire, nonemergency use of FEPP is not authorized

The rules for the use of FEPP are strict, but that's because we have a special program. Obtaining FEPP for only marginal fire use should be avoided, as it can only subject the program to criticism and possible loss of the program.

The accountability level for USDA personal property, including FEPP on loan, was recently raised to $1,000. This change should not indicate that there is a lessening of property control, but that we are now secure with the personnel and tools that are currently in place to manage and control this large volume of property on loan.

If you need help with managing FEPP, please contact your USDA Forest Service Regional/Area FEPP Manager or Francis Russ, Property Management Specialist, USDA Forest Service, Fire and Aviation Management, P.O. Box 96090, Auditors Building 2 SW, Washington, DC 20090-6090. Telephone number (202) 453-9491, FTS 453-9491. ■

**Francis R. Russ,** *property management officer, USDA Forest Service, Fire and Aviation Management,* Washington, DC

# Fire Shelter Deployment: How Long Does It Take?

**Billy Bennett**

*District ranger, South Carolina Forestry Commission, Spartanburg District, Spartanburg, SC*

In the Eastern United States, most fires requiring handcrews for suppression occur in the mountains and foothills of the Appalachian Mountain region. The fuel type in this area is primarily mixed hardwood stands with a loose hardwood litter floor averaging 2 to 6 inches (6 to 15 cm) in depth. Fire in this fuel type can burn intensely with short-range spotting and a high rate of spread. It can advance on firefighters with little or no warning and entrap them, leaving little reaction time for shelter deployment.

**If firefighters ever have to deploy their shelters, they not only should know exactly what to do, but how long it will take to do it.**

### Fire Shelter Deployment Tests

Timed fire shelter deployment tests were recently conducted in this fuel type to determine just how long it would take to clear the minimal 4- by 8-foot (1- by 2-m) site and to deploy the shelter. Three different types of handtools were used in the tests: the pulaski, the fire rake or council tool, and the forest fire shovel. Experienced firefighters proficient with each of these tools conducted the tests wearing nomex clothing, hardhats, gloves, and full web gear. All tests were conducted with the fire shelter mounted laterally on the web gear belt (fig. 1). This was found to reduce deployment time considerably. Removal of the shelter mounted in the upright position was hampered by the main yellow pack. The hard plastic liners in shelter cases also seemed to aid in quick removal.

After a deployment site was located, the firefighter was given the order to "deploy shelter" and the stopwatch time began. The firefighter then raked the 4- by 8-foot (1- by 2-m) area, removed the fire shelter from its pack, and deployed it. Time was stopped as soon as the firefighter was properly inside the shelter. This procedure was executed as quickly as possible to simulate being in a panic situation using minimum standards of safety. Therefore, the duff layer of root mass was not removed.

### Results

Three deployments were timed for each fire tool. The results in minutes and seconds were as follows:

| *Number* | *Pulaski* | *Shovel* | *Rake* |
|---|---|---|---|
| 1 | 1:49 | 1:43 | 1:32 |
| 2 | 1:35 | 1:19 | 1:19 |
| 3 | 1:38 | 1:31 | 1:07 |
| Average | 1:41 | 1:31 | 1:19 |

### Conclusions

Raking a deployment site in this fuel type resulted in a significant fuel buildup adjacent to the deployed shelter (fig. 2). This buildup averaged a length of 8 feet (2 m), a width of 3 to 4 feet (1 m), and a depth of 12 to 18 inches (0.3 to 0.5 m). In an actual deployment, heat generated from this buildup could be considerable. Additional testing indicated that another 30 seconds was needed to scatter this fuel sufficiently to avoid excessive heat buildup.

Practicing deployments in a classroom environment may not be sufficient training. Firefighters should

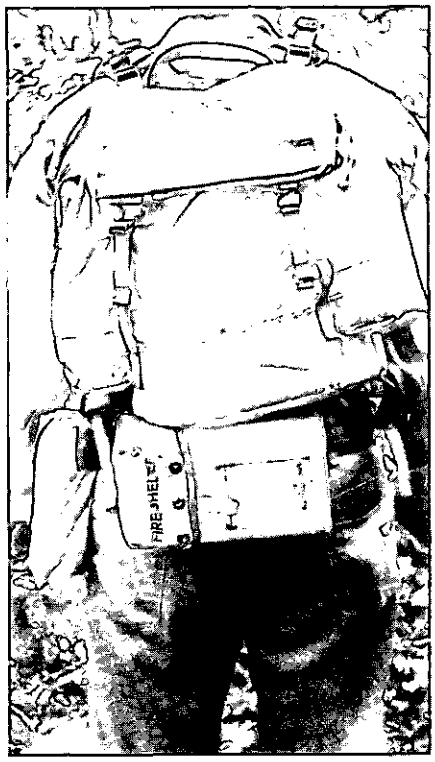


**Figure 1**—*Fire shelter mounted laterally on the web gear belt allows quick and easy access. Be sure all three snaps are tight.*

**Figure 2**—*Fuel buildup next to deployed shelter would generate considerable heat in an actual fire situation.*

consider practicing deployments in a fuel type common to his or her area of fire occurrence and should include site preparation.

The average deployment time in these tests should not be accepted by everyone because every firefighter works at a different rate of speed. Only timing yourself with your usual firefighting tool will prove just how long it will take for you. Practice! ■


## Fire Lookout System in New Hampshire

The State of New Hampshire began operating fire lookouts in 1910 when the State funded six stations. Before that time, there was one lookout and one ridge patrol privately funded during periods of high fire danger. Starting in 1910, the New Hampshire Timberland Owners Association constructed lookouts for the next few years, which the State operated; later the State reimbursed the Association for the construction costs. The Association also funded patrols of their members' woodlands. In 1911, there were 12 stations in operation, and 8 more were built that year. By 1912, 24 lookouts were in operation for the lookout season. The system continued to grow and evolve—some stations were abandoned in favor of more advantageous locations. As the USDA Forest Service added lands to the White Mountain National Forest, it took over many State-operated towers, enabling the State to establish lookouts in southern and central New Hampshire to provide more complete lookout coverage of these areas.

The lookout system reached its maximum number in the early 1940's when approximately 50 State and Forest Service towers were in operation. After this time, the fire danger from slash left by the 1938 hurricane and from wartime enemies subsided and both the State and Forest Service discontinued some stations. The Forest Service closed its last operating towers at the end of the 1968 season. The State experienced a tower revival of sorts, operating 30 towers from 1961 through 1973. During the next 4 years, 8 stations were closed and air patrols were started. In June 1981, budget problems caused the 22-tower system to be cut back to 15 towers. In 1989, the State operated 15 towers—one operated part time due to hiring problems and another only during high-danger periods. One tower, closed by the State in 1981, was reopened and has been operated by the town of Moultonboro, NH, since 1987.

For 1990, the State operated 10 towers. One additional tower, Redhill Tower, is operated in high-danger times by Ossipee Valley Mutual Aid Association (a dispatching service for fire organizations in surrounding towns and Moultonboro continues to operate the tower it reopened 3 years ago. There is 1 USDA Forest Service and 23 other towers on Kearsarge North Mountain. The State maintains 15 and the remaining 8 are owned by others or abandoned. Steelwork without the tower cabs exists on several more summits.

Anyone interested in more information about lookouts in New Hampshire or with historical information to share may contact Chris Haartz, P.O. Box 162, Campton, NH 03223. ■

**Chris Haartz,** *fire lookout, Department of Resources and Economic Development, Concord, NH*

# Horizontal Roll Vortices in Complex Terrain

**Donald A. Haines and L. Jack Lyon**

*Research meteorologist, USDA Forest Service, North Central Forest Experiment Station, Lansing, MI, and supervisory research wildlife biologist, Intermountain Research Station, Forestry Sciences Laboratory, Missoula, MT*

Observations of horizontal roll vortices (HRV) are well documented for intense wildland fires occurring on flat terrain (Haines 1987; Haines and Smith 1987). However, there have been no reported observations of HRV associated with complex terrain. Haines and Hutchinson (1988)[1] suggested that the additional atmospheric turbulence caused by rough terrain might dominate the balance of fluid forces necessary for HRV and quickly destroy formations. However, we conclude that HRV did form during an intense Montana wildland fire on a mountain face that was observed by the junior author. This article describes the phenomenon.

### What are HRV?

HRV are bent over, very slowly rotating fire whirls that typically form as pairs. HRV sometimes collapse outside of the fireline, dropping fire brands on suppression crews (Haines and Hutchinson 1988). They are, therefore, a threat to personnel working the flanks, especially near the head of the fire.

HRV form most often during extreme burning conditions with unstable air and light winds. Higher wind speeds and crossflows cause increased turbulence, which, in turn, causes HRV to break up. We found that fires with HRV were among the most intense ever encountered by firefighters.

[1]This half-inch VHS tape, costing $15, is available through Real Productions, 1821 University Avenue, Suite N–153, St. Paul, MN 55104. The address of the video sponsor, North Central Forest Experiment Station, is 1992 Folwell Avenue, St. Paul, MN 55108.

Horizontal vortices are common features of fluids, including the atmosphere. However, unlike vertical vortices, such as tornadoes or most fire whirls that spin rapidly, the angular velocity of a horizontal vortex is usually quite low. Horizontal roll vortices that form in fires develop vertically but bend over easily in light to moderate winds. They typically form as counterrotational pairs at or near the head of a fire and look like slowly rolling cylinders of smoke, flame, and ash, akin to lazy tornadoes lying on their sides (Haines and Hutchinson 1988). Fire-generated HRV, which may spiral out to the sides while moving downwind, are related to other fluid phenomena: the slow swirls of air in the atmosphere that cause long parallel lines of clouds called "cloud streets" as well as the helical motions in lakes that cause the formation of parallel lines of surface debris.

**Horizontal roll vortices sometimes collapse outside of the fireline, dropping fire brands on suppression crews and are a threat to personnel working the flanks, especially near the head of the fire.**

### The Hellgate Fire

The Hellgate Fire began near Missoula, MT, during late afternoon on July 12, 1985. When a suppression crew arrived on the scene 17 minutes after ignition, the fire had already increased to 5 acres (2 ha). Fire behavior included 10-foot (3-m) flame lengths along with crowning and spotting. An 8 mile-per-hour (13-km/h) southwest wind aided fire spread from the ignition point in a valley bottom, up a canyon face with a 50-percent slope. A temperature of 98 °F (37 °C) and a relative humidity of 12 percent resulted in rapid fire spread in cured grass. Fuels in the ignition area were classed as Fuel Model 1 in the Fire Behavior System (Anderson 1982).

The fire was not controlled until July 18 after 1,568 acres (635 ha) of forest land had burned. More than 900 firefighters were involved, as well as 23 ground tankers, 8 dozers, 4 rotary-wing aircraft, and 2 fixed-wing air tankers. In total, the strong containment effort indicates the intensity of this fire.

### Description of HRV Activity

HRV formed during late afternoon on July 15. Observations were made from a distance of 3 miles (1 ha) looking south-southeast. The fire had spread horizontally along a canyon wall and had reached the ridge line (A,A', fig. 1). A firebrand from the ridge caused a spot fire in unburned timber (S1, fig. 1) further to the east (left). The area of this spot fire increased rapidly, causing downhill airflow from the ridge. This activity apparently caused a second spot fire (S2, fig. 1). These two fire areas both crowned in Douglas fir and lodgepole pine, and then began a simultaneous run up the Hellgate north face to the main ridge (B,A, fig. 1). The fire activity took place about midslope on a steep hillside with a vertical rise of 2,600 feet (792 m) from the canyon floor to the ridge (B,A). The two columns, each about 300 feet (91 m) in diameter,

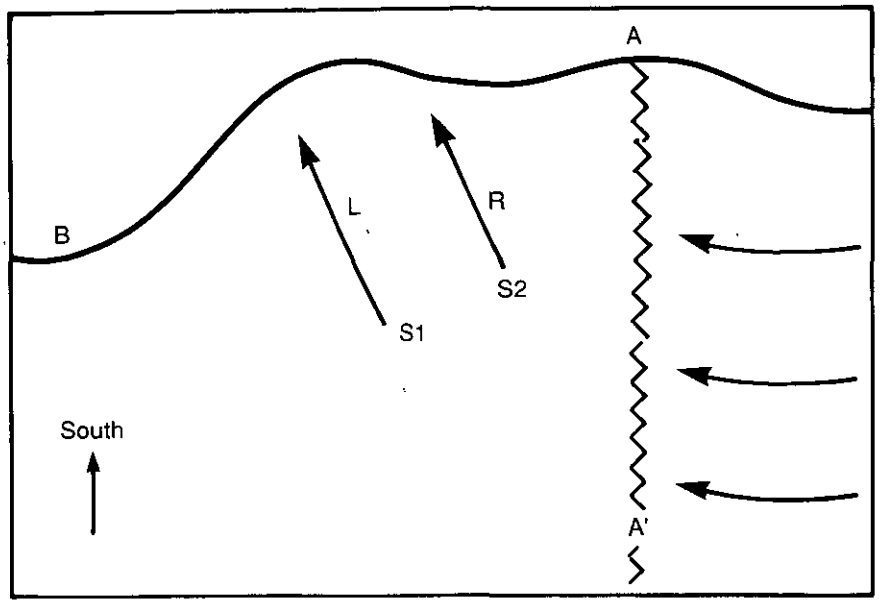


**Figure 1**—*The terrain and the fire's progress on late afternoon of July 15. The center arrows indicate the direction of fire spread to the main ridge on the Hellgate north face.*

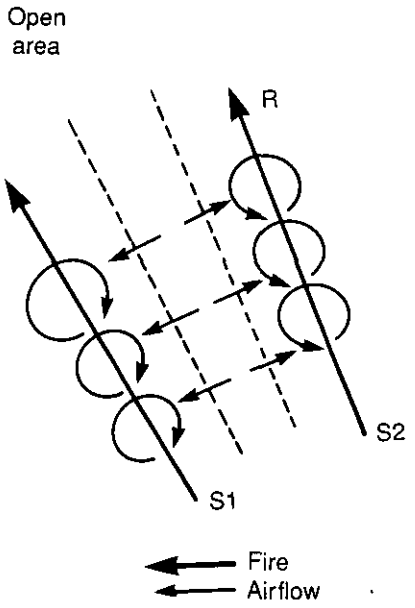


**Figure 2**—*Suggested airflow into and around the columns on the Hellgate north face.*

began to slowly rotate (fig. 2). Banding and rotation of smoke showed that airflow in the left column (L) turned clockwise, while airflow in the right column (R) rotated counterclockwise (fig. 3). Flames were also an integral part of the columns, although they are not apparent in the photograph.

The space between the two columns was relatively smoke free. This suggests that the major source of oxygen to sustain these fire columns descended from above into the open area (300 ft or 91 m wide) between them and spread both left and right near the surface to feed the two columns. The fire continued this behavior until the two columns reached the ridge (B,A). At that point, erratic fire behavior dominated and the columns stopped rotating.

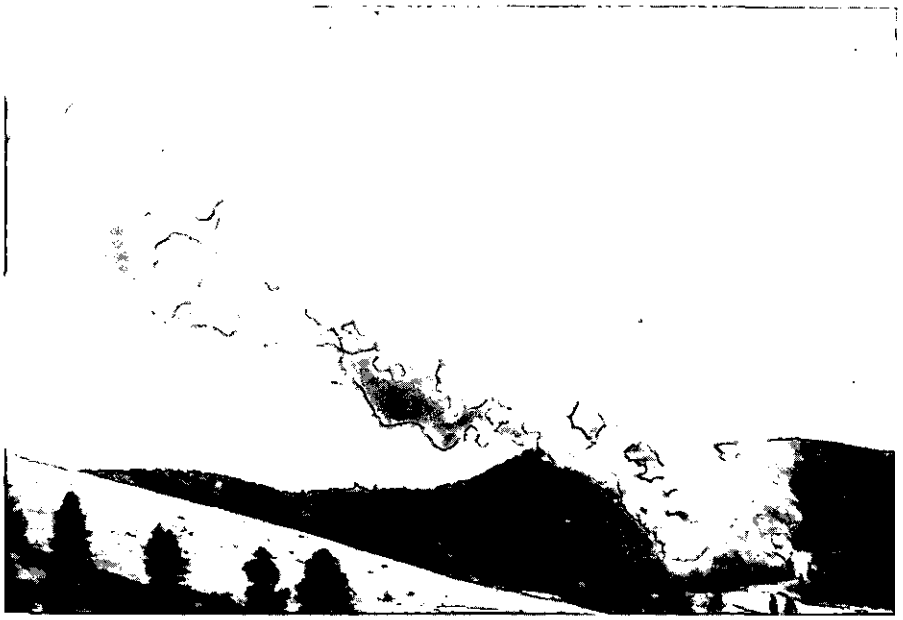

**Figure 3**—*A photograph of two smoke columns on the Hellgate north face showing counterrotational banding as well as the clear area between columns.*

### Implications

Because of the complex airflow and resulting turbulence, HRV do not form as easily in rough terrain as they do over flat land. However, the behavior exhibited by the Hellgate Fire shows that these fluid structures can form in complex topography. In a typical situation, a single smoke column separates into two columnar vortices. In the Hellgate Fire, HRV formation was aided by two well-defined spot fires that produced two columns. The final results are the same in either situation. ■

### Literature Cited


Anderson, H.E. 1982. Aids to determining fuel models for estimating fire behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 22 p.

Haines, D.A. 1987. Horizontal vortices and the New Miner Fire. Fire Management Notes 48(4): 26–28.

Haines, D.A.; Hutchinson, J. 1988. Vortices in wildland fire. [A 14-minute videotape.] St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station.

Haines, D.A. Smith, M.C. 1987. Three types of horizontal vortices observed in wildland mass and crown fires. Journal of Climate and Applied Meteorology 26(12): 1624–1637.



## Proceedings of the 10th Conference on Fire and Forest Meteorology

Paul M. Woodard, Co-Chairman of the 10th Conference on Fire and Forest Meteorology held in Ottawa, Canada, last year, reports that copies *of the proceedings are available free.* The theme of the conference, "Fire and Forest Meteorology in a Changing Environment: New Technologies and Concerns," springs from a larger concern for climatic conditions and our need, as H.L. Ferguson, Assistant Deputy Minister of Atmospheric Environment Service, Environment Canada, noted in his opening remarks to take "greater care of one part of our shared Global Commons—the Atmosphere."

The proceedings includes over 70 presentations given at sessions on lightning and forest meteorology, prescribed burning and fire effects, climate change, smoke management and air quality, forest health and productivity, fire behavior and danger, fire management, and fire weather and climate.

For your copy, write to—
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Edmonton, Alberta
T6G 2H1

# Command Staff Helps ICS Work

**David Hanson**

*Deputy fire chief, County of Los Angeles Fire Department, Los Angeles, CA*

The Incident Command System (ICS) includes three important positions whose officers are intended to function as an extension of the Incident Commander's authority. These officers—safety officer, liaison officer, and information officer—make up the command staff.

It seems that there may be some misunderstanding existing among those of us who deal with major wildland fire emergencies as to the role of the command staff. Some agencies have tended to assign lower-level employees to these positions and have used them as aides to the Incident Commander rather than as an extension of his authority. Certainly, the original designers of ICS did not intend that the command staff members function as minor officials in the organization (fig. 1).

### Safety Officer

Consider the safety officer, for example. The responsibilities and procedures for the safety officer set forth in the Command Section of the ICS Position Manual (ICS–220–4), grant the safety officer authority to put an immediate halt to any practice or procedures on an incident the officer deems to be unsafe. The safety officer is responsible for review of proposed strategy and control operations, for identifying any associated hazards, and for advising the general staff (operations, planning, logistics, and finance) of such hazards. Safety is everyone's business, but ultimately, the responsibility rests with the Incident Commander.

To help the Incident Commander deal with this important issue, ICS has provided the safety officer as part of the command staff to exercise all of the Incident Commander's authority to ensure a safe operation. Any agency or Incident Commander that has concern about safety on a particularly hazardous operation or incident should appoint a strong safety officer and, when needed, adequate subordinate safety staff.

### Liaison Officer

It is a mistake not to take the liaison officer appointment seriously. The liaison officer must be granted real authority on major wildland fire incidents, particularly those involving assisting and cooperating agencies. On a complex incident, it is not possible for the Incident Commander to coordinate personally the participation of these agencies or to respond effectively to their needs. This is when the liaison officer must have the authority to act for the Incident Commander.

The ICS Position Manual Command Section (ICS–220–3) describing the duties and responsibilities of the liaison officer, also describes the role to be played by the cooperating and assisting agency representatives. Agency representatives are expected to bring to an incident the authority necessary to commit resources and to speak for their agency in all matters regarding planning and operations.

Agency representatives are directed to report to the liaison officer. If no liaison officer has been appointed, the agency representative is to report directly to the Incident Commander. This organizational framework provides another clear example of the importance the originators of ICS placed on command staff positions. In order for the liaison officer to interact appropriately with agency representatives as intended in ICS, the liaison officer must have the authority necessary to make commitments for the Incident Commander in response to the needs and requests of cooperating and assisting agencies. As is the case with the safety officer position, if the complexity of the incident and the number of cooperating and assisting agencies make it necessary to appoint staff to assist the liaison officer, it is perfectly appropriate to do so.

**The original designers of the Incident Command System intended that the command staff function as an extension of the Incident Commander's authority.**

### Information Officer

The last member of the command staff, the information officer, must be considered equally important to the other members, particularly in light of the news media sensitivity of today's world. The information officer must be recognized as the Incident Commander's public voice, meeting the demands for information imposed by local politicians, agency administrators, the news media, and the general public.

Public information often plays a key role in obtaining support for incident operations from the agency, the public, and the elected officials that control or influence funding

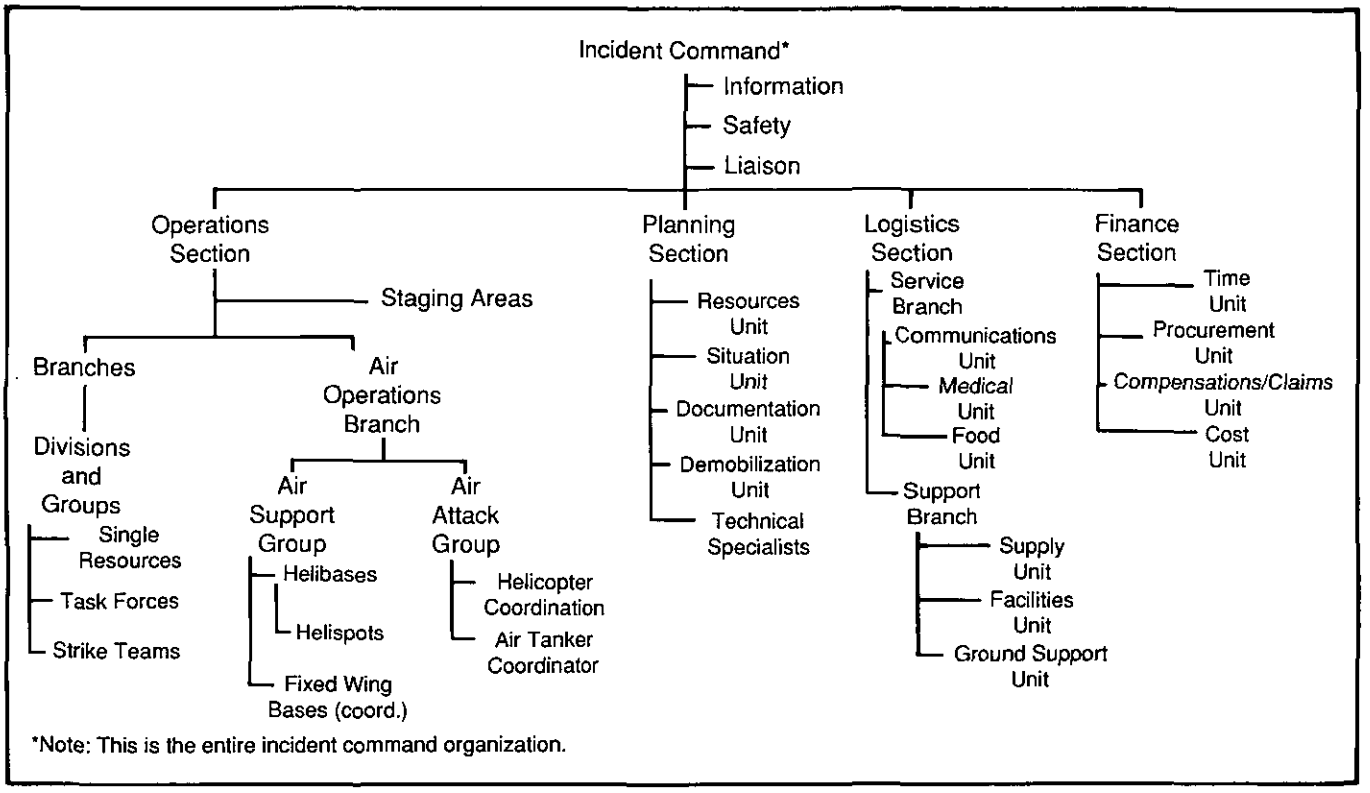



**Figure 1**—*Example of Type I or II Incident Organization. (Fireline Handbook 3, PMS 410–1, p. 32.)*

resources. The way public information is handled on an incident can affect ongoing incident operations and the agency's ability to function in the future. Of the command staff positions, the information officer may be the least misunderstood by ICS users. Some ICS observers have noted that, usually, the information officer position has been recognized as important and has been given a great deal more attention than the other command staff positions.

To conclude, the information officer, the safety officer, and the liaison officer, all must be recognized as key ICS officials. If used properly as an extension of the Incident Commander's authority, they can contribute greatly to the success of major wildland fire suppression operations. ■

# Management Effectiveness at the Leader Level

**Roger D. Erb and Jerry L. Monesmith**

*Fire management specialist, USDA Bureau of Land Management, Division of Fire and Aviation Management, Washington, DC, and branch chief for safety and training, USDA Forest Service, Fire and Aviation Management, Washington, DC*

Five very active fire seasons have occurred since 1985, involving a large, complex organization and massive mobilization and deployment of firefighting resources. Fire seasons 1987 and 1988 were two of the four worst in history. A major success story exists however! That story is the ongoing effective and efficient interagency cooperation and involvement, supported and encouraged by the Incident Command System (ICS), in successful fire suppression. Field personnel from the local fire department to the Federal agency can take most of the credit for this.

The National Wildfire Coordinating Group adopted the ICS for interagency use beginning in the 1986 fire season. Since then, many States, Federal agencies, and other emergency service practitioners such as police departments, medical or rescue services, the American Red Cross, and local fire departments either have or are seriously considering implementation. One of the results of the widespread use of the ICS is a concern about the management of wildland fire suppression operations at the strike team and task force leader level within the system. Numerous fire reviews and accident investigation reports identified concerns about the role, use, and quality of performance of leaders at this level.

### Geographic Boundaries Below the Division Level

The main area of concern revolves around geographic boundaries for line assignments below the division supervisor level. If only one strike team or task force leader is assigned to a division of the fire, that leader has definite boundaries marked on the fire map. If more than one leader is assigned to a division on the fire, depending upon assignment, the leaders may be expected to work anywhere within the division or may be assigned to work a portion of the division. In some cases, multiple leaders carry out various tasks within the same geographic area. It is at these intersections of authority that confusion has occurred. Up to now, these smaller parts of the division had no ICS nomenclature, making it difficult to assign a single individual overall authority and responsibility for the coordination of resources and implementation of planned tactics within the area.

**Should ICS reestablish the sector and sector boss position or create a different kind of geographic breakdown within the division?**

To relieve the confusion resulting from instances of overlap of responsibility, some recommended the sector and the sector boss position be reestablished. The Incident Command Working Team of the National Wildfire Coordinating Group considered the sector and sector boss option but decided not to reestablish the position. Instead, another kind of geographic breakdown has been created.

The term "segment" has been chosen to identify a geographical area of authority and responsibility within a division to which a task force leader, strike team leader, or single resource boss may be assigned authority and responsibility to coordinate resources and implement planned tactics. A segment may be part of a division, an area inside or outside the perimeter of an incident, or a fire or group of fires within a complex (fig. 1). Segments are identified with Arabic numbers. The number of segments established within a division should not exceed five, the span-of-control optimum.

Sector bosses were not reestablished by the Working Team because it was determined that adequate supervision is provided by the task force or strike team leader or the single resource boss in accordance with span-of-control guidelines.

No changes in the planning process are necessary because segments are used. Incident action planning can remain at the division level while allowing the division supervisors the option of dividing their divisions into segments on the line. On the other hand, divisions can be geographically subdivided into segments in the planning process and noted with corresponding tactical objectives under control operations on the Division Assignment List, ICS Form 204. This is consistent with the planning process as described in chapter 9 of the November 1989 NWCG Fireline Handbook 3, PMS 410-1: "The Planning Process works best when the incident perimeter and proposed control lines are divided into logical geographic units for planning purposes. The tactics and the resources are then determined for each of the planning units, and then the planning units are combined into segments or divisions, utilizing span-of-control guidelines." Too often, our planning

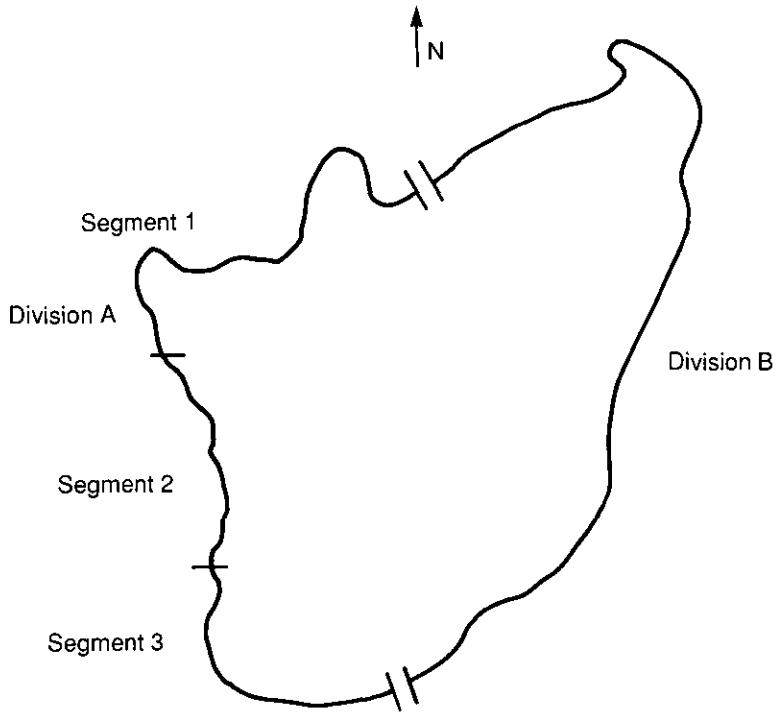



**Figure 1**—*A diagram of divisions and segments of one division, Division A. The leadership resources of Division A are a dozer strike team leader, holding task force leader, burnout task force leader, engine single resource boss, and crew strike team leader. From these resources, the crew strike team leader was made responsible for segment 1; the engine single resource boss, for segment 2; and the holding task force leader, for segment 3.*

process starts with predetermined divisions, and then we determine the resources needed for the division. Frequently, this kind of planning results in divisions with too few or too many resources for reasonable control. The concept of using segments for these planning units is compatible with a sound planning process.

## The Glamorous and the Flexible

Another reason for the lack of management effectiveness at the leader level may be from the overuse of strike teams (the use of the same kind and type of resource with a leader and common communications). Within the ICS organization, neither the task force (different kind and type of resource with a leader and common communications) nor the task force leader has been used to its fullest extent. The glamour of being a strike team leader and of strike team activities seems to overshadow our perception of the usefulness of the flexible task force. A task force may be more effective than the strike team in meeting specific objectives because of the mix of resources. This variety allows tactical objectives, in part dictated by terrain and fuels, to be met. Emphasis on the accomplishments of the effectiveness of strike teams may be resulting in the incorrect selection of needed resources and organizational units to meet the tactical objectives.

## Assigning Divisions

The third reason for concern about the role, use, and performance of the leader in ICS stems from a reluctance to designate divisions on initial attack operations or on small multioperational period fires. The ICS term "division" can refer to small geographic areas on a fire incident. A division does not need to only cover a large area, embrace a large number of resources, or have a division supervisor-qualified person commanding that division. The initial attack Incident Commander that separates an incident into two or more divisions regardless of the size of the incident has made an important step toward implementing ICS. If the incident escalates in size and complexity, the Incident Commander is in a position to expand the organization accordingly. Even if there are only two crews on a relatively small incident, the initial attack Incident Commander can assign one crew to take one side of the fire, calling it Division A, and assign the second crew the other side, calling it Division B. There is a no real need to assign a division supervisor-qualified person to command a division until or unless the personnel and resources assigned to that division reach a number that makes it necessary due to span-of-control considerations.

### Leader Importance

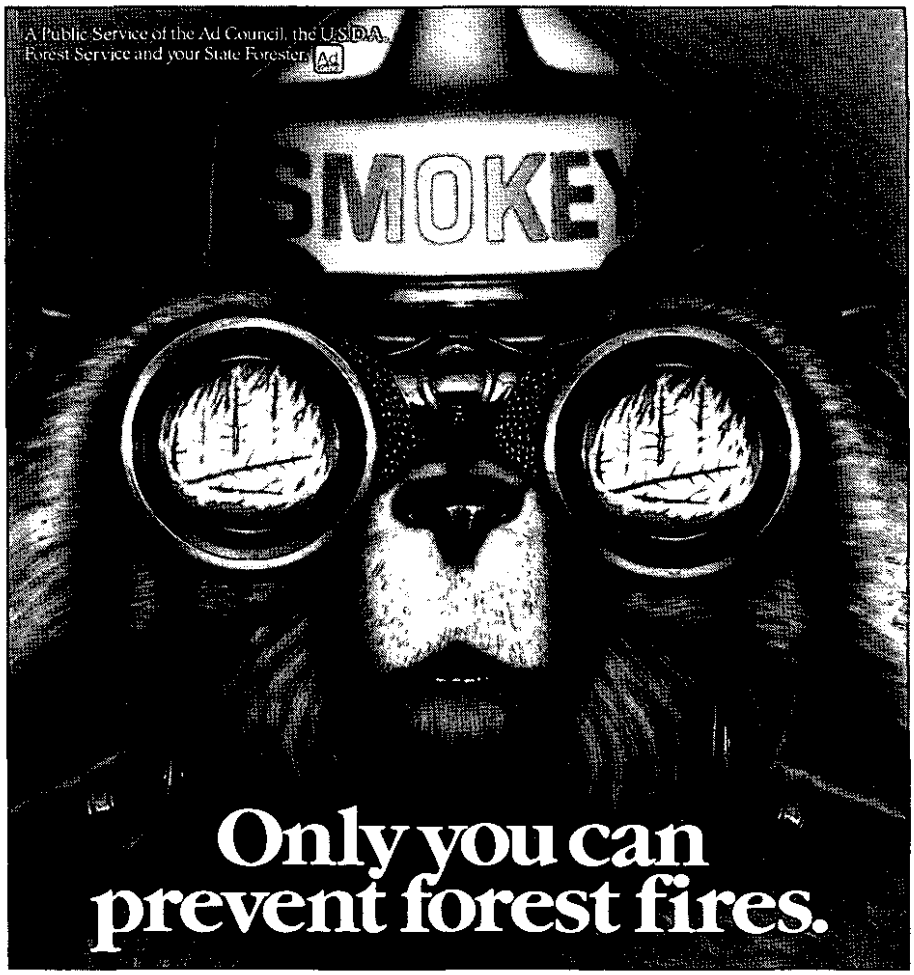
The leader is important in ICS. If used properly, the leader can enhance ICS safety, tactical effectiveness, and organizational efficiency. The use of this position is not mandatory. The decision rests with the Incident Commander. If span-of-control, geographical area supervision, or tactical operations can be improved, leaders should be assigned. Regardless of whether a task force or strike team leader is assigned, emphasis needs to be placed on the importance of the leadership role when describing what is expected in any tactical assignment. The designers of ICS intended that this position in the organization be the first level of management performed in the fire suppression operation. This individual who takes on the duties and responsibilities of that position, in addition to understanding the capabilities and use of the resources assigned, must also be able to employ the resources tactically and manage them effectively in fire suppression activities.

### Suggestions

The following is suggested as guidance to Incident Commanders and fire management personnel that may help build a more effective ICS organization, particularly at the leader level:

- Stress to division supervisors that they should make geographical assignments by use of segments to task forces or strike teams if it will make objectives more understandable and achievable.
- During incidents this season, stress the importance of developing good measurable objectives by division supervisors and the correct use of task forces rather than the possible overuse of strike teams in some situations.
- See ICS, not so much as a limiting factor or a formal dividing or organizing of our fires, but more as a basic framework for organization that can be applied to initial attack or even major incidents.
- Clarify objectives so that they are understood by all within the division or segments.

Above all, the leader is responsible for the safety of the resources assigned and should visit each group during the shift. The accomplishment of objectives results from not only quality management of resources but also the skill to use the resources effectively in fire suppression tactics. ■



# Fire Behavior in High-Elevation Timber

**Mark Beighley and Jim Bishop**

*Fire management officer, USDA Forest Service, Deschutes National Forest, Bend Ranger District, Bend, OR, and State forest ranger 1, California Department of Forestry and Fire Protection, Butte Ranger Unit, Oroville, CA*

## Introduction

The Fayette Fire was started by lightning on August 21, 1988, near Fayette Lake, on the Pinedale Ranger District of the Bridger-Teton National Forest. On August 24, a major fire run overtook Spike Camp 2. Government and personal gear was lost, but no personal injuries were reported. The fire was controlled on September 14 at a final size of 38,507 acres (15,500 ha).

It became evident early in the incident standard fire prediction methods, based on the procedures taught us at the Fire Behavior Analyst, course (S–590) at NARTC (National Advanced Resource Technology Center, Marana, AZ) were not applicable to the kind of fire behavior we were experiencing on the Fayette Fire. The fire did not spread continuously in surface fuelbeds. Torching, crowning, and spotting were common. In fact they were not just incidental, they were absolutely essential to the movement of the fire. Adjusting the fire model outputs by the use of recommended correction factors also provided unsatisfactory results. Fire spread rates and intensities were extremely sensitive to small variations in fire environmental factors, with quantum steps up or down in spread rate and intensity from small changes of relative humidity or wind.

We began to look carefully at the fire behavior, noting details of how the fire spread and monitoring the fire environment. Initially an attempt was made to measure spread rates that would allow us to calibrate fire behavior model outputs. Eventually we classified and correlated the fire behavior with important factors such as humidity and wind. Matching fire behavior "activity levels" with fire history data allowed us to make serviceable spread rate predictions. When weather predictions held true, our forecasts of fire intensity, forward spread rates, and fire perimeter increase proved reasonably accurate. The fire behavior information developed was incorporated into the tactical decisionmaking process and interpreted in the Incident Action Plan for fireline overhead and firefighters, allowing them to anticipate large increases in fire intensity.

**It became evident early in the incident standard fire prediction methods were not effective under these conditions.**

The fire burned mostly within the Bridger Wilderness on the southwest flank of the Wind River Mountains in Wyoming. Elevations on the fire ranged from 8,000 to over 10,000 feet (2,400 to 3,000 m). Most of our information relates to elevations between 9,000 to 10,000 feet (2,700 to 3,000 m), the zones of the fire that remained most active during our tenure from August 24 through September 16, 1988.

## Description of the Fire Environment

The environment in which the Fayette Fire took place provided a combination of variables that resulted in a broad range of fire behavior extremes, from total inactivity to conflagration.

The fuels were predominantly mature to overmature lodgepole pine and subalpine fir stands with a high standing dead component. The density of the timber stands varied greatly from nearly closed canopies to scattered stringers of timber on mostly rocky sites. Ground fuels consisted of a light to moderate dead-and-down component of windfallen tree boles with many decomposed logs. A large portion of the understory area was carpeted with grouse whortleberry, a 4- to 8-inch (10- to 20-cm) high herbaceous plant, portions of which were dead. Duff and litter were deep in rocky areas where fallen needles concentrated in crevices, and shallow, less than one quarter inch (0.6 cm), on flatter, less broken terrain. The surface fuel complex tended to be discontinuous over most of the area.

The terrain varied from well-defined drainages with a 60-percent slope on the lower elevations (8,000 to 9,500 ft or 2,400 to 2,900 m) to flatter but more broken terrain, dotted with small pothole lakes at higher elevations (9,500 to 10,500 ft or 2,400 to 3,200 m).

A wide variety of weather conditions were experienced. Temperatures approaching 80 °F (27 °C) and relative humidities in the 10- to 12-percent range occurred on several days, with winds up to 30 miles per hour (48 km/h). During the period from September 10 to 12, measurable precipitation fell, with high temperatures in the 30's (−1 to 4 °C) and minimum relative humidities in the 50's and 60's. Several cold fronts passed through the fire area, and on

one occasion strong east winds up to 40 miles per hour (64 km/h) developed unexpectedly.

### Fire Behavior Observations

Fire behavior in the previously described fuelbed was observed at close range on several occasions, for periods totaling approximately 30 to 40 hours. In addition to visual observation, measurements were made of spread rates, spotting distances, and time required for an initiating spot fire to generate enough heat to ignite tree crowns and start new spot fires. Simultaneously, observations were made of relative humidity, temperature, wind, and slope. The following description of fire behavior begins with conditions at the low end of the scale of fire activity and progresses to more severe conditions and higher levels of activity.

**Low-Level Activity.** The daily cycle of fire activity begins with a previous day's holdover fire that is burning in heavy, dead-and-down fuels. No spread is sustained overnight in the fine surface fuels, and even smoldering in the duff is minimal, much of it having gone out during the night when it reached thinner areas. As the day progresses and increasing temperatures and decreasing relative humidity lower fine fuel moisture, the fire begins to burn more intensely in heavy dead fuels, and it spreads into adjacent lighter fuels including dead, attached branches of trees; low-growing live evergreens such as juniper and lower portions of subalpine fire; and smaller dead-and-down material. Any spread into fine surface fuels at this point is limited to areas immediately adjacent to flaming, larger dead fuels.

Eventually heat builds up under a tree canopy, fire climbs the ladder fuels (which are abundant), and the tree or compact cluster of trees torches out. This kind of sporadic torching commonly begins by midmorning, earlier on drier days and later on more humid days.

When the radiant heat from the torching trees is available to boost the fire, it spreads in the fine surface fuels. As the surface fire spreads away and the radiant heat diminishes, the fine surface fuels generally go out. Occasionally a small "run" takes place in the whortleberry, but it requires a little wind and slope to keep it going. One such run measured 9 chains per hour (of slope 15 percent, midflame wind of 3 mi/h (5 km/h), and a relative humidity of 17 percent). Often the flanks of such runs go out and only the head keeps burning.

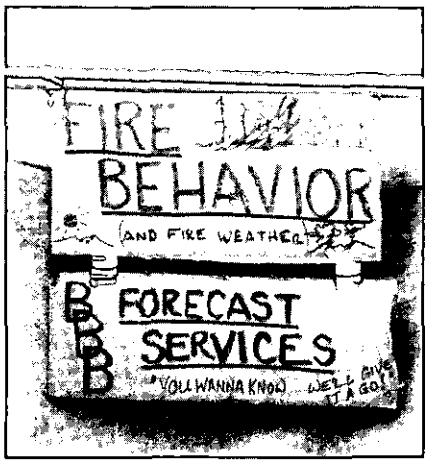
Torching tree crowns toss out firebrands to distances in the 100- to 200-foot (31- to 62-m) range. The more potent firebrands are commonly branch tips approximately one-quarter inch (0.6 cm) in diameter and fir cones. Firebrands shower an area downwind, but only a small fraction ignite new fires. Nearly all the active spot fires are in dead material in all stages of decay, from sound to decomposed wood. Firebrands landing in sparse grass, grouse whortleberry, or sparse needle litter usually do not light the material but if they do, the new fire goes out quickly.

The spot fires positioned under aerial fuels begin to increase in intensity until the ladder fuels are ignited. Common ladder fuels are a low bushy juniper that grows under the lodgepole pine, the lower foliage of subalpine fir, and dead branches attached to the lower portions of trees. The time for a spot fire to build sufficient intensity to torch out new crowns varies widely and depends a lot on the details of how the fuels receiving the firebrand are positioned relative to the ladder fuels. However, the time to crown torching is frequently an interval of 20 to 90 minutes.

We have termed the activity described above as "low-level." The torching is sporadic and isolated. No fire is sustained in surface fuels or crowns. Occasionally, where continuous fuels are positioned upslope or downwind of torching crowns, sluggish crown fire will move a short distance in the trees. The crowning overall would be classified as "passive." Perimeter advance in areas of continuing activity rarely exceeds 0.3 mile (0.5 km) during a burn period.

**Moderate-Level Activity.** At a level we have termed "moderate," the torching of crowns in isolated trees or small groups of trees is already occurring.

A key process in raising the overall level of activity is the maintenance of fire spread in the surface fuels. Even in the more severe conditions, spread in fine surface fuels is minimal and limited until it is aided by the radiant heat provided by torching trees or flaming, heavy, dead fuels. Fire in the surface fuels then spreads until it reaches new trees. Some time is required for the new trees to torch out. However, more-or-less continuous crown fire activity can involve patches of trees

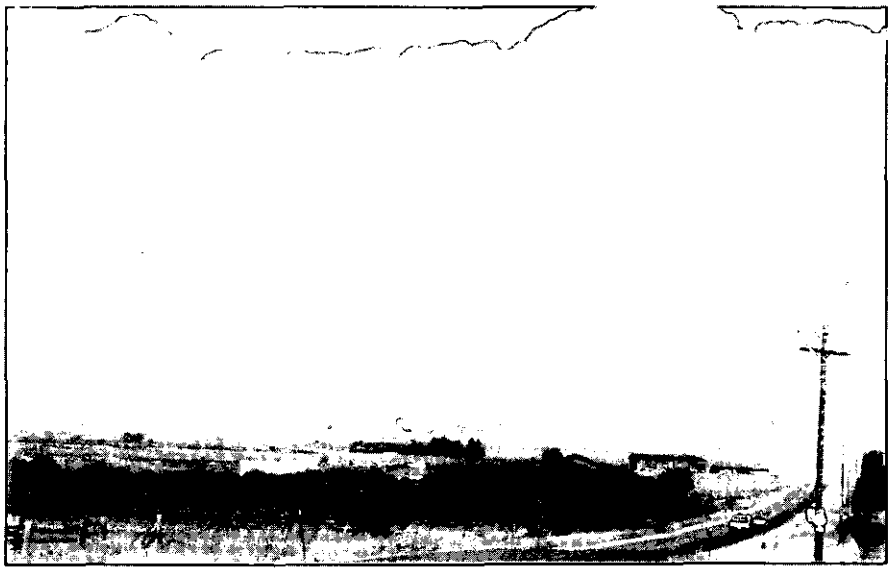



*Office for the firm of Beighley, Bishop, and Berkovitz.*

## Predicting Fire Behavior—the Skillful Art of Combining the Past With the Present To Determine the Future

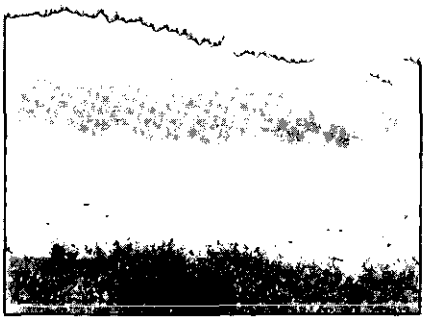
The Fayette Fire demanded something extra from fire behavior analysts—on-the-line fire prediction improvisation. Spotting was not just incidental to the fire, it was an essential element to fire spread. What was the environment like where this fire burned?—overmature lodgepole pine and subalpine fir where at some points canopies were nearly closed and at others stringers of timber trailed through rocky sites, terrain ranging from well-defined drainages to flatter broken terrain, and a wide variety of weather conditions. Combining maximum spot fire distances with the probable level of fire activity for the day (determined largely by relative humidity and wind) finally proved the successful method of predicting fire spread.

*Typical fuelbed of discontinuous ground fuels and lots of jackstrawed timber, viewed from the air.*



*View of the Fayette Fire from the Pinedale, WY, perspective on August 25, 1988.*

*Heavy down logs loaded drainage bottoms. These drainages formed wicks which propagated loaded fire spread.*

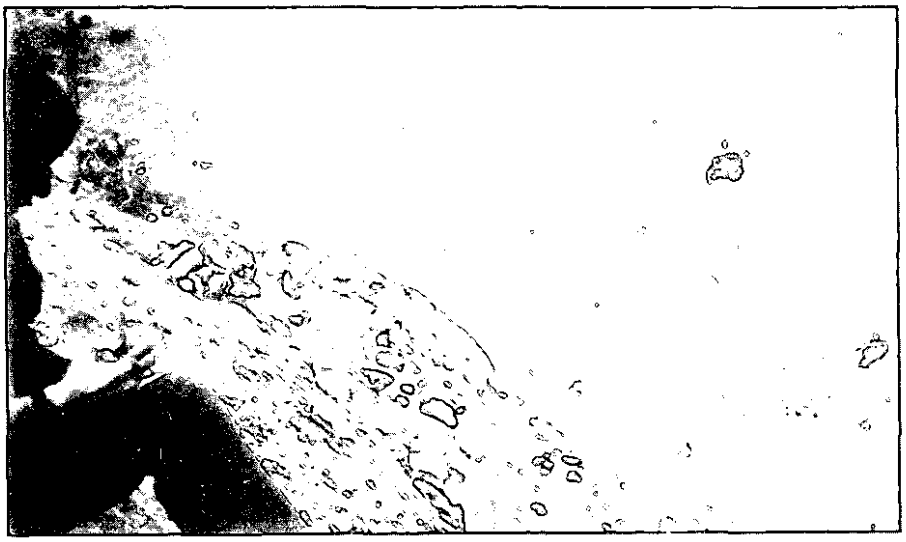


*Typical spot fire scenario. Spotting, up to 1½ miles (2.4 ha) ahead of the front, was common.*

*Typical ember landing in grouse whortleberry to start spot fires ahead of the main front.*

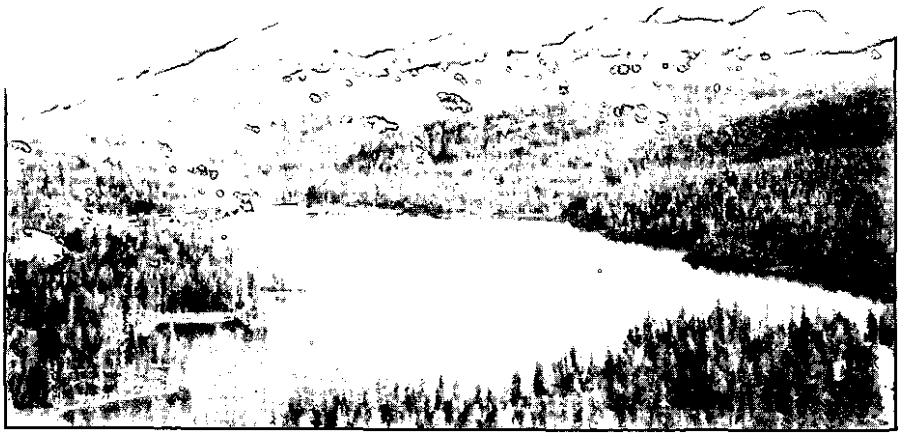
*Spot fire beginning to spread into surrounding fuel.*

*Dead logs under ladder fuel complex. Ignition under low relative humidity conditions caused instant torching of crowns.*



*Fire behavior analyst takes spread rate measurements and observations on an initiating spot fire.*

*Ignition of tree crowns would occur within minutes of the initiating spot fire.*



*The Continental Divide became the final fireline stopping the Fayette Fire. Horseshoe Lake is in the foreground.*

up to an acre or two (0.4 or 0.8 ha) in size before it dies away. The activity dies out when surface fuel discontinuity prohibits the continued involvement of new trees in torching. The crowning at this point is still essentially passive and dependent upon spread in the surface fuels. This is in contrast to that which occurs in low-level activity, which depends more on the preheating of canopies over individual spot fires and is not dependent on surface fire spread. Spotting activity continues, of course, and reaches out to approximately one-quarter mile (0.4 km).

At the upper end of moderate-level activity, crown fire runs are sustained that usually end when they reach the top of the slope. During these runs, the fire spread in surface fuels, driven by radiant heat from burning crowns, keeps pace with the crown fire. Short-range spotting, within a zone extending approximately 15 feet (5 m) ahead of the flame front in surface fuels, aids surface spread. There is an essential, mutually reinforcing interaction between the radiant heat from crowns impinging on surface fuels and the heating of new crowns by the spreading surface fire. The entire fuel complex is aflame, including surface fuel already blackened by passage of the surface flaming front, ground to crowns. This is classified as an "active" crown fire. One such run on slightly sloping terrain with 8- to 12-mile-per-hour (13- to 19-km/h) winds moved at 100 chains per hour.

Spotting reaches out to one-half mile (0.8 km). New long-range spots do not usually spawn new crown runs of significant proportions. They commonly trigger torching and crown fire over small areas. Fire spread during the burn period typically amounts to three-quarters of a mile (1.2 km).

**High-Level Activity.** On days of "high-level" activity, active crown fire is usually occurring by early afternoon. Low humidities make sustained spread in fine surface fuels prevalent. Without the low humidities and attendant, continuously advancing surface fire, continuous crowning cannot be maintained.

Major runs often develop in zones "seeded" with spot fires by previous days' activity. Significant areas (tens or hundreds of acres) become involved in active crown fire within a few tens of minutes, and major runs take off, driven by wind or slope. When winds reach approximately 15 miles per hour (24 km/h), some independent crowning takes place. Crown fire moves out ahead of the surface fire, at least for a while. Without higher winds, the independent crown runs are usually narrow and not sustained.

Long-range spotting reaches out to three-quarters of a mile (1.2 km), perhaps more in extreme cases. The long-range spots build rapidly enough to initiate new major crown runs. The fire moves across ridges and basins, with an advance of 3 miles (5 km) in a burning period being typical.

**Summary.** In summary, the salient features of each activity level are described as follows:

- *Low*—overall spread is maintained by torching and spotting. Surface fire spread does not aid crowning.
- *Moderate*—Spread is sustained by surface fire, active crowning takes place, but independent crowning is rare and long-range spotting does not give rise to new major runs.
- *High*—Active crowning is common, and independent crowning becomes important. Long-range spotting can initiate new major crown runs.

## Prediction Procedures

It is obvious that the mechanism of spread on this fire violated most of the basic assumptions on which the fire spread model is built (that is, no crowning, spotting, or fire whirls; uniform, continuous fuelbed; and source of ignition no longer influencing fire). Occasionally fire spread was limited to surface fuels, specifically in the grouse whortleberry and dead-and-down fuel component. Spread rates using Northern Forest Fire Laboratory Fuel Model No. 10 were well within the range of acceptance for such fire spread. But, overall, ground fire spread alone became such an insignificant component in predicting overall perimeter movement and fire intensity that the use of the standard fire behavior spread model was abandoned. The spot fire program in the BEHAVE System was very useful in predicting maximum spot fire distances. Fire spread predictions were made using a combination of maximum spotting distances and the probability that a certain level of fire activity would occur for that day.

The level of activity and consequent spread rate were closely correlated to two primary factors, relative humidity and wind. To oversimplify a little, the humidity basically determined the level of activity achieved by the fire, and the

wind dictated the spread produced by that activity. Without low humidities to accelerate the torching process, the fire was confined to limited spread in the surface fuels, with modest spotting. On several occasions, high winds, 30 to 40 miles per hour (48 to 64 km/h), failed to produce significant fire spread in the presence of humidities over 20 percent. The wind's major contribution was twofold:

- Provides the horizontal trajectory component necessary to transport firebrands well ahead of the crown fire
- When the relative humidity conditions supported active crowning, provides the horizontal thrust necessary to convert an active crown fire into an independent crown fire

The basic activity level was determined by the combinations of humidity and wind that are summarized in the matrix illustrated in table 1. Topography and fuel continuity in the active fire areas were considered and used to modify our initial judgments, up or down.

**Table 1**—*Fire activity level matrix**

| Relative humidity (percent) | Wind speed (miles per hour) | | | | |
|---|---|---|---|---|---|
| | 0–5 | 5–10 | 10–15 | 15–25 | 25+ |
| 10–13 | M-H | H | H | H | H |
| 14–16 | M | M | M-H | H | H |
| 17–19 | L | L-M | M | M | M-H |
| 20–25 | L | L | L-M | L-M | M |
| 25–30 | L | L | L | L | L-M |
| 30+ | L | L | L | L | L |

*Key: L = low-level activity, M = moderate-level activity, and H = high-level activity.

### Not Exactly by the Book

The fire prediction approach outlined above, though not refined, was workable in a situation that defied the conventional approach. We were able to provide useful guidance to the planners and to the firefighting crews.

**Some Useful Advice—Observe, Analyze, and Apply.** We hope that some of what we have reported is useful to others dealing with fires that have similarities to the Fayette Fire. At the least, we encourage the general approach we took on this fire. Begin with careful observation, continue with analysis of what is *seen, and apply what is learned.*

**Clearinghouse for Fire Behavior Analysis.** We encourage comment and input that relates to the information in this report. Furthermore, we would like to see the fire behavior analysis of a given incident routinely summarized and shared with other analysts. The report should address the general nature of the fire *behavior, verification, measurements,* the adequacy of the prediction system, and any techniques developed to improve prediction capability. Perhaps a central repository and clearinghouse could be created to make available or distribute the information. ■

# Criticism: Stumbling Block or Building Block[1]

**Gary F. Appleby**

*Deputy Chief, Philadelphia Fire Department, Philadelphia, PA*

"Hey, Knucklehead! The next time you attack a fire that size with a booster line, I'm going to strangle you with it!"

So much for the kind of fire service constructive criticism we all grew up with. I guess it wasn't all that bad; at least we got the message. Most of us managed to learn the "what," if not the "why."

Today, criticizing employees can be much trickier for supervisors. Out of professional and legal necessity, we've had to take criticizing out of our "reflex-action bag" and place it in the bag with actions to which we give some prior thought.

In the 1980's, profanity is out; empathy is in. Screaming is embarrassing; emotional control is requisite. Hidden agendas are cheap shots; being up-front is expected. Humiliating a person is destructive; saving face is constructive.

Most of us have taken more than our share of supervisional training courses that were designed to teach us how to get maximum productivity from our subordinates. However, there is a lack of specific information targeted for the fire service on the actual mechanics of criticism.

Criticism is a double-edged sword. As such, it can easily become lopsided, most commonly on the giving side. As professionals, we must be willing to accept justified criticism just as well, and as quickly, as we give it. For too many fire officers, the ability to accept constructive criticism decreases proportionately with each promotion, while the ability to deliver acerbic opinions to subordinates quadruples with each new horn. This is a trap that most fire officers have fallen into at one time or another. We take ourselves a bit too seriously and forget where we came from.

Most progressive fire officers have realized that criticism can have devastating effects on subordinates. In the business world, it is one thing to criticize a subordinate for the loss of a potential customer. However, in the fire service, it is quite another matter to criticize someone for questionable actions that resulted in injury, death, or needless damage to property. In our profession, the stakes are high. One thoughtless comment or unguarded remark can leave deep psychological scars that may weigh on the recipient's mind for many years. The untold emotional damage that we heap on ourselves through our own lack of compassion is staggering. Many of us fail to give our coworkers and subordinates the compassion and respect they need and desire.

### Points To Remember

Several points should be considered by the person initiating the constructive criticism before he or she begins to speak. First, consider if the person is really interested in hearing the constructive criticism. Some texts advise that the safest procedure is to withhold criticism until a person solicits it. This may be valid in theory, but in the world of emergency medical services or firefighting, repeating an error may pose an unacceptable risk.

As supervisors, we are obligated to inform our subordinates of their errors. Obligation comes with the territory. Without question, it is a much easier task if the recipient is seeking feedback. But for the supervisor to wait and hope that an invitation will be forthcoming is a sign of poor leadership. Newly promoted, first-line supervisors routinely make this mistake. However, if your criticism is aimed at a superior or peer, you may be justified in waiting for the invitation.

**In the business world, to criticize a subordinate for the loss of a potential customer is one thing; it is quite another to criticize someone for questionable actions that resulted in injury, death, or needless damage to property.**

Constructive criticism should be aimed at recent behavior. Bringing up a matter in which someone used poor judgment a month ago could do more harm than good. For the criticism to be evaluated and discussed intelligently, it should be as fresh as possible. As time passes, the reasons for our behavior can fade. To bring up an incident a week after it occurred often will put the employee on the defensive as he or she tries frantically to recall the circumstances. By delaying criticism, you place the recipient at an unfair disadvantage that will do nothing to foster a climate of message acceptance.

The recipient will wonder, "Why now? Why didn't the lieutenant tell me then?" Occasionally, the wondering will be expressed aloud. If you

[1]Reprinted with permission from "*Fire Command*®" 56(1), 1989, National Fire Protection Association, Quincy, MA 02269.

wait to criticize, you should anticipate the questions and be prepared with a legitimate answer.

Aim criticism at a subordinate's behavior, not at his or her personal character. Saying "I noticed that there was a significant delay in your drafting operation, and you appeared to be upset" will solicit a much more honest reply than saying "I knew you couldn't draft! Now you've proved it to us all!" The first approach describes an observed behavior and leaves the door open for frank communication, while the latter virtually shuts down any possibility of meaningful, two-way communication. Also, make sure that the behavior being criticized is one the subordinate can do something about.

Try to begin the conversation with a positive statement about the subordinate. A sincere pat on the back will pave the way for the criticism to come. However, your positive statement should not be contrived simply because some management checklist recommends its inclusion. In fact, any patronizing statement will surely be recognized as such and will be certain to add sting to the bite. If you have to think long and hard for something positive to say about a person, you're better off skipping this point and getting right to the matter at hand.

Criticism should be as specific as possible. Don't leave any gray areas as to what was unsatisfactory or what could have been done better. For example, if a form was prepared incorrectly, address the exact errors. If a fire attack didn't run smoothly, don't condemn the entire effort. Instead, address the exact evolutions that require improvement. If an administrative matter was mishandled, pinpoint the exact phases that should have been handled differently. Wholesale indictments are rarely appropriate; even our worst blunders usually have elements that were handled properly.

During the conversation, stick to the issues. Move on to new material only when you're comfortable that your meaning has been grasped. Get all criticism out into the open. Many supervisors make the mistake of rushing through the conversation, feeling relieved after they've made one or two points. They conclude the discussion prematurely and fail to bring some of the subordinate's questionable behavior to light.

**Not an Easy Task**

No one promised you that criticizing would be easy. Sometimes, the 15 minutes that you've allotted can turn into 2 emotional hours. This is why many forward-thinking leaders refuse to schedule any interviews involving criticism in a narrow timeframe. Criticizing is often like opening a surprise package: You may think you know what you're getting, but, on occasion, the feedback may startle you. For example, an admission of drug dependence may be forthcoming, a serious counteraccusation against coworkers may be voiced, or the subordinate may offer justified criticism of the superior's own behavior and performance. Any issue raised should be addressed.

Finally, give suggestions on exactly how the employee can improve future performance. This process also serves as a valuable check valve in keeping the criticism under control. If you can only state that the behavior was unsatisfactory and can't think of a better method, then a yellow caution flag should go up signaling the need for more research, examination, or thought before you even attempt to confront the subordinate. It's easy to tell a ladder company officer, "You screwed up the ventilation job, and my guys took a beating!" but with this negative approach, there is no guarantee that the error won't be repeated. A more positive approach would be to wait for the proper moment, and then calmly discuss the strategic and tactical elements of the fire with the officer.

Ideally, a supervisor's goal should be threefold:

- Describe the unsatisfactory behavior
- Give reasons why the behavior was unsatisfactory
- Offer solutions on how to correct the behavior in the future

While no one omits the first item, many officers fail to give the second or third the attention they deserve.

Most of us know how hard and sometimes painful it is to be criticized. However, most progressive fire officers have changed with the times and are striving to make the process as painless as possible. Many fire service leaders now include a segment on criticism in officer development programs.

All of us, regardless of rank or job specification, are encouraged, if not required, to grow in our jobs. Without some periodic evaluation of our

behavior, growth is almost impossible. Offering and accepting constructive criticism is a quick, inexpensive, and relatively easy way to communicate our evaluations and feelings back and forth.

"So, knucklehead, how come you haven't caught on yet?"

For more information, contact the author at 6417 Windsor Avenue, Philadelphia, PA 19142. □

## Wildland-Urban Interface Information

Wildland-Urban Interface Reference Materials, a book listing publications, videos, films, pamphlets, and other wildland-urban interface materials produced by public agencies and private organizations, is available through the Boise Interagency Fire Center. This 39-page publication, compiled by Linda R. Donoghue, Edward Johns, and Donna M. Paananen, was sponsored by the National Wildfire Coordinating Group's Wildfire Prevention Working Team.

To order, contact the Boise Interagency Fire Center, Attention: Supply, 3905 Vista Avenue, Boise, ID 83705; telephone: (208) 389-2542 or FTS 554-2542. Its publication number is NFES 2096, and its cost is $1.07 per copy. ■

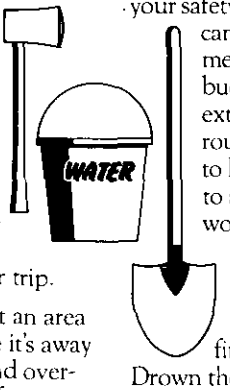

# HOW TO BUILD A CAMPFIRE.

Everyone loves to sit around a warm campfire. But campfires can be dangerous if not properly built. So before you build your next campfire, here are a few simple facts to remember.

**ARE CAMPFIRES ALLOWED?** There are some places in the United States where campfires cannot be built. And there are other spots where campfires are allowed only certain months of the year. So be sure to ask about local campfire laws when planning your trip.

**SELECTING A SITE.** Try to select an area with lots of shade. And make sure it's away from all bushes, needles, leaves and overhanging branches. So that sparks from your campfire have less chance of starting a forest fire.

**PREPARING YOUR CAMPFIRE.** The forest floor is covered with very flammable materials – things like bark, dry leaves and roots. So always clear a 10-foot area around your campfire. Then dig a hole the size of your campfire in the middle of the cleared area. And be sure you dig down until you reach thick, natural soil. This will prevent the fire from spreading along the dry topsoil and getting out of control.




**STARTING A CAMPFIRE.** Always have your safety tools ready before you light your campfire. Simple firefighting equipment includes a shovel, an ax, a big bucket of water, or a car-size fire extinguisher. After you've surrounded your campfire with rocks to hold in the flames, you're ready to add the fuel. Always use dry wood and cut it into short sticks. But never cut into a living tree.

**PUTTING THE CAMPFIRE OUT.** Always make sure your fire is dead out before you leave. Drown the campfire with lots of water, mix the ashes with plenty of dirt and then drown and stir again. And always check to make sure the rocks around your campfire are cool and not hiding hot embers. And finally, if some of the wood in your fire isn't completely burned, be sure to scrape it down, wet it down and bury it in plenty of dirt.


Please. Follow these simple rules the next time you build a campfire. You'll be sure to have a safe trip. And a forest to visit again next year.

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