AN ANALYSIS OF NINE TRACTOR-PLOW FATALITIES

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GENE MORSE,
STATE OF FLORIDA

INTRODUCTION:

Under the auspices of the NWCG Fireline Safety Committee, an analysis was conducted of seven fatality events that resulted in nine firefighters being killed. The common factor among these tragedies was the use of tractor-plow units as primary equipment on forest and wildland fire suppression activities.

All of the tragedies were well documented, with extensive details, photographs, and maps providing an adequate background of events and factors leading up to the deaths of the nine firefighters.

It was felt that a careful analysis would be useful if trends surfaced that would point toward corrective actions that could be taken to minimize the possibility of 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 establish definitive observations based upon the weather factor by itself.

APPROACH:

The decision was made to follow the process developed in the NWCG "Standards for Survival" training. This fireline safety training program centers around an expansion of the original "13 Situations that Shout Watch Out" to the "18 Situations that Shout Watch Out" and a restructuring of the Standard Fire Orders into a format that makes for easy recall.

The new structure of the "Watch Out" Situations and Fire Orders has gained widespread acceptance among forest and wildland fire suppression agencies:

STANDARDS FOR SURVIVAL

"WATCH OUT" SITUATIONS

(SURVIVAL CHECKLIST)

___ 1. FIRE NOT SCOUTED AN 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/SUPERVISOR

___ 8. CONSTRUCTING FIRELINE DOWNHILL WITH FIRE BELOW *

___ 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 AN 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

*These items were added to the original 13 after analysis of numerous accident investigations indicated the lack of awareness of these situations contributed to the accident occurring.

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.

Practical application of the "Standards for Survival" training centers around identifying a potentially dangerous fireline event, linking it to a "Watch Out" Situation from the Survival Checklist, and then taking a positive action)observing the appropriate Fire Order) to eliminate or minimize the possibility of injury/death to the firefighter.

The following is an example of the reasoning process necessary for firefighter safety, using a hazardous event drawn directly from one of the fatality reports:

POTENTIALLY HAZARDOUS EVENT

- "It had been jumping our lines....the thing (fire) had already jumped a 60-foot canal..."

"WATCH OUT" SITUATION

- #16: Getting frequent spot fires across line.

FIRE ORDER NOT OBSERVED

- I: Initiate all action based on current and expected fire behavior.

The point needs to be made that, obviously, **all** of the Fire Orders are closely intertwined. Therefore, **all** of the Fire Orders must be actively observed to conduct safe fire suppression activities.

However, in analyzing the fatality events, it was apparent that, in each instance, a single "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 alternative action (Fire Order) to counteract that negative situation had been immediately observed, then a tragic situation very likely could have been avoided.

SITUATION AWARENESS:

Perhaps some cynics would say that this process is too simplistic or too obvious. A rebuttal to that viewpoint is that Scotoma is a major contributing factor in many fireline fatality events.

What is Scotoma and how does it apply to fireline fatalities? Scotoma is a medical/psychological term, and the following definition has direct relevance to this analysis:

"Scotoma is, literally, a blind spot. In a psychological sense, it is that condition which occurs when we tend to block out from our consciousness anything that we do not consider to be important--or critical to our survival."

An example taken from common experience will shed some additional light. How many of us--while walking along a sidewalk in a busy urban area--are acutely aware of the danger only a few feet away? The danger is posed by automobiles and trucks hurtling past, sometimes coming very close to us--but we block this image from our minds, because we consider street traffic near us to be "routine" and thus non-threatening.

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."

Although it was phrased differently in several reports, this same type of comment surfaced repeatedly. The meaning is clear: it was "just another fire" and thus Scotoma had taken hold, blocking out sensitivity to hazardous events or conditions present in the fire environment.

The prevalence of this attitude or mind-set 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."

When the sensitivity to the "Watch Out" Situations is heightened, it is not too difficult to identify common contributing factors in the tractor-plow fire suppression accidents that caused the deaths of the nine firefighters.

This, then, was the underlying basis for this analysis: To identify hazardous conditions or events in the fatality reports, and then link them to the NWCG "Survival Checklist" to determine if any significant trends were apparent.

The findings established that there were 84 separate indicators of these hazardous conditions or events in the fatality reports. Listed below are some specific examples drawn directly from the reports, linked to the "Survival Checklist," and identifying the appropriate dominant Standard Fire Order which--if it had been promptly observed--may very well have saved a firefighter's life:

	Hazardous Condition/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."	#6:Instruction 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."	#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_____off loaded and started plowing?" A:"None...I never heard any."	#7:No communication link with crew members/supervisors.	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..."	#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."	#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."	#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."	#10:Attempting frontal assault on fire.	F: Fight fire aggressively but provide for safety first.
8.	"(He) noticed a space 50-100 long on the line that was not tied together."	#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."	#15:Wind increases and/or changes direction.	R: Recognize current weather conditions and obtain forecasts.

An analysis of the 84 seaparate hazardous conditions/events, when linked to the Survival Checklist, indicated the following trends:

- Twenty-two tied directly to Survival Checklist situation #4:

  Unfamiliar with weather and local factors influencing fire behavior.

- Thirteen were linked closely to Survival Checklist situation #7:

  No communication link with crew members/supervisors.

- Twelve were connected directly to Survival Checklist situation #15.

  Wind increases or changes direction.

- Eleven were linked to Survival Checklist situation #16:

  Getting frequent spot fires across line.

What does this analysis of the deaths of nine firefighters establish? With 13 conditions/events associated with communications, it is obvious that poor or non-existent communications places the firefighter in an exceptionally vulnerable position. No one can question the paramount necessity of maintaining close, effective communications with other personnel in the hostile fire environment.

But it is even more revealing to note that **more than half** of the hazardous conditions/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 a lack of sensitivity to--significant changes in fire behavior.

What recommendations can be made, on the basis of this trend study? Listed below are some specific action items that NWCG agencies may wish to consider:

RECOMMENDATIONS:

- The established national courses in fire behavior (Introduction to Fire Behavior; Intermediate Fire Behavior; and Advanced Fire Behavior) are excellent and should continue to be offered to the forest and wildland firefighter. However, this study certainly suggests that other, more localized, fire behavior training--ideally focused toward individual state or regional fuel types--should be developed on a priority basis by NWCG agencies.

- An academic understanding of the relationship between fuels, weather, and topography is critical for the firefighter. But just as critical is transferring that fire behavior **knowledge** into the most prudent **application of tactics** that will get the fire suppression job done without compromising firefighter safety. A logical follow-on to classroom training in fire behavior would be simulated fire exercises in the field, where firefighters would be required to demonstrate the safest and most effective tactics, given different fuel/weather/topography conditions. This should be concluded with an extensive critique or evaluation to determine if the participants had made the right tactical decisions.

- There probably is a fuel condition threshold (possibly fuel moisture) 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. Agencies should be able to determine this threshold level for their local area.

- 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 to identify structured materials available for sharing by all NWCG agencies.

Requests for copies of this publication should be forwarded to:

Chairman, NWCG Fireline Safety Committee

Room 1004 RPE

USDA-Forest Service

Post Office Box 96090

Washington, D.C. 20090-6090

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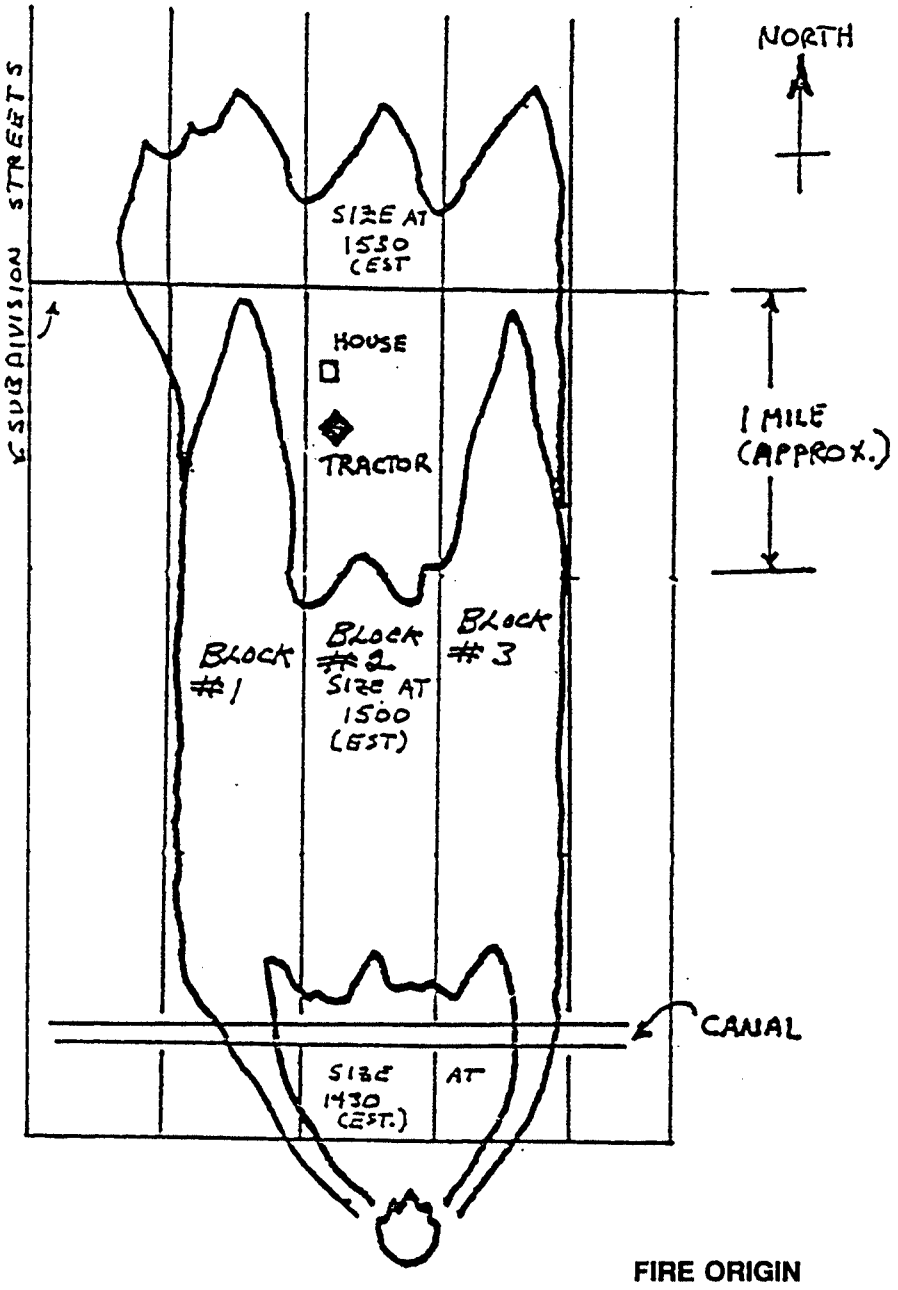
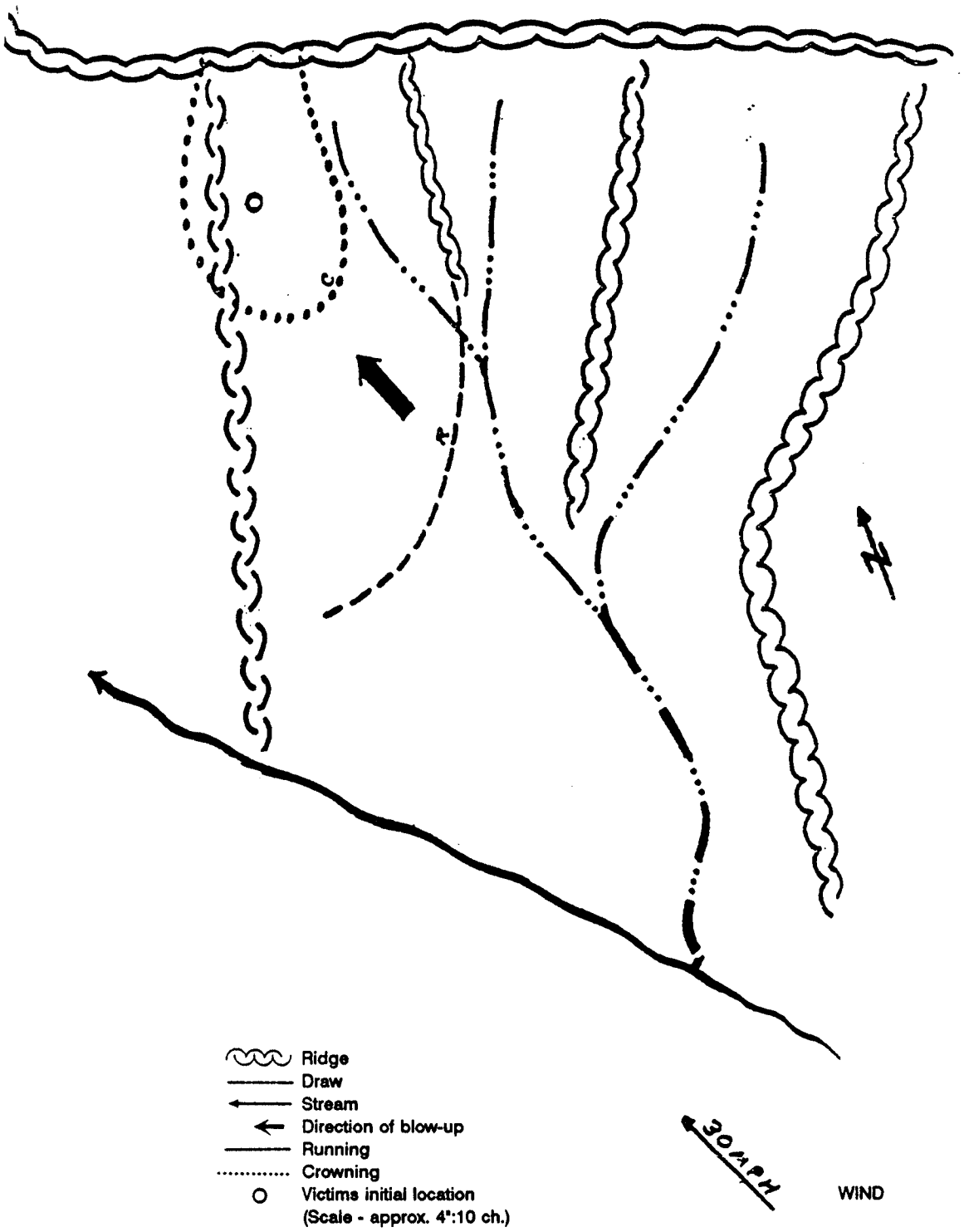


This sketch of a fatality scene, prepared by a fire behavior analyst, graphically illustrates a dangerous fireline condition. It shows the fire with three separate heads, burning in three subdivision blocks. The area that the fire occurred in is a huge, largely unpopulated subdivision with heavy fuel loading. Mild drought conditions existed. Note the lcoation of the firefighter's tractor, in a "pocket," with the fire heads on either side advancing more rapidly than the fire in Block #2. Personnel on this fire considered it to be "routine"--until it blew up.



A number of "Watch Out" Situations were present when a fire tragedy occurred in this mountainous region, resulting in the deaths of two firefighters. 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 M.P.H. winds.