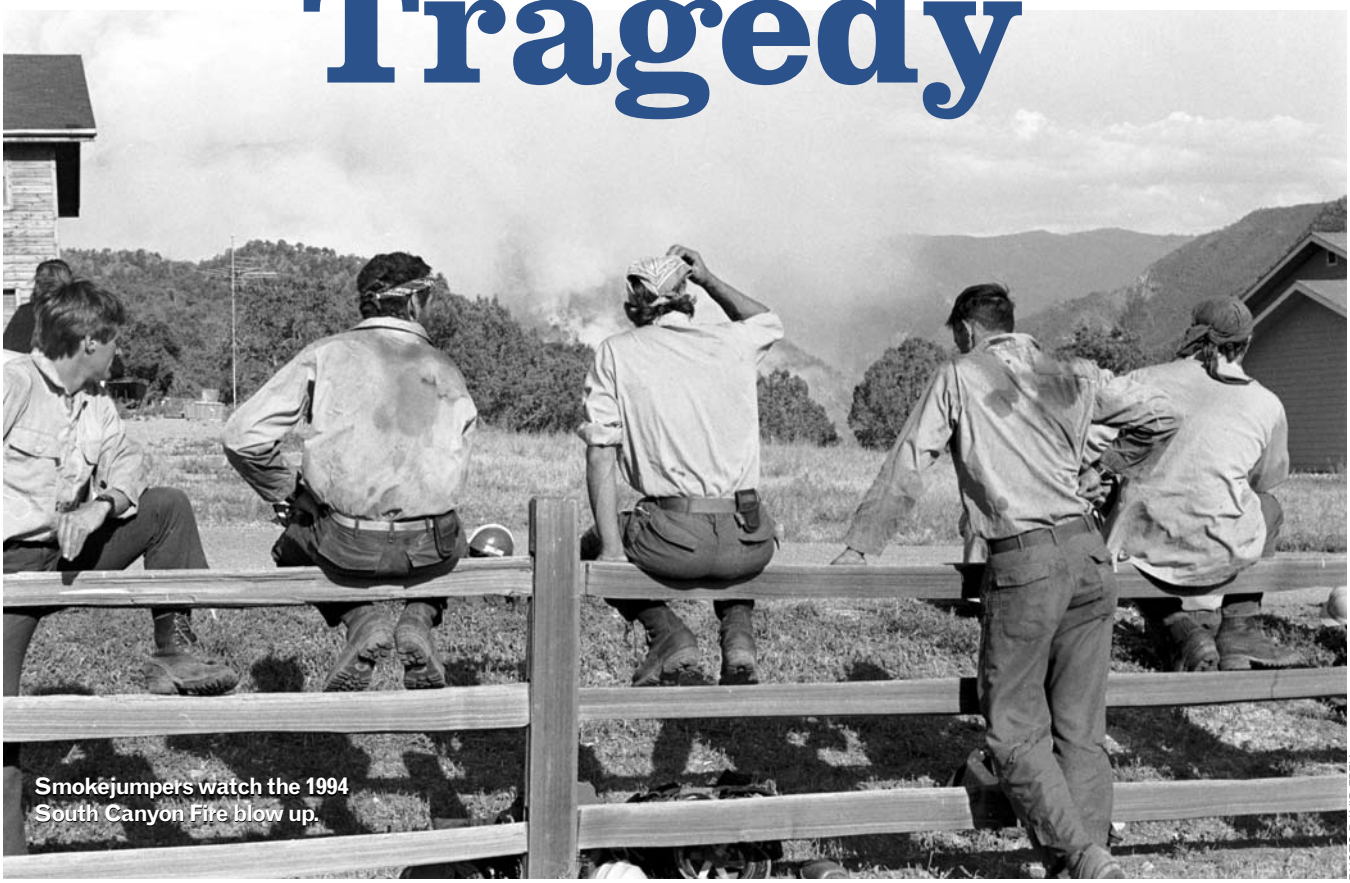
Born of Tragedy

By Shari Downhill



Smokejumpers watch the 1994 South Canyon Fire blow up.

PHOTO DAVID FREY

The Human Factors movement rises out of South Canyon

Wayne Williams stood in Storm King Mountain's west drainage riveted on the blowup above him—at that moment the South Canyon Fire was consuming not only the mountainside's vegetation at a phenomenal rate, but also the lives of 14 firefighters. At that moment, firefighters he knew personally were dying. That was how he would remember the fire season of 1994.

Williams, a seasoned smokejumper stationed in Missoula, Mont., had just arrived in Colorado to fight the blaze. Instead, his most important fight would be standing down attempts by fire overhead managers to quickly remove the firefighters' bodies. With little concern for diplomacy or political correctness (or objections Colorado's governor might have to colorful fireline vernacular), Williams demanded the scene be left undisturbed to allow investigators a clear view of what happened.

With that one move, Williams' role shifted. He would unintentionally become the first ground-level firefighter to formally usher in the era of "Human Factors," the study of human behavior and decisional error on the fireline.

"None of that occurred to me then, at the scene," Williams says. "You know, 'How did they get in that situation?' It honestly really never crossed my mind then. But you always [eventually] try to figure out how somebody died. If they're friends or somebody close to you, [you] hope … they did everything they could do to protect themselves before the event took place."

Because of his previous experience in mountain rescue, Williams was selected to lead a group of smokejumpers into the fatality site, and they found a scene none could explain. Williams, among others, wanted to hear what experienced investigators could see that his eyes and intellect couldn't. He wanted to know how so many experienced firefighters could die together.

In the Beginning

Williams helped kickstart the study of Human Factors on the fireline by preserving the South Canyon fatality site, but a foundation had already been laid by organizational psychologists and decisional scientists, such as Karl Weick, Earl Wiener, Barbara Kanki, James Reason, Gary Klein and Judith Orasanu, as early as 1989. Their studies and writings, both theoretical and field-applied, broadened the perspective of the wildland fire realm with the sweep of a multi-disciplinary brush.

Weick's contribution included an examination of the Mann Gulch

Fire of 1949. He used the case history chronicled in Norman Maclean's book "Young Men and Fire" to base his theory of organizational collapse. Wiener and Kanki's cockpit/crew resource management model evolved directly from the military and civilian aviation industry. Reason's Swiss cheese model of human error suggests four levels of human failure and discusses how an error chain can form (if the "holes" in each level line up) and lead to an accident. Klein's Recognition Primed Decision Model examines how decision makers can rapidly recognize a plausible course of action. And Orasanu, an investigator for NASA, focused on decision making under stress and strengthening areas of weakness. (For more information on these works, see "Reading Material," p. 29)

Out of the Ashes

Ted Putnam was a member of the South Canyon Fire's fatality investigation team. He worked at the Forest Service's Missoula Technology and Development Center (MTDC) and would play a significant role in the evolution of not only the South Canyon Fire's investigation and final report, but also in introducing the concepts of Human Factors over the next decade.

Even before South Canyon—beginning as early as his years as a smokejumper and particularly following the Dude Fire of 1990—Putnam says he became increasingly convinced of the importance of enabling wildland firefighters to become more adaptive, effective and safe through better decision-making methods. He also became increasingly alarmed that human errors observed and documented on fatality incidents such as the Dude Fire were not being incorporated into a collective attempt to improve firefighter safety and survivability.

An equipment specialist at MTDC with an academic background in psychology, Putnam continued trying to understand how firefighters could be taught to better address and control the barriers undermining their decision-making abilities—barriers such as stress and distraction on the fireground. At the urging of others, Putnam began to document and publish his position in critical papers, such as "Fire Safety: Up in Smoke?" These articles and papers filtered out into the firefighter ranks and touched a common thread of concern.

On the charred fireground of Storm King Mountain, Putnam did his best to recreate the possible scenario(s) leading up to the firefighters' deaths. Putnam's investigative findings and proposed fire scenarios were neither accepted nor supported by his team, he says, primarily because these scenarios relied on human-behavior considerations to reconstruct the fatality event.

The investigative methods and the final reports of both the investigation and the incident management review team would become entangled with political posturing and maneuvering, resulting in a cloud that still hangs over not only the investigation but the individuals connected to it. However, the Storm King Mountain tragedy opened the doors to a collective process of learning and subsequent thinking, and organizational evolution.

Jerry Williams, then-USFS assistant director of fire aviation and management in Washington, D.C., encouraged Putnam to begin publishing his own position regarding Human Factors on the fireline. (Williams made this suggestion, Putnam says, during a period when Putnam was criticizing the interagency investigative response at South Canyon—criticism that would eventually result in what Putnam considers organizational retaliation against him.) Putnam's first published piece included a description of the human errors he believed occurred on the South Canyon Fire. While reading a draft of Putnam's first article, Williams told Putnam about a paper by Weick that described similar errors on the Mann Gulch Fire, prompting Putnam to read Weick's work.

Weick's examination of the Mann Gulch Fire intrigued Putnam due to its apparent applicability to the events at South Canyon. Putnam was given permission by his MTDC managers to orchestrate a workshop in 1995 to examine the subject of Human Factors in the wildland fire realm. Weick and other subject-area experts were invited to participate, including Gary Klein. Mark Linane, then superintendent for the Los Padres Hotshots in California, also attended, consistently reminding the mostly academic and management-level workshop participants that it was important to keep the real issues facing firefighters central to the discussion. The dialog produced at this workshop became the catalyst for how this new view (at least to the wildland fire industry) would be introduced to the ranks of wildland firefighters.

Though the evolution of Human Factors on the fireline has often been marred by the same political posturing that plagued South Canyon, it has resulted in a growing understanding—what terms like situational awareness and mindfulness mean, for example. Putnam's vision of preparing firefighters to overcome (or at least recognize) the effects of stress and distraction on the fireline resonated with firefighting personnel from the ground up through management, even if his proposed methods proved less popular.

Bricoleur Defined

In his 1966 book "The Savage Mind," French anthropologist and structuralist Claude Levi-Strauss introduced the idea of bricolage. Levi-Strauss's metaphor for bricolage is an instructional handy person, a do-it-yourself craftsperson who can put to use a host of materials lying around at various stages of construction. This craftsperson works by continuously shifting according to the ever-changing requirements of the task.

In his examination of the Mann Gulch Fire, Weick describes fire survivor Wag Dodge as a bricoleur:

"While no one can say how or why the escape fire was created, there is a line of argument that is consistent with what we know. Bruner (1983: 183) described creativity as "figuring out how to use what you already know in order to go beyond what you currently think." With it as background, it now becomes relevant that Dodge was an experienced woodsman, with lots of hands-on experience. He was what we now would call a bricoleur, someone able to create order out of whatever materials were at hand (e.g., Levi-Strauss, 1966; Harper, 1987). Dodge would have known at least two things about fires. He would have known the famous fire triangle—you must have oxygen, flammable material and temperature above the point of ignition to create a fire (Maclean, p. 35). A shortage of any one of these would prevent a fire. In his case, the escape fire removed flammable material.

And since Dodge had been with the Forest Service longer than anyone else on the crew, he would also have known more fully their four guidelines at that time for dealing with fire emergencies (p.100). These included (1) start a backfire if you can, (2) get to the top of a ridge where the fuel is thinner, (3) turn into the fire and try to work through it, and (4)don't allow the fire to pick the spot where it hits you."

According to Withen, "The bricoleur is the firefighter who has mastered all of the knowledge of firefighting, 'forgotten it,' yet uses it through the guise of common sense, intuition, instinct, or old-salt experience. The experienced firefighter—the bricoleur—does not need or want another checklist.

Putnam's Role

"The industry owes a lot to Ted [Putnam] for bringing Human Factors to the forefront of the firefighting mind with the vision of a thoughtful, effective and safe workforce," McDonald says. "While he didn't necessarily guide all that happened after the HF conference, he was the single person who broke the ice and made Human Factors an issue that could not be ignored."

Withen agrees. "From my own position," he says, "Ted is the fountain from which Human Factors emerged for two reasons: He stood up to 'the machine' and refused to sign the South Canyon report, and he convened the first workshop on Human Factors."

That, Withen maintains, sets Putnam apart from other agency fire managers who may have believed in the importance of pursuing Human Factors research and implementation on the fireground, but were ambivalent about risking their careers to do it before it was organizationally safe. Putnam's insistence that Human Factors issues needed to be considered along with the physical aspects of fire put him at the head of the pack, Withen contends.

Wayne Williams also credits Putnam with leading the way to the evolution of Human Factors on the fireline. "After the [South Canyon Fire] investigation, and later on that winter, Putnam's articles really led me to believe that human behavior was a major contributor to the fatalities at South Canyon ... and also at [the Thirtymile Fire]," Williams says. "It's obvious to me that [these] incidents did not have to end in a fatality. And you can take that lesson all the way back to Mann Gulch.

"At South Canyon, Putnam did a great job explaining how human behavior can be a major factor in accidents that lead to fatalities," he continues. "Of all of the information that has come out of South Canyon, Thirtymile and the Cramer Fire, Putnam's work was the most meaningful to me, and has made me a far better and safer firefighter."

Why? "Here's a guy who has a vast background in fire and psychology. He's a hybrid—the perfect person to help in the understanding of how human behavior plays a part in [wildland fire] accidents and fatalities," Willliams says. "Back in 1994, I [attributed the South Canyon firefighters'] deaths to some really strange fire behavior. Otherwise, these experienced guys would have never been overtaken by the fire. That was then. Now, I accept the fact that they made mistakes, and I must learn from them. That's what they would have wanted. I realize now [that with] fatalities ... human behavior issues are almost always a factor."

Though present at the beginning of the Human Factors movement, Putnam hasn't been involved in developing the related educational curriculum, or the ongoing discussions of how to incorporate the concepts for wildland firefighters. Putnam retired in 1998 and says that because of his refusal to sign the South Canyon investigation report, he has not been invited to join in the dialog. "At South Canyon, we did a good job of figuring out and explaining what happened," Putnam says. "But we didn't do a thing to explain *why* it happened. I didn't sign the report because we weren't telling the whole truth."

Discussions with Putnam make it clear he doesn't fully recognize the part he has played in the larger picture. He also expresses intense concern for what he considers a lack of focus on strengthening of the individual mind.

In the late 1990s, Putnam urged firefighters to learn how to use meditation to increase their ability to think clearly, remain calm and better focus during stressful field situations. He proposed adoption of a one-week course on mindfulness meditation used by other organizations.

Though some took his advice, meditation wasn't accepted or used to any great extent due primarily to spirituality and machismo issues. Fire crews felt uncomfortable participating in deep breathing exercises in fire camp. Teasing brought additional stress for firefighters, not less. If firefighters pursued meditation, they did so individually, not as a crew-supported activity.

Still, McDonald's logic of shared cognition suggests that although firefighters may not pursue mind-strengthening in unison, nor use the methods of meditation Putnam proposed, they are beginning to collectively understand conceptually what mindfulness and situational awareness mean, and that it's possible to strengthen their ability to focus and make sound decisions, especially in stressful situations. Most importantly, they are beginning to understand that this strengthening could very well mean the difference between life and death for them, and for the firefighters they may lead in the future.

Look for a recent Putnam interview at www.fireleadership.gov/toolbox/documents/leaders_meet.html/ under "Leaders We Would Like to Meet."

Putnam's formal suggestions for improving firefighter safety from a human-behavior perspective included:

1. Adopt crew resource management concepts into wildland firefighter training on a broad scale;
2. Encourage federal land management agencies to become "learning organizations" as well as "mindful organizations;"
3. Conduct accident and fatality investigations responsibly, professionally, ethically and truthfully;
4. Use mindfulness meditation to improve a firefighter's mental strength and acuity.

Turning the Ship

Teachers preparing to teach a new concept must first maneuver through the often messy, cumbersome and clumsy process of learning themselves. Lark McDonald specializes in just such messy business. As a private consultant and adult training specialist with Mission Centered Solutions headquarters in Franktown, Colo., McDonald has been instrumental in shepherding the evolution of Human Factors training development, along with agency training specialists like Jim Cook, a former hotshot superintendent and currently USFS training projects coordinator at the National Interagency Fire Center.

The most valuable aspect of the last decade's efforts in understanding wildland fire human behavior, McDonald says, is a "shared cognition"—the ability of firefighters and fire managers to understand Human Factors terminology and build vital "mental maps" that make Human Factors concepts fundamentally recognizable and ultimately fathomable.

"Since 1999, more than 15,000 firefighters have been provided [with] some level of Human Factors training," McDonald says. "[For example] the term 'situation awareness' has been standardized to some degree in the organizational vernacular, in a simplified user language. In 1995, no one discussed decision-making and situation awareness in debriefs. Now they do.

"That," he says, "is a huge step because, while simple, the vocabulary is standardized enough that people can talk about [it] with each

other, even if the definitions are not verbatim. The concepts are still in accordance with the research done in a lot of places. And, although they are boil-downs of complicated processes, they are still valid and correct."

McDonald and Cook have both been involved in the creation of the leadership and Human Factors training programs introduced to the wildland firefighting ranks, beginning in fall 2000 with L-180: Human Factors on the Fireline, followed by the development of L-280: Followership to Leadership, L-380: Fireline Leadership and L-381: Incident Leadership. (For more information on these courses, visit www.fireleadership.gov/courses/courses.html.)

The incorporation of Human Factors concepts, doctrine, standards and training into operations is inevitable as the wildland firefighting industry and culture mature. In 1996, U.S. land-management agencies were in an "awareness" phase, learning about human behavior on the fireline. In 2005, they're applying Human Factors theory to a myriad of operational tactics, standards and expectations on the fireground.

"I think the future payoff is worth working through the problems," Cook says of the interagency leadership and Human Factors training efforts. "What makes it easy for me to continue is to see young people grab onto it."

Patrick Withen, a veteran smokejumper and professor in sociology and organizational studies at the University of Virginia, participated in the 1995 Human Factors workshop. Withen believes firefighting agencies haven't gone far enough in addressing the cultural, social and organizational factors on the fireline.

"The current state of our understanding of Human Factors on the fireline is good," Withen says, "but we have just established the anchor point. We need to head up the hill and begin flanking this flare-up. We have only begun to educate and train our firefighters and fireline managers in the psychology of small group dynamics in stressful conditions, and to an even lesser extent in tactical and strategic decision making in high reliability organizations."

In addition to the formal classroom curriculum and field experience designed to improve firefighters' leadership and crew cohesion understanding and skills, there's an interagency attempt to develop a cache of tools, knowledge and resources beneficial to firefighters. A newsletter recently posted on the Wildland Fire Lessons Learned Center's site (www.wildfirelessons.net), for instance, addresses the effects of fatigue due to sleep interruption, and the effect it has on an individual's ability to respond to unexpected or new stimuli.

What Would Weick Say?

It's interesting to note that Weick's organizational theories, which have played such a profound part in launching the Human Factors dialog in wildland fire, stress the importance of improvisation and bricolage (see "Bricoleur Defined"). This may seem to conflict with the direction wildland fire agencies have taken. Perhaps in terms of mandatory adherence to agency rules, it does.

But again, McDonald's observations apply: It's impossible to effectively improvise or operate effectively as what Weick calls a bricoleur if an individual's knowledge of fire behavior, topography, weather, knowledge of the woods and ultimately basic human behavior is inadequate.

Cook and McDonald both say Human Factors teachers need to use sound methods and responsibly developed curriculum to convey this information and practical experience effectively. Lastly, individual firefighters and fireline leaders must take personal responsibility for strengthening their minds, bodies and their ability to consider new, often foreign material and concepts.

That, Weick's theoretical work suggests, leads to intellectual resiliency—the ultimate survival skill on the fireline. Putnam's work focused on strengthening that resiliency through mindfulness.

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