

Fire Management today

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**MANAGING THE
UNEXPECTED**



United States Department of Agriculture
Forest Service

Coming Next...

In the next issue of *Fire Management Today* (68[3] Summer 2008), visit countries around the world and learn from international experts about the challenges of firefighting globally. Visit our familiar friends in Australia and Canada, then jet across the world to the Mediterranean and introduce yourself to five countries that call themselves the “Fire club.” [Excerpt] “Fire is a global phenomenon. Worldwide, fire can play a role in either maintaining or threatening natural habitats and human societies. In any case, we must consider the global context for our actions, as well as the best role each nation can play in managing fire for both people and nature.”

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On the Cover:



On the Cover: Firefighters take a look back to see that their handline is holding on the West Hunter Prescribed Fire in the Okanogan-Wenatchee National Forest in Washington State. Photo: Eli Lehmann, Forest Service, Mount Baker-Snoqualmie National Forest, Concrete, WA, 2004.

The spring issue of Fire Management Today will feature an in-depth examination of how a High Reliability Organization (HRO) provides a foundation for how we all should be operating in wildland fire management.

The issue also highlights how the Wildland Fire Lessons Learned Center is encouraging firefighter safety by promoting organizational learning and the center's ongoing efforts to make the entire wildland fire community a healthier learning culture.

The Forest Service's Fire and Aviation Management Staff has adopted a logo reflecting three central principles of wildland fire management:

- **Innovation:** We will respect and value thinking minds, voices, and thoughts of those that challenge the status quo while focusing on the greater good.
- **Execution:** We will do what we say we will do. Achieving program objectives, improving diversity, and accomplishing targets are essential to our credibility.
- **Discipline:** What we do, we will do well. Fiscal, managerial, and operational discipline are at the core of our ability to fulfill our mission.



Firefighter and public safety is our first priority.

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ADAPTING TO CHANGE

Fire and aviation management is increasingly complex. Interagency and social expectations for interoperability, along with enhanced risk management and improved efficiency, provide a basis for an energetic program. Our fire and aviation program in the Forest Service is working hard to “stay ahead of the game.”

Our more vibrant implementation of appropriate management response (AMR) is an example of strategic and cultural change. While “appropriate” is a value-laden term, as used in the Federal Wildland Fire Management Policy, the term is meant to encompass a wide variety of response to wildland fire.

The future is described not only by AMR but by High Reliability Organizations (HRO). HROs constantly adapt to change. Change is happening with us; in some places, 2007 brought about dramatic change.

Actually implementing a wide variety of responses and becoming a flexible, innovative, learning organization are key linchpins to our future. -

Fire management professionals, line officers, and communicators all worked together to temper expectations about what we can do with a wildland fire that is exceeding all our measurements and is very dangerous. Through written analyses and shared information, we were more creative in approaching wildland fires that we knew would resist our best traditional control efforts. We learned from each other and, where we could, implemented different suppression strategies than in years past.

We are more effective when we put the right resources in the right place at the right time.

It's harder than some people might think. We lined out the management action points where we could fight the fire safely and actually have some effect on its progress.

The Forest Service workforce steeped in a tradition of hard work and service and we are proud of it. By being smarter and more patient, we are maintaining that service ethic every day, whether we are digging line or digging in and preparing to fight the fire on our terms.

We are more effective when we put the right resources in the right place at the right time.

Actually implementing a wide variety of responses and becoming a flexible, innovative, learning organization are key linchpins to our future. ■

BUILDING THE FOUNDATION FOR A LEARNING CULTURE



Paula Nasiatka

The acknowledged need for an interagency Wildland Fire Lessons Learned Center to serve the country was rooted in the Tridata Firefighter Safety Awareness Study, conducted after 14 firefighters perished in Colorado's 1994 South Canyon Fire.

Although originally proposed as a center to focus on firefighter safety, early firefighter community surveys indicated that a desire existed for such a wildland fire lessons learned center to take a more holistic approach by looking at organizational learning in wildland fire and its organizational culture.

As the Wildland Fire Lessons Learned Center organized in 2002, it began to benchmark other lessons learned centers to ascertain their foundational lessons and to discover what practices work and which ones to avoid.

Less than a year after inception, Lessons Learned Center staff contacted Harvard Business School Professor David A. Garvin, author of *Learning in Action*, to ask for help.

Garvin offered to come out to our center based in Tucson, AZ, to discuss organizational learning—particularly organizational culture and “leading learning”—with interagency fire professionals. The first meeting initiated the foundation for

Paula Nasiatka, coordinator of this issue of Fire Management Today, is the Center Manager of the Wildland Fire Lessons Learned Center, Tucson, AZ.

A necessary link and obvious relationship exists between these two processes: High Reliability Organizing and Organizational Learning.

a continuing and productive relationship between the wildland fire community and Harvard Business School.

The Lessons Learned Center developed a road map for its work that centered on organizational learning and the six critical tasks of a learning organization (see sidebar). Center staff believed that if they, as a knowledge resource center, were going to help the wildland fire community become better at organizational learning, they too had to walk the walk and talk the talk.

High Reliability Organizing and Organizational Learning

Several members of the wildland fire community had been working with University of Michigan Business School Professor Karl Weick after meeting him at the first Human Factors in Wildland Fire Conference in 1995.

Weick's work in sensemaking and developing a High Reliability Organization (HRO) resonated with many wildland fire professionals. In *Managing the Unexpected: Assuring High Reliability in an Age*

Six Tasks Critical to Organizational Learning

According to David A. Garvin of Harvard Business School, six specific tasks are critical to organizational learning. By engaging in these tasks, a unit can significantly improve both its programs and its learning. These six critical tasks can be directly applied to all wildland fire management programs:

1. Continually collect intelligence about the environment,
2. Learn from the best practices of other organizations,
3. Learn from your own experiences and past history,
4. Experiment with new approaches,
5. Encourage systematic problem solving among all members of your unit, and
6. Transfer knowledge throughout the organization.

For more information on these six critical tasks, see the article “Measuring Success in Your Fuels Program” in the 2006 issue of *Fire Management Today* (Vol. 66, No. 4).

of Complexity, authors Weick and Kathleen Sutcliffe reference how HROs are learning organizations. Thus, a necessary link and obvious relationship exists between HROs and Organizational Learning.

This first meeting initiated the foundation for a continuing and productive relationship between the wildland fire community and Harvard Business School.

High Reliability Organizing is a way to think logically about how to proactively develop special skills to avoid—or be better prepared for—unexpected events. It is a way to make sense of the unexpected when it does happen, and quickly recover vital systems. An HRO is the foundation for how wildland fire management operates and should strive to operate.

More than 300 fire professionals attended three national Managing the Unexpected in Wildland Fire Workshops—that featured Weick and Sutcliffe. Followup critiques, evaluations, and after-action reviews from students and faculty indicated that the workshops were successful and that High Reliability Organizing is an important component of the fire management toolbox.

Where Do We Go Next With High Reliability Organizing

Following the third workshop, a small interagency group gathered at the Wildland Fire Lessons Learned Center in August 2006 to answer the following key questions:

- Should we continue to use the national Managing the Unexpected Workshops as the primary method of teaching High Reliability Organizing?
- Is it time to change or modify approaches to teaching how to develop an HRO?
- What new approaches to applying High Reliability Organizing to

fire management operations are most pertinent at this time?

The group developed a mission statement describing how High Reliability Organizing fits into the Wildland Fire Lessons Learned Center's comprehensive organizational learning strategy.

Goals Developed

Distinct goals were then developed for meeting the HRO mission. To receive further input and validate the goals, they were discussed with a larger representation of wildland fire professionals who had also been involved with HROs and the national Managing the Unexpected Workshops.

Goal One—Curriculum

Curriculum for workshops and seminars was developed to include:

- An Advanced HRO Seminar—participants worked with Weick and Sutcliffe in a 2-day graduate-style session (25 participants attended this seminar in February 2007). This seminar set the stage for an interagency cadre to discuss in detail the five HRO principles and learn how best to teach and apply each principle to work practices.
- Train-the-Trainer Workshops—a cadre of master instructors (Advanced HRO Seminar participants) will teach effectively conveying HRO principles to select groups of approximately 50 students per workshop.

Instruction on learning styles and various teaching methods—In May 2007, a successful pilot workshop called Facilitating an HRO in Wildland Fire was held in Nebraska City, NE.

- Participants of the Train-the-Trainer Workshop will conduct three High Reliability Organizing in Wildland Fire Workshops annually at various locations throughout the country.

Goal Two—Education and Outreach

An HRO education and outreach component will help ensure that stakeholders—both inside and outside fire management—have a thorough knowledge of High Reliability Organizing and how it aligns with other efforts. A consistent message—integrated with other national fire management initiatives—about the value of an HRO will be delivered to stakeholders.

Goal Three—Measuring Effectiveness of High Reliability Organizing

A critical need exists to answer fundamental questions about the time, money, and effort that are invested into HROs: Is it working and is it meeting the mission statement developed at the Wildland Fire Lessons Learned Center?

High Reliability Organizing is the foundation for how all members of the wildland fire community should operate in wildland fire management.

We realize that all of these wildland fire focus areas should be presented and discussed in an integrated, cohesive fashion. -

Mission Statement

“The Wildland Fire Lessons Learned Center actively promotes a learning culture to enhance and sustain safe and effective work practices in the wildland fire community.

The center provides opportunities and resources to foster collaboration among all fire professionals, facilitates their networks, provides access to state-of-the-art learning tools, and links learning to training.”

A set of significant questions have been designed to answer this crucial question. These questions are being pursued in the research project “Assessing High Reliability Organizing in Wildland Fire” being conducted by Kathleen Sutcliffe and Michelle Barton of the University of Michigan Business School, in cooperation with the Aldo Leopold Wilderness Research Institute and the Boise National Forest.

Strategic Plan

The Wildland Fire Lessons Learned Center recently completed its first strategic planning effort. An inter-agency planning team, along with wildland fire stakeholders from around the country, helped the

center develop its mission, vision, goals, and objectives for the next 5 years. HRO principles have been consistently discussed as key foundational elements.

As reflected in our mission statement, HRO leadership, doctrine, and principles-based decisionmaking are all represented. Teaching or referring to these focus areas as isolated undertakings does little to build or strengthen our learning culture. Instead, all of these wildland fire focus areas must be presented and discussed in an integrated, cohesive fashion.

Moving Forward

According to Harvard Business School organizational learning experts, three building blocks form a learning organization:

1. A supportive learning environment,
2. Concrete learning processes and practices, and
3. The practice of reinforcing leadership behaviors.

Two questions that wildland fire organizations should constantly ask: Have we, as a fire community, firmly established these building blocks? Have we done better with some aspects of organizational learning than others?

I’ll leave you with an appropriate quote from *Is Yours a Learning Organization?* by Amy Edmonson, David Garvin, and Francesca Gino (2007):

“Organizational learning is therefore likely to be heavily influenced by the behavior of leaders. If leaders prompt dialogue and debate through active questioning and listening, learning is likely to be encouraged.

If they signal the importance of spending time on problem identification, knowledge transfer, and reflective post-audits, these activities are likely to flourish.

If they behave in ways that acknowledge their own openness and willingness to entertain alternative points of view, options are likely to multiply and diverse alternatives are likely to be voiced.

Leadership behavior is thus the vehicle that gives life to supportive learning environments and ensures the effective implementation of critical learning processes.”

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MAKING SENSE OF ORGANIZING FOR HIGH RELIABILITY AND LEARNING



Jim Saveland

The complex world of wildland fire management is fraught with great challenges:

- Dramatically improve firefighter and public safety;
- Reduce the costs of large wild-fires;
- Restore fire-adapted ecosystems across large landscapes, while minimizing the nuisance of smoke and the chance of escaped fires; and
- Achieve all of these challenges in a polarized political environment while the wildland urban interface grows rapidly and the climate changes.

All of these challenges require wildland fire managers to be experts in risk management. Unfortunately, outdated safety policies and thinking are not much help for moving in this direction. The Occupational Safety and Health Act of 1970, Executive Order 12196 of 1980, and 29 Code of Federal Regulations 1960 require the heads of Federal agencies to furnish to employees places and conditions of employment that are free from job safety and health hazards.

While this paternalistic attitude and mental model of providing a safe work environment is an important part of the safety story, it is only a small part of today's story of complex systems operating in chaotic environments. These acts

Jim Saveland is the program manager for human factors and risk management at the Forest Service's Rocky Mountain Research Station, Fort Collins, CO.

Mindfulness is a rich awareness of discriminatory detail and an enhanced ability to discover and correct errors that could escalate into a crisis. -

and orders form an important piece of the history of job safety and still represent a very relevant story in a factory or office building. Yet, they occupy less and less of our attention on the fireline—and rightly so.

The 1970 Act assumes that we have more control of our environment than we actually do. It assumes that the head of the agency provides an environment free from safety and health hazards and that all employees have to do is comply with standards, policies, and directives and use protective equipment. These assumptions are part of what professor of human factors and flight safety Sidney Dekker (2006) calls “the old view of human error”—also known as the “The Bad Apple Theory.” Simply stated, complex systems would be fine, were it not for the erratic behavior of some unreliable people (bad apples) in it. The Bad Apple Theory is in many respects a recasting of Douglas McGregor's (1985) famous “Theory X” back in 1960.

The wildland fire management community is not waiting for the heads of agencies to furnish places free from job safety and health hazards. Rather, this community is beginning to explore state-of-the-art safe and effective operations: organizing for high reliability and learning. The focus of attention is

shifting from bad apples to complex systems. Such a journey takes us on a path toward leadership in risk management.

Organizing for High Reliability

There are five principles of high reliability (Weick and Sutcliffe 2001):

1. Preoccupation with failure,
2. Reluctance to simplify,
3. Sensitivity to operations,
4. Commitment to resilience, and
5. Deference to expertise.

These principles are explained in detail elsewhere in this issue of *Fire Management Today*. Perhaps the one principle that gives people the most difficulty is “preoccupation with failure.” People like to celebrate success and find it difficult to focus on failure. Yet, this is precisely what is required.

Think of it like defensive driving: being constantly alert to the possibility of what could go wrong and having a mental plan of action to deal with the situation should it arise. Practicing the five principles of high reliability is called “mindfulness” (Weick and Sutcliffe 2001, Weick and Putnam 2006). Mindfulness is a rich awareness of discriminatory detail and an enhanced ability to discover and

correct errors that could escalate into a crisis.

In contrast, a tendency toward “mindlessness” is characterized by “a style of mental functioning in which people follow recipes, impose old categories to classify what they see, act with some rigidity, operate on automatic pilot, and mislabel unfamiliar new contexts as familiar old ones.” A mindless mental style works to conceal problems that are getting worse (Weick and Sutcliffe 2001).

Weick and Sutcliffe (2001) incorporate James Reason’s (1997) work on a safety culture as an informed culture, a vital component of organizing for high reliability. Reason argues that it takes four subcultures to ensure an informed culture. Assumptions, values, and artifacts must line up consistently around the issues of:

- What gets reported when people make errors or experience near misses (*Reporting Culture*);
- How people apportion blame when something goes wrong (*Just Culture*);
- How readily people can adapt to sudden and radical increments in pressure, pacing, and intensity (*Flexible Culture*); and
- How adequately people can convert the lessons that they have learned into reconfigurations of assumptions, frameworks, and action (*Learning Culture*).

Organizing for Learning

The need to develop a flexible and a learning culture brings us to research on organizational learning. Organizing for high reliability and organizing for learning have a common core: the desire to detect and correct errors.

I’ve previously discussed (Saveland 2005) the need to talk about the two types of errors: misses and false alarms. While we in the wildland fire community tend to focus on the miss and near-miss, false alarms lead to what Scott Snook (2000) calls “practical drift.”

desire for zero fatalities and serious accidents with the recognition of inherent risks of fire management operations.

These competing perspectives can be thought of as an example of the Stockdale Paradox (Collins 2001).

One of the common themes of “human factors” is moving away from focusing on individual behavior and focusing more attention on systems and processes.

Peter Senge (1994) talked about the five disciplines of a learning organization:

1. Mental models (deeply ingrained assumptions, generalizations, or even pictures and images that influence how we understand the world and how we take action);
2. Personal mastery (becoming experts at our craft);
3. Building shared vision (the capacity to develop and hold a shared picture of the future we seek to create);
4. Team learning (starts with dialogue, the capacity of members of a team to suspend assumptions and enter into a genuine thinking and acting together); and
5. Systems thinking (using causal-loop diagrams as a robust language for telling stories about complex systems).

Today, we seem to be struggling with Senge’s third discipline—our notion of building shared vision. In our haste and impatience, we typically charge a small group to go off and develop a vision, and then push it through the organization. However, this is an activity that we must all engage in. The other trouble comes with reconciling our

The name refers to Admiral Jim Stockdale, the highest ranking U.S. military officer in the “Hanoi Hilton” prisoner-of-war camp during the height of the Vietnam War. The Stockdale Paradox goes like this: “retain faith that you will prevail in the end, regardless of the difficulties; and at the same time, confront the most brutal facts of your current reality, whatever they might be.” In other words, if this perspective is applied to the wildland fire arena: we must retain faith in a vision of zero fatalities and serious accidents and at the same time confront the brutal facts of the inherent risks of our current wildland fire reality. This vision of zero fatalities is not mere wishful thinking. The first step to achieving it is believing it, seeing it in your mind’s eye. That’s what vision is about.

In an effort to make the concepts of organizational learning more practical, David Garvin (2000) came up with six critical tasks—that, by the way, guide the day-to-day operations of the interagency Wildland Fire Lessons Learned Center:

1. Collect intelligence about the environment;
2. Learn from the best practices of others (benchmarking);

3. Learn from past experience;
4. Experiment with new approaches;
5. Encourage systematic problem solving; and
6. Transfer knowledge throughout the organization.

So far, I've talked about the human factors work of Dekker (2006) and Reason (1997), the High Reliability Organizing work of Weick and Sutcliffe (2001), and the organizational learning work of Senge (1994) and Garvin (2000). How do we begin to make sense of these concepts? Are they competing against each other or do they somehow fit together? To answer these questions, I find it helpful to turn to the integral philosophy of Ken Wilber (2000).

Integral Perspective

One way of looking at the world is to make a distinction between what's inside and what's outside, as well as make a distinction between an individual and a group of individuals. When we combine the interior and the exterior with the individual and the collective, we get Wilber's (2000) four quadrants or perspectives (fig. 1).

What goes on inside the individual is how he or she makes personal meaning. This upper left quadrant includes situational awareness and

mental models. What we can see on the outside is individual behavior.

The intersubjective world of groups of people is their culture and shared values. This manifests in the world as systems and processes.

The exterior is what we can readily see and measure. The watchwords for the exterior column are "what gets measured gets done." These are the quadrants of concrete decisionmaking.

Fire suppression doctrine is an effort to articulate the basic principles and shared values that drive our systems and processes.

We can't see what's going on inside a person or a group of people. The watchwords for the interior column are Einstein's famous quip, "Not everything that can be counted counts, and not everything that counts can be counted." These are the quadrants of individual and collective sensemaking.

All four quadrants are important and necessary. One thing to watch out for is what Wilber (2000) calls "monological madness"—thinking that one, and only one, quadrant

holds the key to changing the world. One of the common themes of "human factors" (Dekker 2006, Reason 1997), high reliability (Weick and Sutcliffe 2001), and organizational learning (Senge 1994, Garvin 2000) is moving away from focusing on individual behavior and focusing more attention on systems and processes.

There is increasing recognition of the importance of the lower left quadrant of culture and shared values. The fire suppression doctrine is an effort to articulate the basic principles and shared values that drive our systems and processes. Ed Schein (1999, 2004) presents some of the most scholarly work on culture change. According to Schein, there are three levels of culture:

1. Just beneath the surface are *Artifacts*, the visible organizational structures and processes;
2. A little deeper lies *Espoused Values*, the strategies, goals, and philosophies (espoused justifications); and
3. Deep beneath the surface are *Basic Underlying Assumptions*, the unconscious, taken-for-granted beliefs, perceptions, thoughts, and feelings (ultimate source of values and action).

Because the intersubjective world of our culture can't be seen, we access it through storytelling (Denning 2005) and conversation (Isaacs 1999).

Summary

Ever since the first wildland firefighter's human factors workshop (Putnam 1996) back in June of 1995, the fire community has been moving away from the "old view of human error." For some, it may seem like a long, slow, tough journey—but progress is being made.

Figure 1.

	Interior	Exterior
Individual	Personal Meaning	Individual Behavior
Collective	Culture and Shared Values	Systems and Processes
Sensemaking ↔ Decisionmaking		

Today, with the increased focus of attention on human factors, high reliability, organizational learning, just culture, doctrine (principle-centered leadership), and adaptive leadership, the interagency wildland fire management community is helping lead the world to a paradigm shift in the way we think about safe operations and risk management.

These are not isolated and disconnected concepts competing for our limited attention. These ideas weave together into a new tapestry of how we make sense of the emerging world of fire management in the 21st century to assist us in improving safety, reducing costs, and restoring fire-adapted ecosystems.

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Web Sites on Fire*

The Tea Kettle Ecosystem Experiment!

TA critical question in the Sierra Nevada forests of California is how to use disturbances effectively to restore ecosystems following a century of fire suppression.

This Web site and its free DVD describe the different ecological effects of applying fire and thin-

ning fuels treatments on mixed-conifer forests.

The study provides an important contrast of how the type and intensity of disturbance (including different levels of thinning) affect forest functions and succession. By measuring more than a dozen ecosystem components, including vegetation, soil, microclimate, carbon, invertebrates, food webs, small mammals, and tree response variables before and after treatments on replicated plots, the collective studies provide a core understanding of how ecological processes change in

response to fuels treatments. Free copies of a DVD summarizing the experiments' results "The Teakettle Experiment: Fire and Forest Health" can be ordered at the Web site. The DVD has a combination of six films, publications in PDF format, and Web resources with information about restoring forest 'health' in fire-suppressed forests.

Found at <<http://teakettle.ucdavis.edu>> or contact <<mailto:mpnorth@ucdavis.edu>>

* Occasionally, *Fire Management Today* briefly describes Web sites brought to our attention by the wildland fire community. Readers should not construe the description of these sites as in any way exhaustive or as an official endorsement by the Forest Service. To have a Web site described, contact the managing editor, Cindy White, at Forest Service, Darrington Ranger Station, 1405 Emens Avenue North, Darrington, WA 98241, 360-436-1155 (tel.), 360-436-1309 (fax), cwhite@fs.fed.us (e-mail).

THE GENESIS AND EVOLUTION OF HIGH RELIABILITY ORGANIZING



Michael DeGrosky

The wildland fire community discovered the High Reliability Organizing concept relatively recently. Despite its somewhat recent introduction to the wildland fire industry, it is not a new concept.

It's just new to us in the wildland fire community.

High Reliability Organizing—Not A New Concept

For more than 20 years, a small but diverse group of organizational experts have researched the nature of what we have come to call a High Reliability Organization (HRO). The HRO theory builds on and extends organizational research conducted since the late 1940s. Our understanding of these origins will remain important as the wildland fire community becomes generally familiar with High Reliability Organizing concepts—and as advocates work to provide an HRO with traction among wildland fire practitioners.

Understanding the genesis of HROs remains particularly important not only to those advocating the concept, but to anyone intending to

Michael DeGrosky is chief executive officer of the Guidance Group, a consulting organization specializing in the human and organizational aspects of the wildland fire services, and is an adjunct instructor in leadership studies for Fort Hays State University. DeGrosky is also a 30-year wildland fire services veteran and maintains his qualifications as an operations section chief and type 3 incident commander.

For more than 20 years, a small but diverse group of organizational experts have researched the nature of what we have come to call HROs.

teach this organizing model to others in the wildland fire community.

HRO advocates strive to inform and influence opinion shapers and decisionmakers who have too often been bombarded with management approaches that pass like thunderstorms—a lot of noise with little significant change. As a result, those advocating an HRO orientation must confront and overcome the hurdle of skepticism when hesitant managers—and suspicious firefighters—assume that they are merely hearing about the latest management fad.

Those who believe that High Reliability Organizing represents a relevant concept for wildland fire organizations will find that to convince leaders in the wildland fire community, they must first help them understand the well-researched nature of an HRO.

Those advocating an HRO orientation must confront and overcome the hurdle of skepticism when hesitant managers—and suspicious firefighters—assume that they are hearing about the latest management fad.

Weick and Sutcliffe

Most people in the wildland fire field know about High Reliability Organizing from the reading the work of Karl Weick and Kathleen Sutcliffe of the University of Michigan's Ross School of Business and their book *Managing the Unexpected: Assuring High Performance in an Age of Complexity* (2001).

Weick introduced High Reliability Organizing to wildland fire personnel during the 1995 Wildland Firefighters Human Factors Workshop hosted by the Forest Service's Missoula Technology and Development Center. Thus, High Reliability Organizing figured prominently in the birth of the human factors movement in wildland fire.

In the ensuing years, Weick, along with associate Sutcliffe, have significantly contributed to understanding High Reliability Organizing among wildland fire personnel. However, the High Reliability Organizing concept and the groundbreaking research originated in the 1980s with a group of scholars (Karlene Roberts, Gene Rochlin, and Todd La Porte), University of California (UC) Berkley.

Roberts' from the 1993 book *New Challenges to Understanding Organizations* summarizes much of the seminal research contributing to the High Reliability Organizing theory.

Discovering Resilience

In the process of extending existing organizational behavior research, the UC Berkeley researchers "discovered" High Reliability Organizing already existing in organizations rather than, as one might suspect, purposefully creating a HRO as a management system.

As discovered by these pioneering researchers, a subset of exceptional organizations managed their work according to principles that they held in common. Presumably, some error-resilient organizations had been functioning in this way for some time. Consequently, the scholars originating the HRO concept did not apply a preconceived system to existing organizations. Rather they derived their model by observing existing reliable and resilient organizations.

The High Reliability Organizing concept and the groundbreaking research originated in the 1980s with a group of scholars from the University of California, Berkley.

Roberts, Rochlin, and LaPorte originally examined three organizations:

- The Diablo Canyon nuclear reactor,
- The Federal Aviation Administration's air traffic control system, and
- The U.S. Navy's nuclear aircraft carriers.

All three organizations struck the scholars as being unique. While they operated in high-risk environments similar to other organizations in the research literature addressing organizational failures, they had *not* failed. In fact, these organizations had excellent safety records.

In the subsequent years, the academy of scholars studying high reliability has grown and HRO researchers have expanded their inquiry to organizations from a broader array of industries. Besides wildland fire, organizations have applied HRO research results in the aviation, financial services, petrochemical, space exploration, and health care industries.

The Future

There's no question that High Reliability Organizing provides wildland fire organizations with a very relevant tool. Let's hope that as we strive to convince leaders in the wildland fire community, that they will embrace the well-researched nature of an HRO and recognize its enormous potential in our work.

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ORGANIZING FOR HIGHER RELIABILITY: LESSONS LEARNED FROM WILDLAND FIREFIGHTERS



Karl E. Weick and Kathleen M. Sutcliffe

The late wildland firefighter Paul Gleason had it right when he said, “If I make a decision, it is a possession. I take pride in it; I tend to defend it and not to listen to those who question it. If I make sense then this is more dynamic and I listen and I can change it. A decision is something you polish. Sensemaking is a direction for the next period.”

The reason Gleason had it right is that his preference for sensemaking encourages listening, questioning, updating, and directing—all of which help people adapt to changes in fire behavior and crew behavior. Mindful management of the unexpected is about learning and sensemaking in the face of ambiguity and threat. We make sense by imposing some frame of reference and then interpret the bits and pieces we see as a plausible story within that frame of reference.

For example, we use the morning briefing as a frame of reference and, once we’re on the line, we

*Dr. Karl Weick and Dr. Kathleen Sutcliffe are internationally recognized experts on High Reliability Organizing. Authors of the new *Managing the Unexpected—Resilient Performance in an Age of Uncertainty* and their earlier edition *Managing the Unexpected—Assuring High Performance in an Age of Complexity*, they have been working with the wildland fire community for several years. Weick is the Rensis Likert Distinguished University Professor of Organizational Behavior and Psychology and Sutcliffe is the Gilbert and Ruth Whitaker Professor of Business Administration at the University of Michigan, Ross School of Business.*

construct a story that explains the flame heights and speed of spread within the context of that briefing.

But sometimes the pieces don’t fit.

When this happens, we tend to overlook the significance of this “poor fit” and mindlessly retain the frame and the story that we started with. We don’t keep updating our understanding. Instead, we keep the frame rather than question it, ignoring things that don’t fit the frame—or we let disagreements persist unresolved. This pattern of selective sensemaking is precisely what the principles of the High Reliability Organizing discourage.

Mindful management of the unexpected is about learning and sensemaking in the face of ambiguity and threat.

The wisdom of Gleason’s observation has been apparent to us as we have discussed high reliability principles with members of the wildland fire community during workshops, staff rides, interviews, and field observations.

On the basis of those discussions, we have fine-tuned our understanding of how groups organize for high reliability. The fine-tuning is evident if you compare the first and second editions of our book *Managing the Unexpected*.

In this article for *Fire Management Today*, we comment briefly on six themes that stand out in those discussions. Three themes, normalizing, complexity, and failure reaffirm properties originally associated with High Reliability Organizations (HROs). The other three themes, resilience, brutal audits, and updating, represent modifications of some original conclusions. We continue to be struck by the relevance of High Reliability Organizing for the wildland fire community as well as the importance of further opportunities to learn about the nature of this relevance.

Reaffirmed Reliability Themes

1. Mindful organizing lies at the heart of reliable functioning.

Managing the unexpected is about curbing the temptation to treat unexpected events as normal, and then dealing with the consequences when you fail to curb that temptation. Mindful action means that you pay close attention to small, early failures so that you can correct them while they still can be corrected. “Even with wide safety margins and detailed operating procedures, missteps, missing resources, miscommunications, or mistakes have to be found and put right before they can turn into a tragic flaw” (Perin 2006). In HROs, the big issue is how long a problem lasts. “The longer problematic conditions persist, the less predictable and controllable system interactions become” (Perin 2006). The

earlier you catch a discrepancy, the more options you have to deal with it. But the earlier you try to catch an error, the harder it is to spot it.

HROs are not error-free, but errors don't disable them. HROs don't necessarily discover discrepancies more quickly, but when they do spot discrepancies, they understand their meaning more fully and can deal with them with greater confidence. These capabilities seem to be enhanced when people create practices and ways of working that:

- Track small failures,
- Resist oversimplification,
- Remain sensitive to operations,
- Maintain capabilities for resilience, and
- Take advantage of shifting locations of expertise.

Specifically, when people follow these five principles of mindful organizing, they weaken tendencies to:

- Look solely for confirmation of their hunches,
- Develop tunnel vision under pressure,
- Misunderstand and misestimate the complexity of events,
- Treat unexpected deviations as normal,
- Blame others for errors,
- Discount worst case scenarios, and
- Underestimate the rate of change.

If these tendencies go unchecked they can lead to unreliable performance, escaped fires, injuries, and fatalities. Efforts to reverse these tendencies are much harder than they look. They're hard because—to organize mindfully—you have to forgo the “pleasures” of attending to success, simplifying, planning,

following checklists, and pushing decisions up the chain-of-command.

2. Complexity is inherent in reliable organizing. Wildland fires of any type are complex events. As the Cerro Grande Board of Inquiry said, “Because of the potential for unintended consequences, prescribed fire is one of the highest risk activities land management agencies undertake. Contingency planning, which includes identifying necessary resources should a planned ignition exceed prescription parameters, is an essential component of a burn plan” (National Park Service 2000). To deal with this complexity, HROs are guided by a reluctance to simplify views of the world. They hesitate to live by generalizations and generic categories because they know that it takes a complex mental picture to register a complex event. They work hard to complicate their views in order to register differences between present situations and past experience more fully.

When you organize, you simplify. But you don't need to simplify casually, habitually, or instantly. You can be more deliberate in your choices of what to simplify. To be more deliberate means to be more thorough in articulating mistakes that you don't want to make. In the case of prescribed burns, one mistake you don't want to make is to misjudge the complexity of the burn. As the Cerro Grande Board of Inquiry noted, there are strong

The pattern of selective sensemaking is precisely what HRO principles discourage.

links among complexity ratings, resources deployed and on standby, and having contingency plans. If simplifications lead to misspecification of any one of those elements, brutal audits are likely.

Here is an example of a misspecification in the making. A fire manager talking about a soaring quota for acres to be burned said, “I know what complexity I want to get when I write my burn plans because I know how many acres I have to burn.” Lower rated complexity means more acres burned, but it also means more vulnerability if those ratings ignore on-the-ground conditions.

Complexity is not a problem unique to the world of firefighting. Everyone makes assumptions about how complex a project will be, what resources are needed to complete the project, and how to avoid entrapment. Those assumptions can be rough or nuanced. Resilience lies in the direction of nuance.

3. Preoccupation with failure equals preoccupation with learning. Preoccupation with failure, the first HRO principle, captures the need for continuous attention to details by detecting small discrepancies that could be symptoms of larger problems in a system. HROs watch for early warning signals because they know that they have neither experienced all ways in which a system can fail nor have they imagined and deduced all possible modes of failure. This first principle tends to be the one that firefighters find most objectionable. When they hear this guideline, firefighters think that they are being encouraged to find fault with other people, ignore their successes,

search for bad news, or become vulnerable to career setbacks when they admit screw-ups.

Firefighters also worry about the amount of effort it takes to look for failure day in and day out. As one firefighter put it, “If every day we have to assume that we’ve missed something, then it is a real struggle to think that way.” Objections such as these miss some important points.

First, reliable performance is defined relative to failure.

Reliability refers to “what one can count on not to fail while doing what is expected of it.” The role of failure in reliable performance can be specified by three questions:

- What do people count on?
- What do people expect from the things they count on?
- In what ways can the things people count on fail?

The answers to these three questions provide clues about what it is that could go wrong and what it is that you don’t want to go wrong. The key word in all three questions is **what** one can count on, not who.

Reliable performance is a system issue, not an individual issue. Failures are connected. Small early failures steer subsequent events toward outcomes that no one expected.

HROs are preoccupied with failure in three ways. First, they detect

small emerging failures because these might be clues to additional failures elsewhere in the system. Second, HROs anticipate and specify significant mistakes that they don’t want to make. In both cases, the preoccupation is warranted because the chain of events that produce failures can wind deep into the organization and be hard to spot. It takes more than attentiveness to what is going well if you want to stay on top of the complexity.

Third, a group’s knowledge of a situation, environment, and the group itself is incomplete. HROs recognize failure based on the existence of those knowledge gaps.

Those who object to a preoccupation with failure often are acting in ways that exemplify this principle.

Consider these actions described by fire managers:

- “After I get briefed on Lookouts, Communications, Escape Routes, and Safety Zones (LCES), I go walk the escape route for myself, time the walk, and examine the size of the safety zone.”
- “We work hard to describe the worst case scenario, watch for signs that it is beginning to happen, and hope for the best.”
- “We need to think about what could go wrong when we move into that area with all of those trees blown down.”
- “If we cross this draw, do you know how many 10 and 18 we break?”

- “Didn’t we just learn something from those fatalities at South Canyon?”

In each of these cases, people are paying attention to two things: small, early clues that something is not right and the potential mistakes that they don’t want to make.

Paying attention to the mistakes you don’t want to make is a hallmark of high reliability. In fact, research shows that the major determinant of reliability in an organization is not that it values reliability or safety more than other organizational values, but that it strongly disapproves of incorrectly specifying, misestimating, and misunderstanding.

Saying “Be safe” is not enough. When more members of an organization care about incorrectly specifying, misestimating, and misunderstanding, the organization can attain higher reliability (Schulman 2004).

Modified Reliability Themes

Mindful Organizing Requires Resilient Performance

In the first edition of *Managing the Unexpected*, the subtitle reads *Assured Performance in an Age of Complexity*. In the second edition, the subtitle has been changed to *Resilient Performance in an Age of Uncertainty*. Why the change from “assured” to “resilient” and from “complexity” to “uncertainty?”

Think about the following statement: “A safety zone is just a hypothesis.” That statement means that however reassuring a LCES structure might be, it still has uncertainties and requires adjustments, improvisation, and resilience to provide the protection

The wisdom of Paul Gleason’s observation was apparent as we discussed HRO principles with members of the wildland fire community. -

Managing the unexpected is about curbing the temptation to treat unexpected events as normal, and then dealing with the consequences when you fail to curb that temptation.

expected. In an age of uncertainty, it's hard to anticipate specifics and prepare for them. Therefore, you need generalized resources. As crewleaders often say, "be prepared for anything."

In any setting where people strive for higher reliability, they never achieve perfection. That's because "human fallibility is like gravity, weather, and terrain—just another foreseeable hazard" (Wildavsky 1991). If errors are inevitable, managers need to be just as concerned with the cure as they are with prevention. To be resilient is to be aware of errors that have already occurred and to correct them before they worsen and cause more serious harm. When you manage the unexpected, you're playing catch up by facing something that has happened but was not anticipated.

Despite the best-laid plans, unexpected events often force organizations to be reactive rather than proactive. Resilient reacting occurs when a system stretches and then returns to something resembling its former shape. Resilience involves the ability to:

- Absorb strain and preserve functioning despite the presence of adversity;
- Recover or bounce back from

disruptive events—as the system becomes better able to absorb a surprise and stretch rather than collapse, the "brutality" of an audit decreases; and

- Learn and grow from episodes of resilient action.

These adjustments are possible because of large and varied response repertoires, competence in reassembling existing practices into new combinations, intense sharing of information, and a well-developed ability to maintain emotional control during chaos.

Although people prefer to anticipate trouble and plan their defenses in advance, it's difficult when there is uncertainty. As Aaron Wildavsky explains, "Where risks are highly predictable and verifiable, and remedies are relatively safe, anticipation makes sense; most vaccines fit this criterion of efficient anticipation. Where risks are highly uncertain and speculative, and remedies do harm, however, resilience makes more sense because we cannot know which possible risks will actually become manifest" (1991).

When managers face uncertainty, their goals are to lower the magnitude of the disruption by catching it early and speed up the resumption of the activity that was underway before the disruption.

Brutal Audits: An Enduring Threat

In the first edition of *Managing the Unexpected*, just two pages before the end of the book, we included Pat Lagadec's description of a brutal audit that reads, "The ability to deal with a crisis situation is largely dependent on the structures that have been developed before chaos arrives. The event can in some ways be considered as an abrupt and brutal audit: at a moment's notice,

everything that was left unprepared becomes a complex problem, and every weakness comes rushing to the forefront" (Lagadec 1993).

In the ensuing years, we have come to see the idea of a brutal audit as a central factor in resilient performance. In the revised edition, the very first sentence reads, "Unexpected events often audit our resilience."

Brutal audits are common in wildland firefighting. An entrapment is an example of a brutal audit, as are lousy briefings, poor maps, dated weather forecasts, inexperienced managers, etc. When entrapment and other events occur, people under pressure often fall back on old habits and routines (self-interest, familiar roles, overlearned personal tendencies, and flight) that are less suited to the current circumstances. Doing so can make a situation worse.

When people are put under pressure, they tend to act like they did in their previous role. For example, recently promoted crewleaders revert to squad boss behavior. The reason this principle has become more crucial is that with more shuffling of personnel among crews, more temporary assignments, more training compressed into less time, and more regulations to keep track of there is less complete learning of newer skills and less time spent building close ties. The result is a weakened team with much left unprepared. Under pressure, when it is important to see clearly what is happening, alertness falters and small errors become large.

Brutal audits are a harsh reminder that safe functioning is not bankable (Shulman 1993). Just because

an incident management team or crew were able to hold it together yesterday doesn't mean that they'll hold it together today. Teams have to work on strengthening their coordination, communication, and trust every day. They never solve the problems of reliability and resilience once and for all. Instead, they have to train for safe functioning, practice it, build it into their practices, and overlearn those practices.

Continuous Updating To Reduce Uncertainty

Mindful organizing is sensitive to impermanence and change. Failing to register ongoing variation and change is a symptom that alertness is waning. This is one reason why blind adherence to plans is dangerous.

To see how updating can reduce uncertainty, consider how managers dealt with the Hawkins wildland use fire in the Dixie National Forest (Keller and Fay 2005). This fire burned more than 35,000 acres (14,000 ha) and threatened the town of Enterprise in southern Utah.

Fire agencies and local ranchers had been meeting for years to discuss concerns about the area's overgrown vegetation and had agreed to conduct a prescribed burn. Before fire managers could light the planned fire, nature did it for them. When a series of lightning strikes started several small wildland fires in late July 2004,

12 miles (22 km) southwest of Enterprise, fire managers decided to manage two of these ignitions as wildland fire use (WFU) events.

As then-Dixie National Forest fire management officer Brett Fay recalls, "We expected the fire would burn around 7,000 acres (2,800 ha); we didn't expect it would get so big." They also didn't expect that the fire would uncharacteristically change direction multiple times, grow so fast, cross a dirt road boundary, or generate so much smoke that the town's residents would need to be evacuated. Nor did they expect that the (suppression) water source that they had counted on would be unavailable.

Surprises kept cropping up, but every time a new surprise surfaced, managers updated their understanding of events. They weren't afraid to ask for help or admit that they were in trouble. As a result, on the third fire day, after 12,500 acres (4,800 ha) had burned, the Hawkins

People should train for safe functioning, then practice and perform it—essentially, over learning those practices. -

WFU was declared a suppression fire. After the decision was made, Patti Koppenol, the Intermountain Region's deputy regional fire director, claims she "heard a collective sigh of relief as though people thought we had finally come to our senses."

Contrast this pattern of continuous updating with the less frequent updating at the Cerro Grande prescribed burn, which resulted in \$1 billion of damage in May 2000. The crew that lit the fire expected that their burn plan was doable and met objectives, that the fire itself would be of low to moderate complexity, that they had a capable crew and resources, that the dispatch system



Karl Weick and Kathleen Sutcliffe on the Cerro Grande Staff Ride during the first Managing the Unexpected Workshop held in Santa Fe, NM. Photo: Tom Iraci, Forest Service, 2004.

Paying attention to mistakes that you don't want to make is a key hallmark of high reliability.

was reliable and responsive, that contingency resources were on standby, that weather forecasts did not preclude burning, and that they were at a preparedness level that made burning possible.

The very fact that so much of the success of this project was tied to these expectations suggests the need for continuous updating to see if expectations were being fulfilled and to catch early indications that they weren't.

That updating happened more slowly than did changes in what they faced. As a result, they were slow to adjust to such things as a burn that was more complex than anticipated, a blackline whose inner edge was hard to extinguish, loss of a crew due to exhaustion just 4 hours after the burn started, uncertainty about whether a standby crew would be provided and how soon, conflict about budget issues, and an exhausted holding crew.

The leadership at Cerro Grande did less updating than did the leadership at the Hawkins Fire. The Cerro Grande Board of Inquiry implied a similar assessment: it described judgments at Cerro Grande as "not arbitrary, capricious, or unreasonable in light of the informa-

tion they had prior to the burn" (National Park Service 2001). It is the information during the burn that was more critical. Systems that mismanage the unexpected tend to ignore small failures, accept simple diagnoses, take frontline operations for granted, neglect capabilities for resilience, and defer to authorities rather than experts. Fragments of this pattern remain visible in Cerro Grande.

The Core of Mindful Organizing

Mindful organizing is about listening, asking questions, and taking action to better understand a developing story. This is the core of the resilient sensemaking that Paul Gleason practiced. A team that talks, asks questions, and thinks while acting is better able to identify:

- Large threats in the making,
- Oversimplification,
- Attention that is distracted from current operations,
- Excess attention to anticipation at the expense of resilience, and
- Deference to authority rather than to people with expertise.

We all try to make sense.

Organizing for high reliability is about acting in ways that keep sensemaking focused on the present conditions, on threats before they get uncontrollable, and on quick recovery from interruptions.

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THE CERRO GRANDE PRESCRIBED FIRE ESCAPE MEETS THE FIRST MANAGING THE UNEXPECTED WORKSHOP



Paul Keller

Back in May 2000 when I first heard the news about the now infamous Cerro Grande prescribed fire escape—mostly through the scream of national headlines—I immediately thought: Who messed-up?

No doubt about it, I wanted to assign blame. Somebody, I truly believed, had to step up, admit to, and be held responsible.

My coworkers—even though we were all hundreds of miles away from the smoke—not to mention the pertinent details—felt the same. Unfortunately, so did the system.

That following Sunday—after 18,000 people had been evacuated and 235 homes had fallen to the flames in nearby Los Alamos and surrounding communities—I remember watching a morning news program. The well-known television reporter was pressing the Secretary of the Interior to reveal what exactly was going to befall the person or persons responsible for this calamity. The Interior Secretary duly retorted that they were launching an official investigation and would know within the week just who was to *blame* for

Paul Keller served as managing editor of Fire Management Today from June 2005 to June 2007. A former hotshot firefighter and newspaper editor and publisher, he works as a technical writer-editor for the Wildland Fire Lessons Learned Center and for the Forest Service's National Fire Systems Research and Fire and Aviation Management programs.

No doubt about it, I wanted to assign blame. Somebody, I truly believed, had to step up, admit to, and be held responsible. -

this inexcusable disaster. People, he assured, would definitely be held accountable and punished.

I'm sure that, back then, I privately thought: Good!

That was before I had experienced the first national wildland fire community-tailored Managing the Unexpected Workshop on High Reliability Organizing. Little did I know then, I had a lot to learn about organizing, organizations, and blame.

They Eagerly Came

How can we organize for high performance in a setting where the potential for error and disaster can be overwhelming? In doing so, how can we best apply High Reliability Organizing concepts into the prescribed fire and fire use arenas?

These questions and others encompassed the key underlying themes that wove through that first week-long Managing the Unexpected in Prescribed Fire and Fire Use Operations, A Workshop on High Reliability Organizing event. This innovative week beckoned nearly 100 members from the ranks of the national interagency wildland fire community to Santa Fe, NM. This first Managing the Unexpected

Workshop would set the tone for a subsequent ongoing annual series of these special hands-on organizational learning conferences featured in different parts of the country (see sidebar).

Four years after the Cerro Grande Fire and after several people's careers had careened into nightmares, I attended this inaugural May 2004 event hosted by the Wildland Fire Lessons Learned Center. This unique high reliability learning session's focal point was an all-day staff ride* to the actual Cerro Grande prescribed fire site**.

The four primary members of Bandelier National Monument's Cerro Grande prescribed burn crew, including the unit's then-fire management officer, agreed to return and participate in this event.

In the immediate aftermath of the Cerro Grande escape, all of these employees had been abruptly removed and transferred from their

* For more information on the staff ride learning tool concept, see *Fire Management Today* Issue 62 Volume 4 on the Dude Fire Staff Ride or the *Fire Management Today* Issue 66 Volume 2 article "Staff Ride to the Battle of Little Bighorn and Mann Gulch Fire."

**This prescribed fire was originally known as the Upper Frijoles Units 1 and 5 Prescribed Burn. Because it was implemented on Cerro Grande peak, and its subsequent escape was named the Cerro Grande Fire, the burn is now commonly referred to as the "Cerro Grande" prescribed fire.

Annual Workshops Introduce High Reliability Organizing Concepts

A total of three national Managing the Unexpected in Prescribed Fire and Fire Use Workshops have been hosted by the Wildland Fire Lessons Learned Center:

- The May 2004 event in Santa Fe, NM, with the field study staff ride of the Cerro Grande prescribed fire escape.
- In February 2005, the second workshop held in Jacksonville, FL, featured a field study of the Okefenokee Ecosystem Fuels Management Program.
- In May 2006, the Managing the Unexpected Workshop convened in Missoula, MT, that highlighted an onsite staff ride to the I-90/Tarkio Fire shelter deployment site.

The purpose of all three workshops was to introduce participants to the principles of High Reliability Organizing using key ideas developed by Dr. Karl Weick and Dr. Kathleen Sutcliffe. The workshops' common, overall goal was to help facilitate new knowledge and tools—workable methods—for implementing High Reliability Organizing back on participants' home units.

The Wildland Fire Lessons Learned Center is now developing a curriculum on high reliability designed to help build wildland fire programs that are consistently successful in achieving their fire management objectives safely and effectively. The center is achieving this through a special cadre of wildland fire employees who are teaching people to facilitate High Reliability Organizing techniques on their home units. (For more information, see article on page 35).

The written reports and video/DVD productions from all three of the national Managing the Unexpected Workshops are available through the Wildland Fire Lessons Learned Center at <http://www.wildfirelessons.net>.

jobs at Bandelier. Their offices had literally been raided by Federal law enforcement agents. Their files and records were taken—and never returned. Even more devastating, their lives were locked into the crosshairs of a seemingly never-ending onslaught of official inquiries, reviews, and investigations that dragged on and on for almost 12 long months.

These four people's charge at the Managing the Unexpected Staff Ride was to come back and explain how and why they had planned and implemented this landscape-scale burn that would forever alter their lives. They knew that every step of the way on that staff ride, they would be subjected to questions and second-guessing from an astute

wildland fire-savvy audience. And yet, they eagerly came.

Overarching Theme

The concept and practice of High Reliability Organizing served as the overarching theme of this Managing the Unexpected Workshop. University of Michigan professors Dr. Karl Weick and Dr. Kathleen Sutcliffe, internationally recognized experts and authors on this subject, served as the workshop's central presenters.

Weick is the Rensis Likert Distinguished University Professor of Organizational Behavior and Psychology at the University of Michigan, Ross School of Business, whose research interests include high-reliability performance, collec-

tive “sensemaking” under pressure, and handoffs in extreme events.

Sutcliffe is the Gilbert and Ruth Whitaker Professor of Business Administration at the University of Michigan, Ross School of Business.

Her research is devoted to High Reliability Organizing and under-



Kathleen Sutcliffe at the first Managing the Unexpected Workshop held in Santa Fe, NM. Photo: Tom Iraci, Forest Service, 2004.

The concept and practice of High Reliability Organizing served as the overarching theme of the Managing the Unexpected workshop. -

standing the fundamental mechanisms of organizational adaptation, reliability, and resilience.

As we quickly learned that week, both of these individuals are approachable, personal human beings who exude a sincere interest in helping the wildfire fire environment become a safer place to be.

These two distinguished researchers and thought-leaders on organizational concepts and strategies examine organizations—High Reliability Organizations (HROs)—that must manage unexpected threats and, therefore, can't afford to make mistakes. These work environments include flight deck crews on aircraft carriers, nuclear power-generation and chemical production plants, air traffic control systems, hospital emergency departments, and the entire wildland fire community. Weick started his long-time affiliation with wildland firefighters at the Wildland Firefighters Human Factors Workshop held in the aftermath of the fatal 1994 South Canyon Fire.

Before the workshop, all participants received Weick and Sutcliffe's



Karl Weick at the first *Managing the Unexpected* Workshop held in Sante Fe, NM. Photo: Tom Iraci, Forest Service, 2004.

thought-provoking book *Managing the Unexpected—Assuring High Performance in an Age of Complexity*. This dynamic duo is universally heralded for helping develop the concepts that support High Reliability Organizing. They were in attendance at the workshop all week and also experienced the staff ride. “We had the opportunity to clarify ideas, answer questions, and learn,” Weick observed at week's end.

High Reliability Organizing

“The key definition of High Reliability,” Sutcliffe explained to us, “is working in an environment in which both high risk and high effectiveness can coexist.”

“High Reliability Organizing is really the glue or foundation for how we operate—and should strive to operate—in wildland fire management,” said Paula Nasiatka, manager of the Wildland Fire Lessons Learned Center and *Managing the Unexpected* Workshop moderator. “It is a way to think logically to better prepare for the unexpected events. It is a particularly good method for making sense—and even foreseeing—the unexpected.”

Starting on the workshop's first day, through an interactive combination of lecture, discussion, exercises, and video presentations, Weick and Sutcliffe illustrated the principles of an HRO. They also explained the idea and importance of what they call “mindfulness” as they introduced us to:

- A set of organizing practices that can lead to more reliable and effective work, especially under trying work conditions;
- A mindset that can help us catch and correct mistaken or misinterpreted actions;
- A system for better understanding organizing practices that can increase our awareness of small mistakes that can grow into large crises; and
- Examples of what occurs when people and systems give high or low priority to High Reliability Organizing principles.

Blame and Punishment

“Karl Weick and Jim Reason, with his ‘Just Culture’ concept, have taught us that an organization is defined by how it handles blame and punishment,” pointed out Mike DeGrosky, lead facilitator at the workshop.

“High Reliability Organizing is a system,” DeGrosky explained. “It is all about looking at system-wide responsibility. It isn't just a wildland fire safety tool—it's about the entire organization and organizing.”

As we learned that week in Santa Fe, part of an HRO's mindfulness, means paying attention to “weak signals” that things aren't going

Weick started his longtime affiliation with wildland firefighters at the Wildland Firefighters Human Factors Workshop held in the aftermath of the fatal 1994 South Canyon Fire.

right. We discovered that we all need to interpret these signals as portends of possibly bigger, imminent failures and to take the appropriate responsive actions to resolve and correct these situations before they escalate. If we are truly being highly reliable, we are constantly scanning for these weak, telltale signals every day and during all operations.

It's oversimplifying to believe that one individual's action cannot cause large, systemic failures. Consequently, if we simply focus on punishing an individual, the faulty or flawed programmatic system under which this failure occurred is never truly addressed or corrected.

"HROs try to understand the systemic reasons for why the accident happened—rather than focusing on punishing the individual," Sutcliffe confirms. Of course, if criminal negligence or serious malfeasance has occurred, that's an entirely different scenario.

The Staff Ride

Al King, fire management officer at Bandelier National Monument back in 2001 who functioned as holding boss on the Cerro Grande burn, served as the lead presenter at the staff ride's first stand. King's opening words were both heartfelt and riveting. They set a universal tone for the subsequent flow of organizational learning that would percolate throughout that day.

At the next stand at the foot of prominent Cerro Grande peak, presenter Matt Snider, who had served as ignition specialist on the Cerro Grande prescribed fire, echoed King's reasoning. "I came back here today for two reasons," Snider confided. "One, I'm hopeful that something I do or say

Darkest Chapter in My Life

"Coming back here reopens the book on the darkest chapter in my life. But if my participation here today helps prevent any of you from going down the road we did 4 years ago, it will all be worthwhile."—Matt Snider

might help prevent any of you from ever going through what we went through and, two, for (the late) Paul Gleason. Because of his emphasis on learning and teaching, I know he would have wanted us to come back here to be a part of this. *(Editor's Note: See Matt Snider's personal reflections on the staff ride and "Managing the Unexpected" in this issue on page 26.*

"The staff ride was the key to this week," said Dick Bahr, fire use specialist with the National Park Service's Fire Program Center who served as co-chair of the workshop's steering committee. "It got everybody's feet on the ground and simultaneously brought Weick and Sutcliffe's High Reliability Organizing concepts to life."



Al King served as the holding boss on the Cerro Grande prescribed burn. His opening remarks on the staff ride were both heartfelt and riveting. Photo: Tom Iraci, Forest Service, 2004.

What Went Wrong?

As we moved through the various staff ride stands that day, we observed how these people who had implemented the Cerro Grande prescribed fire were all genuine professionals. They all had extensive experience burning in the Cerro Grande fuel type.

So, what went wrong?

An organization is defined by how it handles blame and punishment.

Through the vehicle of the staff ride, it became obvious that a collective series of unexpected events helped upset this team's original operational and contingency plans and most likely collectively conspired to help spawn the eventual escape. These unforeseen setbacks included:

- The unexpected—for the most part, different personnel than anticipated (from the off-unit holding crew) who appeared onsite that evening of the burn. This crew's members eventually became fatigued and had to pull off the burn's high-elevation hill after there was fire on it.
- An inability to receive additional, necessary resources through the dispatch system. Nine hours transpired from the first time

High Reliability
Organizing is really
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“The staff ride was the key to this week,” said Dick Bahr, fire use specialist with the National Park Service’s Fire Program Center who served as co-chair of the workshop’s steering committee. “It got everybody’s feet on the ground and simultaneously brought Weick and Sutcliffe’s High Reliability Organizing concepts to life.” Photo: Tom Iraci, Forest Service, 2004.

that—nearby—resources were requested through dispatch, until they finally arrived on the prescribed fire.

- The helicopter requested to suppress the problematic sloopover area which was located at 10,000 feet (3,045 m), arrived late and without the necessary suppression bucket.

Integration Phase

“It took a real strength and strong display of courage for these folks to return here and become so intimately involved in this,” said lead staff-ride facilitator Dick Mangan. Mangan’s initial sentiments were echoed throughout this staff ride climax session. Other individual comments and observations from various workshop participants included:

- “I saw a tremendous display of resilience by these people who came here to share their stories with us. I hope their presence here was as helpful for them as it was for me.”
- “Yesterday, one presenter expressed how thankful he was to have an opportunity to tell the other side of this event. Certainly, considering all the liability that is surrounding these folks and their agencies, it’s understandable how he might not want to say a lot. But it’s important. It’s important to those who were there. And it’s important to us as profession-

als to hear that side—especially presented in a way in which these people can feel safe doing this.”

- “Even though I was on the type 1 interagency management team assigned to the Cerro Grande Fire, I learned a whole lot more about this fire yesterday on the staff ride. What I now know about this prescribed fire—what we learned yesterday—and what the investigation reports say, are two different things. We need to find a way to set the record straight.”
- “I firmly believe that the whole investigation process needs to be revisited. We all know mistakes are going to happen—hopefully not on this scale. But I’d like to think that when we conduct these post-event processes—these investigations and reviews—that we protect our employees and not abandon them.”

Another important concept highlighted more than once during the integration phase regarded our agencies’ collective focus solely on the initial Cerro Grande prescribed fire escape. This amplified concentration on the burn’s escape overlooks the fact that it was a con-

verted type 1-managed wildfire that eventually burned into Los Alamos a full 4 days after the burn had transitioned from prescribed fire to wildfire.

Stimulate Change

A primary goal of this first Managing the Unexpected Workshop was to help ensure that concepts and knowledge absorbed during the week would successfully make it back home to participant’s work units to help stimulate personal and organizational change.

But we all know the customary, ill-fated scenario. No matter how stimulating a workshop or conference might be, once we get back home, much of our newly acquired insight and motivation takes second place to our daily work demands.

HROs try to understand
the systemic reasons
for why the accident
happened rather than
focusing on punishing
the individual.

“That’s why we decided to conclude the workshop with two nationally recognized organizational psychologists,” explained workshop chair Dave Thomas. “Their facilitated exercise helped us understand why there’s a natural immunity to change in all of us. They gave us a proven, hands-on method for overcoming this resistance.”

These two “immunity to change” experts who worked with workshop participants throughout the event’s final day were Harvard University Graduate School’s Robert Kegan, the William and Miriam Meehan

Professor of Adult Learning and Professional Development, and Lisa Lahey, research director of the school's Change Leadership Group.

Additionally, 20 workshop attendees participated in a 3-month followup coaching process with Kegan and Lahey, authors of *How the Way We Talk Can Change the Way We Work*.

Personal End Note

When I got back home from Santa Fe, I felt truly enlightened. No doubt about it. I could feel those new High Reliability Organizing concepts and perceptions bubbling around up there inside my brain. Then, not too long after my return, I was watching one of those weekly

"High Reliability Organizations try to understand the systemic reasons for why the accident happened—rather than focusing on punishing the individual." —Dr. Kathleen Sutcliffe.

television documentary news programs. The subject was actual hospital mistakes. First up was this distressing case of a poor man whose diseased right arm was scheduled for amputation. In surgery, they mistakenly removed his "good" left arm. Now he would have no arms. The "blame" was assigned to a technician who had—unintentionally—reversed the ex-ray.

I was beside myself. How could someone do such a thing? I started to be consumed with all kinds of punitive thoughts toward this person. That is, until the reasoned voices of Dr. Karl Weick and Dr. Kathleen Sutcliffe began to seep back into my brain.

I quickly slipped my newly acquired High Reliability Organizing lens over my misplaced reasoning. I then realized that maybe that technician is completely overworked. Or, perhaps this person's physical working environment is the true systemic culprit? And what about the hospital's presurgical procedures?

The staff ride got everybody's feet on the ground and simultaneously brought Weick and Sutcliffe's High Reliability Organizing concepts to life. -

I knew that if the system focused solely on retribution to this technician, a significant organizational flaw—the true health of this hospital's overall operational system—might never be addressed.

And I knew that—thanks to the Wildland Fire Lessons Learned Center's Managing the Unexpected Workshop—I was a little smarter than I used to be.

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OPENING THE DARKEST CHAPTER OF MY PROFESSIONAL CAREER

Matt Snider

In May of 2000, I was the acting fire use module leader at Bandelier National Monument near Los Alamo, NM.

When I reported for duty on the morning of May 4, I was prepared to start work on a prescribed fire that would take most of my time for the next month or so. I was completely unprepared, however, for the effect that the events of the next few days would have, both on my life and on the national wildland fire management community.

This escape, which would become known as the Cerro Grande Fire, and its subsequent run through the town of Los Alamos and the Los Alamos National Laboratory precipitated some profound changes in the way that we manage fire on the American landscape.

Four years later, a national workshop sponsored by the Wildland Fire Lessons Learned Center would

Giving a presentation like this meant opening the darkest chapter of my professional career.

Matt Snider is currently State Fire Program Manager for The Nature Conservancy in Savannah, GA. He began his wildland fire career in 1993 at Zion National Park in Utah, and has worked for the National Park Service and Forest Service on engines, helitack crew, fire use modules, and hotshot crew. As this article explains, in May 2000, Snider was involved in the prescribed fire that escaped and eventually became the Cerro Grande Fire that burned into Los Alamos, NM.

provide the foundation for changing the way that we think about our organizations and how we build them.

Second Thoughts

I was asked to participate in the first Managing the Unexpected Workshop and to assist with its staff ride presentation to examine our 2000 prescribed fire escape. I agreed without giving the decision much thought.

But after a couple of days thinking about what I had agreed to, I admit that I was a bit uncertain as to whether I wanted any part of an exercise of this kind.

Giving a presentation like this meant opening the darkest chapter of my professional career and doing so in front of a group of strangers. I had given testimony to an interagency investigation team, a U.S. Government Accountability Office Investigation, and a Board of Inquiry. I had all my personal effects in my office seized—even down to training manuals, periodicals, and old fire photos (to this day I have no idea where any of these items are). And I've told my story to a camera crew and producer from the Public Broadcasting Service.

Therefore, now, second thoughts loomed large—I really didn't think that I had it in me to go through it again.

After developing a serious case of "cold feet," I called Al King, my former fire management officer

"Learning from failure is hard."
—Kathleen Sutcliffe, co-author of *Managing the Unexpected—Resilient Performance in an Age of Uncertainty*.
Speaking at the 2004 Managing the Unexpected Workshop.

at Bandelier who had also helped implement our prescribed fire and planned to attend the workshop and help with the staff ride.

Honoring Paul Gleason

Al reminded me of a couple of things. First, we would be presenting to other wildland fire manage-



Photo of Matt Snider on the Cerro Grande Staff Ride. Photo: Tom Iraci, Forest Service, 2004.

I wanted to come back to New Mexico as a way to honor Paul Gleason's memory and to help myself and others become better "students of fire." -

ment professionals who would not be looking to second guess us in any way. Second, he asked me to remember that it was very important to (the late) Paul Gleason that our experience on the Cerro Grande Fire be a learning opportunity for the wildland fire community.

I had several opportunities to work for and with Paul before the Cerro Grande Fire and considered him

a friend. I wanted to come back to New Mexico to honor Paul's memory and to help myself and others become better "students of fire"—as Paul so often encouraged us to be.

With my feet thawed and my half-hour presentation prepared, I arrived in Santa Fe. I was immediately relieved to run into two old friends who made their support known in no uncertain terms.

For that entire week, I was impressed with the environment that the workshop coordinators, presenters, and attendees created. I never felt second-guessed, even while our actions and decisions on the prescribed fire were being scrutinized.

I was absolutely amazed at the outpouring of support that seemed to fill the room during the staff ride's final integration phase. To listen to so many of my peers say that they, too, would have made the same calls, that they appreciated what we came to do, and that it was valuable for them professionally, was both gratifying and humbling.

Realizing that the worst professional crisis I have ever endured would positively contribute to the improvement of prescribed fire planning and—in the event of another such prescribed fire escape—would hopefully help move us toward a more "Just Culture," made my decision to contribute to the workshop seem, in hindsight, like a very easy one. ■

CASE STUDY: IS HIGH RELIABILITY ORGANIZING THE NEXT BEST THING? YOU DECIDE



Oh no, not another “the latest best thing”...

Brett Fay

In the wildland fire community, it seems like every few months or so some new solution—intended to remedy all of our problems—gets tossed our way. That’s what I first thought about High Reliability Organizing. The next thing I knew, I was telling my fellow wildland fire managers that High Reliability Organizing really was the latest best thing!

So, what’s going on here?

Is High Reliability Organizing really a worthwhile tool for us? Or, is it just someone else’s good idea that doesn’t really have any applicable traction to our wildland fire management jobs?

I was first exposed to High Reliability Organizing in 1990 as part of a larger education on decisionmaking theory, organizational process, and effective teaching techniques. At first, I was skeptical. A High Reliability Organization (HRO) just sounded too academic to have any functional place in our fire community.

As I began to apply the HRO principles and observe its positive effects,

Brett Fay is the regional fire use specialist for the Forest Service’s Intermountain Region. When he first starting applying the High Reliability Organization principles to his work, he was the fire management officer for the Dixie National Forest, Cedar City, UT.

Many of the High Reliability Organizing processes definitely pack a lot of utility for wildland fire managers. -

I realized that no process meets all needs, but many of the High Reliability Organizing processes definitely pack a lot of utility for wildland fire managers.

To be culturally pertinent, our wildland fire management tools must also be relevant to the day-to-day difficulties that confront us. Without the good “fit” between what we actually do and the value that any new process provides us, that “next best thing” could end up an academic exercise with little or no application.

Firsthand Experience

From first-hand experience, I know that applying the High Reliability Organizing process is effective when:

- You have multiple fire starts;
- You have multiple incident strategy objectives;
- You have lots of resources committed;
- Everyone is tired, and you are trying to keep everyone as safe as possible.

Are these the times to try something new? Not usually, of course.

But on closer inspection, HRO principles are not really new at all. The conscious systemic nature of High Reliability Organizing might be new, but the principles are not.

So, how do you present HRO principles to a group that really doesn’t want another “tool?”

What works for me is to first provide different examples of effective HRO principles that people might already be doing (without the HRO labels) and *then* connect these practices into a mindful organizing process with the principles appropriately identified.

Identifying HRO Principles in Practice

The following common fire management practices can make HRO principles relevant to the fire management community:

After Action Reviews. After action reviews (AARs) are a great place to exemplify some of the associated HRO principles such as “giving strong responses to weak signals.” When doing AARs you can identify these signals that might not otherwise be evident. Lack of good com-

munication to and from dispatch is an example of a weak signal that could be important in determining the health of the overall system.

- **Staff Rides.** The wildland fire management organization universally recognizes staff rides as outstanding learning tools. Many of these learning opportunities focus on fire fatalities or other significant organizational failures. In this way, staff rides can be an optimum process to help define where “failures”—both big and small—occurred. The “Preoccupation with Failure” HRO principle lends itself to the practice of staff rides.
- **Incident Command System.** The structure of the Incident Command System (ICS) can be used as example of the HRO prin-

ciple “A Deference to Expertise.” As our wildland fire operations become more complex and complicated, our ICS system is designed to respond to these complexities by deferring to the expertise of a team or incident commander. If you have never been confronted with a certain situation before, wouldn’t it make sense to defer to someone who is more experienced—even if they represent a lower pay scale than you?

How do you present the HRO principles to a group that really doesn’t want another “tool?” -

- **The Wildland Fire Situation Analysis.** The Wildland Fire Situation Analysis (commonly referred to as the “WFSA”) analysis is an example of the HRO principle “A Reluctance to Simplify.” Creating alternatives and identifying and prioritizing objectives are examples of making a decision more complex. HRO principles identify that by making decisions more complex helps to identify more of the nuances that surround a given decision. Once these nuances are identified they are used to make more reliable decisions.

High Reliability Organizing is another tool that helps us better manage unexpected events. Is it the latest best thing? Maybe; maybe not. It's up to each of us to determine.

Try it, you might like it! ■

CASE STUDY: THE HIGH RELIABILITY ORGANIZING FIELD STUDY OF THE OKEFENOKEE NATIONAL WILDLIFE REFUGE



Paul Keller

When we observe the evolution of the fire management program of the Okefenokee National Wildlife Refuge system tomorrow, we are going to be observing collaboration in a complex environment,” Dr. Karl Weick, internationally recognized expert on High Reliability Organizations (HROs) points out to the 120 wildland fire management employees participating in the May 2005 *Managing the Unexpected in Prescribed Fire and Wildland Fire Use Operations – the Second Workshop on High Reliability Organizing* event in Jacksonville, FL.

“We need to pay attention to the mistakes that they *don’t* make and how they have designed themselves to avoid making these mistakes,” Weick tells the workshop participants, who represent several agen-

“Make this a learning moment. When we get back, we’ll pool our experiences. We’ll reflect on what we saw.” -

Paul Keller served as managing editor of Fire Management Today from June 2005 to June 2007. A former hotshot firefighter and newspaper editor and publisher, he works as a technical writer-editor for the Wildland Fire Lessons Learned Center and for the Forest Service’s National Fire Systems Research and Fire and Aviation Management programs.



How can we better manage and be better prepared for unexpected events in the wildland fire arena? Managing the Unexpected—The second workshop on High Reliability Organizing—is part of a continuing organized effort to help improve this country’s prescribed fire, wildland fire use, and fire suppression programs. The workshop’s special focus is a field study of the Okefenokee National Wildlife Refuge system. Photo: Tom Iraci, Forest Service, Pacific Northwest Region, 2005.

cies and various levels of the wildland fire organization.

“Are there parallels between the Okefenokee program and what you do back on your own home units?” Weick asks his attentive audience.

The well-known *Managing the Unexpected* author and esteemed University of Michigan professor continues to prepare the workshop attendees—primed all week in High Reliability Organizing principles—for their impending “hands on” field visit case study of the complex Okefenokee National Wildlife Refuge system.

“You need to ask yourselves:

How are they set up to avoid making mistakes?

Have they identified clues that indicate that they’re moving toward mistakes?

How are they prepared to recover from mistakes?

Do they know where their expertise is located to prevent problems—to be able to contain these problems in the early stages?”

Ongoing Effort

Sponsored by the Wildland Fire Lessons Learned Center, this workshop is part of an ongoing, organized effort to lessen the chance of future prescribed fire escapes and to increase the chances of replicating our wildland fire management successes.

Like all three of the workshops initiated by the center, this effort is to encourage and advance the strong tie between “High Reliability Organizations” and “Learning Organizations.” Dave Christenson, the Wildland Fire Lessons Learned Center’s assistant manager, served as the workshop’s lead planner.

The workshop’s central highlight and learning platform is the field visit of the U.S. Fish and Wildlife Service’s Okefenokee National Wildlife Refuge system to:

- Examine a wildland fire management organization,
- Observe potential High Reliability Organizing principles, and
- Discuss opportunities to incorporate these principles.

The workshop's overall stated theme is to "Help us improve our country's wildland prescribed fire and fire use programs by exploring HRO principles." -

“Keep tabs on what surprises you,” Weick underscores prior to the Okefenokee field visit. “Look for good examples of High Reliability Organizing principles. Make this a learning moment. When we get back, we’ll pool our experiences. We’ll reflect on what we saw.”

The 396,000-acre (160,000-ha) refuge was established in 1936 to help preserve and maintain the swamp’s health and natural features. Fire is a natural component of the total 438,000-acre (177,000-ha) Okefenokee Swamp that stretches from northeast Florida into southeastern Georgia. As workshop participants learn that day, this unique ecosystem is composed of Federal, State, and private lands.

This all-day “Managing the Unexpected” excursion includes:

- An indepth presentation of the Okefenokee National Wildlife Refuge’s fire history and prescribed fire program;
- A “hands-on” tour of the Okefenokee swamp ecosystem; and
- An introduction to the Georgia Forestry Commission, Florida Division of Forestry, and Forest Service, and their related fire management roles.

The complete DVD of this week-long learning event, that includes discussions of High Reliability Organizing principles and how they can be incorporated back on home units, is available through the Wildland Fire Lessons Learned Center at <<http://www.wildfirelessons.net>>. ■

CASE STUDY: HIGH RELIABILITY ORGANIZING AND PRESCRIBED FIRE ON THE BOISE NATIONAL FOREST



High Reliability Organizing: Applying It Instinctively

David Olson and Deirdre Dether

High Reliability Organizing is not rocket science. In fact, we often implement parts of it without knowing its terms. Learning more about High Reliability Organizations (HRO), though, will most certainly help you. By understanding the operations of an HRO, you can strengthen your program implementation and your ability to improve fire management or other operations.

Every year, the Boise National Forest prescribed fire program burns an average of 7,000 to 8,000 acres (2,800 to 3,200 ha). The forest is located near Idaho's capital, which is the third largest metropolitan area in the northwest, and introduction of any smoke into the city can spark a plethora of media interest, community concern, and regulatory agency oversight.

In addition, with rural populations rising and an increased emphasis on wildland-urban interface treatments, the potential for smoke problems impacting a vociferous public is huge. Using smoke management standard operations, such as following regulatory agencies' protocols and using minimal public information, is not always enough. Potentially, if we do so in all situa-

David Olson is the public affairs officer and Deirdre Dether is the forest fuels planner for the Boise National Forest, Boise, ID.

The introduction of any smoke from prescribed fire into this city can spark a plethora of media interest, community concern, and regulatory agency oversight.

tions, we risk losing our prescribed fire program.

Using High Reliability Organizing Practices

The Boise National Forest staff began searching for a better way of "doing business" that eventually led to the use of three fundamental High Reliability Organizing practices:

- Mindful awareness,
- Anticipation, and
- Containment.

After a particularly strong smoke event in downtown Boise, the forest staff decided to improve public awareness by better explaining our prescribed fire program. The lesson learned from this controversial event was that we can't surprise people with our smoke. With this heightened awareness, we developed and implemented a variety of products and methods for more effective public outreach.

Our intent was to comprehensively explain how we developed our forest's prescribed fire program. At the

same time, we acknowledged potential smoke impacts and the various steps that we take to minimize the potential of smoke intrusions. Our target audience included not only residents but also recreationists and hunters whose key seasons overlap with our spring and fall prescribed burn seasons.

We now use an interagency approach that includes our surrounding Payette and Sawtooth National Forests, the Bureau of Land Management's Boise District, and the Southwest Idaho Department of Lands. These combined agencies use the following tools to inform and alert the public to planned prescribed burns:

- Produce and distribute an annual booklet to elected officials, media, smoke-sensitive citizens, and others that describes every planned burn for the entire year, including acreage, legal location, approximate time of ignition, and the burn's purpose;
- Establish a telephone hotline and update it weekly or even daily if needed;

- Establish a Web page (<<http://www.rxfire.com>>) to provide updates and program information;
- Staff roadside information stations at key entry points to target rural commuters who might see a large column of smoke as they drive back and forth from work (see sidebar); and
- Provide information on the prescribed fire program to rural medical clinics and doctors.

Through these activities, the High Reliability Organizing practices of

“anticipation” and “awareness” (no surprises) and “containment” (having the tools quickly and early to address emerging issues) are being implemented.

Following the problematic smoke event that had clogged Boise, our staff initiated the High Reliability Organizing practices in an attempt to prevent surprising the public with smoke. In short, we had an unpleasant event, we were criticized, and we responded by adopting new information and communication approaches that successfully

provided the resilience for us to continue a vital program.

Carriers and Prescribed Fire

In their book *Managing the Unexpected – Assuring High Performance in an Age of Complexity*, authors Karl Weick and Kathleen Sutcliffe use an aircraft carrier flight deck crew as an example of a successful HRO.

On the carrier deck, a number of people, grouped by their shirt color, work at various necessary flight

A Roadside Demonstration

A very concerned parent stops and approaches one of the Boise National Forest’s roadside prescribed fire information centers. This father has a young asthmatic daughter whose health is being impacted by the current prescribed burn’s smoke. He is obviously disgruntled.

The man begins to fire questions about why the Forest Service is even doing this burning. He implies that the agency is just a bunch of “pyros” who like fire.

The Boise National Forest employees staffing this prescribed fire roadside information stand take the time to explain the entire prescribed burn to him. They give the man a booklet that emphasizes the forest’s desire to inform all area residents of the prescribed fire program to help ensure that everyone will know where and when a burn is planned.

The Forest Service employees explain to the man that increasing his family’s awareness about prescribed fire is the reason for the roadside information centers. They emphasize how they want to know about his daughter’s health situation so that he and his family can always be directly alerted to planned burns.

The man’s upset demeanor was gone. He walks back to his car realizing that the Forest Service truly is concerned with his family’s sensitive health care issues.

The prime High Reliability Organizing practice associated with this real world example is “*containment*.” Despite all of the Boise National Forest’s efforts to inform the public about prescribed fire events, a surprised, uninformed, and disgruntled resident surfaced.

If the roadside information center had not been available for this person to make human contact, a potential problem could have escalated into a serious health issue involving air regulators and elected officials—all stemming from one disgruntled citizen.

And, remember, this was all done without fully realizing that this practice had anything to do with High Reliability Organizing.

deck tasks. Each colored shirt supports the prime mission—launching and recovering the aircraft. Without every colored shirt, the overall job would fail.

Such is also the case with the prescribed fire program. The prime task is to conduct the burn. However, by producing the booklets and developing the other informational tools, a “different colored shirt” is used, helping the overall program succeed with public support. Once again, anticipation, awareness, and containment are successfully engaged.

The ultimate ironic story of anticipation, awareness, and containment occurred when an Idaho U.S. Senator was invited to be the keynote speaker at an Environmental Protection Agency (EPA) and Idaho Department of Environmental Quality (DEQ) grant award ceremony to tout the new pollution reduction equipment recently applied to Idaho City school buses. On that very same day, the Forest Service’s Idaho City Ranger District was conducting a prescribed fire—within 1 mile of the event site.

This big ceremony was less than 18 quick hours away when we first heard about it. To facilitate communication, gain understanding of the prescribed fire operation, and ensure completion of the burn, the Boise National Forest immediately

contacted the following people with information about the burn:

- The Senator’s staff,
- The regional EPA director (a speaker at the event),
- The State DEQ air quality manager (another speaker), and
- The Idaho City School superintendent.

This was all done to eliminate surprises and facilitate coordination. By being aware of the event, anticipating potential problems, and using products and communication to contain a potential significant issue, success was achieved.

End result: Everyone supported continuing the burn and was prepared to acknowledge—and even defend—this prescribed fire that could potentially intrude its smoke into the significant award ceremony. While this didn’t happen, the burn’s column was visible from the event site.

What You Can Do

Public emotions, fear, and interest are all stimulated by fire on the landscape. To implement our prescribed fire program, the public needs to understand and prepare for a burn. Thinking the event through with “*awareness*” (what can go wrong with the public), “*anticipation*” (what are the operational objectives that require sen-

The potential for smoke problems impacting a vociferous public is huge.

sitivity to all facets of a burn), and “*containment*” (what mitigation measures might be necessary) demonstrates why a prescribed fire program is, indeed, an HRO program waiting to happen.

Can we claim success at the Boise National Forest? During the past several years, the number of smoke complaints we receive has dropped to almost none. Informal surveys indicate that people know why we are burning.

The challenge now is to not put High Reliability Organizing “in the bank.” To truly implement an HRO requires continuous awareness, anticipation, and containment. As new residents come into the Boise area, which boasts one of the fastest growing populations in the Nation, we realize that we need to continue to build a program that will be successfully supported by the public.

We continue to analyze the potential for errors that we don’t want to occur by always searching for the weak signals that indicate a problem is developing.

To learn more about how we’re accomplishing this, visit the Prescribed Fire in Southwest Idaho Web site <<http://www.rxfire.com>> or call us at 208-373-4100. ■

Outcomes

Consider exploring the High Reliability Organizing principles and practices to realize the following outcomes:

- Achieving integrated involvement during high-tempo times,
- Preventing situations that could turn out badly from occurring, and
- Containing problems before they become bigger problems.

SPREADING THE WORD ON HIGH RELIABILITY ORGANIZING

Paul Keller

If you know what Nomex is, but you haven't heard about High Reliability Organizing—wildland firefighters, we have a problem.

Before this issue of *Fire Management Today*, had you even heard about High Reliability Organizing? Better yet, has this essential safety “tool” yet made it into your or your unit's wildland fire management toolbox?

If your answers are “no,” you'll be happy to know that there's a concerted effort currently underfoot to ensure that you, along with everyone else in the wildland fire community, have the opportunity to get up close and personal with High Reliability Organizing.

That's a good thing.

In fact, the popular opinion on implementing this innovative process—shared by everyone from the Forest Service's national director of Fire and Aviation Management to the on-the-ground firefighter—is: the sooner, the better.

Here's a quick up-to-date summary. In the wake of the third Managing the Unexpected in Wildland Fire Workshop (hosted by the Wildland

Paul Keller served as managing editor of Fire Management Today from June 2005 to June 2007. A former hotshot firefighter, newspaper editor and publisher, he now works as a technical writer-editor for the Wildland Fire Lessons Learned Center and the Forest Service's National Fire Systems Research and Fire and Aviation Management programs.

There was no question that High Reliability Organizing deserves to be included in the wildland fire management toolbox.

Fire Lessons Learned Center), a core interagency group convened in 2006 to determine how the tenants of High Reliability Organizing—the vital organizational learning conduit of these workshops—could be shared with even greater numbers of wildland fire practitioners.

These prior productive workshop sessions were based on the High Reliability Organizing principles developed by Dr. Karl Weick and Dr. Kathleen Sutcliffe in their book *Managing the Unexpected: Assuring High Performance in an Age of Complexity*. In the aftermath of all three of the annual weeklong workshops, the followup critiques, evaluations, and after-action reviews from both participants and staff confirmed that these learning events were highly beneficial to the wildland fire workforce.

It was evident that the High Reliability Organizing principles, that help people to think more clearly about how to perform their work, could help ensure safer and more effective day-to-day outcomes. Thus, it became obvious that High Reliability Organizing deserved to be included in the national wildland fire management toolbox. What's more, the Wildland Fire Lessons Learned Center organizers realized that, ideally, every unit should be benefiting from this valuable tool.

Advanced Seminar

Next step: In January 2007, under the organizing savvy of the Wildland Fire Lessons Learned Center, 27 key interagency people from around the country—all familiar with High

“This is not another checklist. It's not just another list that you pull out of your Incident Response Pocket Guide. High Reliability Organizing is a way of doing business. It's how you think about a problem and how you prepare for that problem.”

Whether it's suppression, wildland fire use, or prescribed fire—it's an ever-changing environment that we constantly have to adapt to. That's why any technique that helps us to learn and to adapt to these situations is one I'm going to latch on to it and use it, you bet.”

—Brett Fay (former Fire Management Officer)
Regional Fire Use Specialist
Intermountain Region

Reliability Organizations (HROs)—participated in an Advanced High Reliability Organizing Seminar. The participants included fire management officers, assistant fire management officers, fuels planners, training specialists, researchers, and safety officers.

Discussions at this seminar again indicated that extra heads-up employees are already spreading the High Reliability Organizing “mindset” through the wildland fire ranks via a unit-level grassroots effort.

“In my past, we have tried to introduce High Reliability Organizing to people that I’ve worked with both on a rappel crew and for the 4 years that I was the lead, annual fire refresher instructor for our forest,” explained seminar participant Tim Lynch, project leader for the Missoula Technology and Development Center’s helicopter rappel equipment and procedures program.

“We were fortunate to have a progressive fire staff,” said Lynch, a former rappeller and smokejumper. “I was given the latitude to teach basic High Reliability Organizing principles at all of our forest-wide fire refresher courses. In teaching the refresher, I always described the High Reliability Organizing processes that we used to create and teach mindfulness and ‘sensitivity to operations’ (one of the five High Reliability Organizing principles) on our rappel crew.”

Lynch continued, “One of things that we stressed very hard was that no matter what your position might be on the crew, you might be the one who notices something important. We let everyone know that it’s important that they feel comfortable bringing things up



A method for teaching the High Reliability Organizing principle “Sensitivity to Operations” is demonstrated through a special sand table exercise at the Facilitating High Reliability Organizing in Wildland Fire workshop. Photo: Dominic Kovacevic, Fire Imagination Center 2007.

that they’re uncertain about or feel uncomfortable with. We all have a responsibility to look out for one another’s safety.”

Held in Tempe, AZ, Weick and Sutcliffe—the HRO dynamic duo—facilitated this advanced seminar, sharing their wisdom and insights with this core wildland fire contingent. This productive session helped pave the way for the next step in the broader HRO “teaching” process, the first Facilitating High Reliability Organizing in Wildland Fire Workshop.

Three months after the Advanced High Reliability Organizing Seminar, this resultant facilitating High Reliability Organizing Workshop convened a select group of highly motivated interagency wildland fire practitioners.

Core Teaching Group

“Our motive is to expand the pool of people who can go out and teach High Reliability Organizing in the real world—out in the field,” facilitator Mike DeGrosky explained the opening morning of the Facilitating High Reliability Organizing in Wildland Fire Workshop, held in Nebraska City, NE. Cosponsored by the Wildland Fire Lessons Learned Center and The Nature Conservancy, this workshop’s future core teaching group audience was immersed in how to effectively teach and facilitate the five key High Reliability Organizing principles.

A cadre of master instructors who had attended the previous Advanced High Reliability Organizing Seminar conducted the event.

Many of the cadre members were also involved in the first three

The HRO principles, which help people to think more clearly about how to perform their work, could help ensure safer and more effective day-to-day outcomes.

national Managing the Unexpected Workshops.

“We are all here this week because we want to learn and we want to teach others,” Paula Nasiatka, the Wildland Fire Lessons Learned Center manager told workshop attendees. “You will be making a difference as leaders as you familiarize yourselves more and more with how we can best facilitate mindfulness and the HRO guiding principles.”

Teaching Guide

A teaching guide *Introducing High Reliability Organizing to the Wildland Fire Community—From the Field to Line Officers* has been published to help spread the High Reliability Organizing word. For the most part, this guide reflects presentations and feedback from the 3-day workshop.

By using and following this guide, the teacher—who knows, it could be you—will understand the fundamentals of High Reliability Organizing and will be better prepared to facilitate these principles to others. This guide is specifically designed to:

- Prepare people to spread HRO principles throughout the wildland fire community,
- Reinforce HRO principles with examples from both within and outside the wildland fire arena,

The most powerful action we can take is implementing High Reliability Organizing and, especially, to model it.

- Explore examples of integrating HRO principles into organizations,
- Help people understand the history and genesis of High Reliability Organizing, and
- Prepare people to teach others about the fundamentals of High Reliability Organizing.
- Incorporating them into their fire curriculum and training,
- Creating an HRO-based burn plan writing workshops,
- Building High Reliability Organizing into large fire assessments,
- Being available for additional High Reliability Organizing audits, training, and mentoring,
- Revising the prescribed fire plan formats using High Reliability Organizing, and
- Incorporating High Reliability Organizing into their annual fire refresher courses.

In the meantime, people will also be sharing the word about High Reliability Organizing with their fellow wildland fire associates on their own—just as they’ve been doing for years.

“Right now, all we can affect is our sphere of influence—the wildland fire community,” said Facilitating High Reliability Organizing Workshop participant Dave Allen, fire management officer at Sequoia National Park. “The most powerful action we can take is to implement High Reliability Organizing and, especially, to model it. It’s hard to go out and try to ‘evangelicalize.’ If a line officer doesn’t push this forward, you can’t let that stop you from implementing and modeling it.”

Allen’s fellow workshop participants also pledged to spread the HRO principles and concepts by:

Even as you read this article, wildland fire people are most likely out there spreading and modeling High Reliability Organizing. In addition, Nasiatka informs that another Facilitating High Reliability Organizing in Wildland Fire Workshop is being planned for 2008.

So if you’re wearing Nomex and you haven’t yet heard about High Reliability Organizing—this process designed to help people better manage unexpected events—you soon will be.

That’s a good thing. ■

TEACHING MINDFULNESS TO WILDLAND FIREFIGHTERS

Dave Thomas

For the last 3 years I have taught half-day workshops, conducted 1-hour lectures, and provided general awareness speeches about the Weick/Sutcliffe model of High Reliability Organizing as described in their book *Managing the Unexpected: Assuring High Performance in an Age of Complexity*.

This article is a series of musings, conjectures, and recommendations pulled from this teaching experience. My intent is to pass on some of the lessons that I have learned teaching High Reliability Organizing, and to pose recommendations for further study.

The most important facet of any talk on High Reliability Organizing is immediately establishing the rationale for why busy wildland fire managers, who are already overloaded with firefighting safety issues and decisionmaking responsibilities, should take the time to study the new High Reliability Organizing concept of mindfulness.

I begin by describing a number of reasons why busy people might

Dave Thomas, 2 years retired as the regional fuels specialist for the Forest Service's Intermountain Region, is now a consultant with Renoveling in Ogden, UT.

The ideas presented in this article were prepared for a luncheon talk at the International Conference on High Reliability Organizations: Practice and Theory, sponsored by the Ecole de Management de Normandie Business School and the University of California, Berkeley, May 2007, in Deauville, France.

want to adopt the mental posture of mindfulness.

I explain how the room for decision error in fire operations has decreased during the past five decades. In my days as a young firefighter from the late 1970s to the late 1980s, you could make a few tactical mistakes and probably not suffer severe on-the-ground consequences.

The room for decision/ error in wildland fire operations has decreased during the past five decades. -

Today, however, mainly due to the heating of the Earth through global warming and a build up of fuels—firefighters are working within an environmental framework of weather and fuel never experienced before. Errors that we might have “got away with” in the past could more easily become catastrophic today.

I support this observation with data from Dr. Tom Swetnam at the Tree Ring Laboratory in Tucson, AZ (<<http://www.ltrr.arizona.edu/~tswetnam/essays.htm>>). Swetnam describes the current fire climate as hotter and dryer than it has been in more than 1,000 years, causing fires to burn more intensely and in spatial and temporal patterns never before experienced.

Under current conditions, we must attempt to apply new methods to mindfully think about the decisions and forecasts that are a usual part of our wildland fire jobs. Droughts, declining natural water supplies, longer fire seasons, hotter days and warmer nights, high fuel levels, have all caused our fire operations’ decision frames to narrow. Today—just as the fire environment has changed—it is imperative for us to change and become more acute at sensing the harsh realities of this radically altered fire environment.

Understanding Mindfulness

As a High Reliability Organizing instructor, it is important to differentiate between Western notions of “mindfulness” and Eastern interpretations (such as Buddhism). To some, the word mindfulness is value laden, having religious connotations. For me, it is crucial to explain that mindfulness is a particular way of being in the world as described by Harvard researcher Helen Langer in her book *Mindfulness* (Langer, E.J. 1989. Addison-Wesley Publishing Company, Reading, MA). Langer described a particular way of being alert to novel distinctions. Weick and Sutcliffe have transfigured Langer’s concept as a method of sensing the world from the high reliability perspective.

I have studied wildfire “near misses” in the Western United States, where serious injury or death could have occurred. Based on these studies, I believe that if we are not more

mindful of our fire operations a serious accident can still occur on a wildland fire in which many firefighters are burned to death.

I don't write this to be a pessimist or to undermine the confidence of the brave men and women who work in wildland fire operations. In fact, I am reluctant to even call attention to these perceptions. I do so simply as my own preoccupation with failure (one of the five High Reliability Organizing principles). Under our current, ongoing droughty conditions and high fuel levels, a fire-related tragedy can easily occur.

As I continue with my introduction, I often use an idea taken from

We must be more acute at sensing the dangers of the wildland fire environment.

Aaron Wildavsky's book *Searching for Safety* (Transaction Publishers 1988). Wildavsky implies that safety is not a bankable item that draws interest in some safety bank account. In fact, he says the exact opposite is true—safety, with time, actually degrades: "Safety degrades; it too has a half-life. Why can't we take for granted whatever level of safety that has been attained? Because unless safety is continuously reaccomplished, it will decline...."

Wildland firefighters must strive to do everything in their power to instill freshness and new life into our old, standby notions of safety to ensure that safety doesn't degrade.

Easy To Be Mindless

Using case studies, I explain how easy it is to go "mindless," regardless of how good an individual or organization is or how much experience an organization has with fire. If we are not constantly wary of losing our situational awareness, disaster is inevitable.

To support this argument, I describe a horrible few minutes of mindlessness that occurred on a prescribed burn in Ontario, Canada,

Deep Smarts

For the past year, I, along with Dr. Dorothy Leonard of the Harvard Business School, have been video-interviewing fire managers who are recognized by their peers as being highly-skilled at their jobs.

These people, to use Dr. Leonard's phrase, possess "deep smarts," the ability to perceive the work world in novel ways and to construct speedy, workable solutions to a majority of problems they encounter—problems that they often have not previously encountered and, thus, they must quickly develop unique solutions.

People with such deep smarts can get a lot of work accomplished without serious disruptions. They help the company earn profits, be more competitive, and get the work done with fewer accidents.

I am just beginning detailed analyses of these deep smart interviews. One thing I have already noticed is that these people with high expertise in various fire management responsibilities, in many cases, were naturally practicing the concepts of mindfulness.

This is an important lesson for fire managers just entering their fields of work, that the men and women who came before them—the pioneers in prescribed fire, wilderness fire management, fire behavior prediction—were already practicing HRO principles.

For instance, Orville Daniels, former supervisor of the Lolo National Forest in Montana, a recognized pioneer in wildland fire use management, told us in his interview that when managing a fire that is being allowed to burn "you will

have adverse consequences in almost any of this high risk stuff...so something eventually will go wrong."

I have used Daniels' quote in many HRO talks as an example of someone who was always preoccupied with failure, a key HRO principle. Richard Rothermel, the Missoula Fire Laboratory scientist who developed the Rothermel fire spread equation, told us that he wished the spread rates and fire intensities that his model produced could have been banded in a web of probabilities. I have reconstructed Rothermel's sentiment to mean that he was reluctant to simplify, and—another key HRO principle—he believes even the quantitative outputs from his fire spread model should be looked at with a wary eye.

Mindfulness will help us get more fire back into these fire-dependent ecosystems.

in which a highly professional burning crew in just 7 minutes was burned over. Seven young foresters died in that fire. If it can happen to this highly motivated and experienced prescribed burning crew, it can happen to any burning crew.

Next, I explain the irrationality (mindlessness) of always learning our primary safety lessons through trial and error. It is our job to be better at anticipating errors before they occur, before a brutal audit forces us to notice the discrepant events in the fire environment. The following quotation, which reinforces this view, is taken from French disaster expert Pat Lagadec:

“The ability to deal with a crisis situation is largely dependent on structures that have been developed before chaos arrives. The event can . . . be considered an abrupt brutal audit: at a moment’s notice, everything that was left unprepared becomes a complex problem, and every weakness comes rushing to the forefront.”

I then make the case that to be good at mindfulness, to learn the cognitive skills necessary to regularly practice mindfulness, is to begin the movement from being a novice firefighter to one who is acquiring the skills of a master. It is a lifelong journey.

Polishing Skill Sets

Such a transitioning firefighter wants to move to a higher level of personal accomplishment in his or her profession—just as all professionals aspire to do, whether their

bailiwick be chess, poker, skiing, mountain climbing, foreign languages, or cooking.

To support this view, I tell stories about famous sports figures (Tiger Woods—truly a master of mindfulness), as well as people in the arts, to illustrate how excellent practitioners are continually polishing their skill sets. To masters in sports and the arts, just being good is never good enough.

Finally, I make the claim that to sense problems in the fire environment while they are small and weak—before they’ve incubated into larger, more devastating problems—increases the number of opportunities that we will have to safely put fire back into fire-dependent ecosystems.

After all, the wildland fire community works hard at becoming better at enhancing the ecosystems that they are assigned to protect and preserve. Accident prevention helps accomplish this primary mission.

The fewer mistakes we make:

- The fewer fire use events will get out of control,
- The more chances we will have to practice our skills as natural resource managers and stewards of the land, and
- The more fire we will get back into these fire-dependent ecosystems.

Recommendations

Firefighters need to develop metaphors for mindfulness as it is pertinent to wildland fire operations. These metaphors should be words or phrases that envelope the whole process of thinking toward novel distinctions about routine fire operations.

Just as firefighters commonly use the phrase “slide tray” to describe the variety of fire experiences that they have seen or experienced and that they now hold within their heads as analogues to be used on similar fires in the future, mindful firefighters need metaphors that encompasses the style of thinking that they are doing.

Academics working within the field of high reliability should describe the differences between their approaches. What is the primary difference between Karlene Robert’s approach to High Reliability Organizing and the approach established by Weick and Sutcliffe? To wildland fire practitioners it is tremendously difficult to separate the subtle differences in theory and to establish whether these differences, in the end, really matter.

Also, I have found it particularly valuable to have at least a taste of Weick’s earlier books on sensemaking. These prior works provide the groundwork for his particular version of what it means to “make sense” of the world. I recommend the essays in his *Making Sense of the Organization* (Blackwell Publishing Limited 2000).

Preparing mindful case studies is much different than preparing rational cause-effect case studies. I have found it difficult to prepare case studies from past wildland fire accidents or escaped prescribed burn reports that sharply delineate the principles of mindfulness. It is relatively easy to provide simple analyses to the potential etiology of complex firefighting errors. It is harder to add nuance and novel thinking to the same incident in hindsight. Once a wildland fire investigation report is published and, through hindsight, the cause

It is imperative for us to change and become more acute at sensing the harsh realities of this radically altered fire environment. -

of an event becomes known, it becomes difficult, if not impossible, to take away the sense of inevitability.

A tip sheet or checklist prepared by both academics and on-the-ground practitioners would provide an outline of how one might prepare mindful case studies.

The culture of wildland firefighting for the past three or four decades has been one of simplifying fire operations into standard operating procedures, into checklists (the 10 standard firefighting orders), and the simplifying of simplifications (Lookouts, Communications, Escape Routes, and Safety Zones).

Beware of Simplifying

We have attempted to make operating in a complex world simple and straightforward. But mindfulness requires us to think with more serendipity, with more variety and complexity. To paraphrase Weick and Sutcliffe, it takes complexity to understand complexity and we must be cautious every time we attempt to simplify the world.

We must fight the tendency to turn High Reliability Organizing training programs into classes that become nothing more than exercises in tactics—if the hotshot crew would have done this, that burn-over would not have happened...if the burn boss would have written a better burn plan, the burn would not have jumped the control lines.

Simplification of the wildland fire environment, and the thinking processes used by firefighters working in that environment, results in thinking that the environment is simple and somehow, controllable. Although such thinking is somewhat comforting, which in and of itself could be dangerous, the intrinsic complexity of the fire environment is lost in this tactical narrowing of focus.

In the classroom, we must fight to maintain the feisty, ever questioning, creative beauty of mindful thinking.

Hopefully, in some small way, these remarks will help other teachers of mindfulness to be better prepared for their classroom adventures in teaching this new style of sensing the dangers that most definitely lurk in the world of wildland fire operations. ■

A PERSONAL ACCOUNT OF RESILIENCE AND PRESCRIBED FIRE



Riva Duncan

Many who work in fire management will, at some time in their career, face something difficult, an “abrupt and brutal audit” (Lagadec 1993) that will shake their confidence at best and leave them heartbroken at worst.

I know.

How do some of us get through those dark days, learn from our mistakes, and continue to do our jobs as best we can? What makes some of us “bounce back” from a serious accident, a fatality, or an escaped prescribed fire and continue to do the work on the land that is not only important but necessary? Why are some people able to adjust and adapt quickly in a rapidly changing fire environment?

Rather than speculate about what other people possess that helps them “get back up on that horse,” I will tell you my story.

In 1998 I began, what would prove to be, a wonderful 5-year tenure working on the Apalachicola National Forest in northern Florida. The Apalachicola has the largest prescribed fire program of any other national forest in the country. In addition, wildland fires can ignite here during any month of the year.

With a program of burning approximately 100,000 acres (40,000 ha) per year, this is the place to learn

Riva Duncan is the deputy forest fire management officer for the Klamath National Forest, Yreka, CA.



The first spot fire on the Cascade II Prescribed Burn. Photo by Matt Preece, Uinta National Forest.

about fire behavior and fire ecology. Most of the people I worked with were from the South. Many grew up there. Not only had they been burning with the Forest Service for years, several of them had been burning with their daddies and granddaddies since they were kids.

When I arrived from my northeast “asbestos” forest, folks willingly transferred their land ethic to me. The fire practitioner “heroes” whom I had the privilege of working—and learning—with helped me to understand why fire is “good.” They knew the difference between a dormant season burn

and a growing season burn. And they took the time to teach me a true appreciation of such “hands-on” fire ecology. They taught me to drop a match or carry a drip torch mindfully, and to always know the outcome and consequences of my actions. It was a wonderful gift.

Safe Learning Environment

We had a very supportive district ranger, Andy Colaninno, who encouraged a safe, learning atmosphere. He wanted his employees to be creative and innovative and to learn from their errors.

They taught me to drop a match or carry a drip torch mindfully and to always know the outcome and consequences of my actions. It was a wonderful gift.

High Reliability Organizing Principle #4:

A Commitment to Resilience

One such lesson occurred when I was a burn-boss trainee on a 2,000-acre (800-ha) unit. Our two principle lighters—both fairly new to the Apalachicola—were driving all—terrain vehicles (ATV) with rear-mounted drip torches. Driving around the burn unit’s perimeter after we had completed our ignition operations, I came across a group of local hunters who informed us of a spot fire across the swamp—outside the unit.

The burn boss trainer called the helicopter manager to prepare for a reconnaissance flight. Sure enough, we had fire outside the unit. We looked for a good place to burn out from and then talked in the ground forces. My fire management officer told me that I’d better call Andy, the district ranger, at home (it was Saturday). On the phone, Andy asked if we were catching the slop-over. I informed him that we were, that we were burning out a section of the adjacent unit and it should be finished soon. He said “sounds good” and told me that I could fill him in on Monday.

After we finished the burn, we stood around the trucks to talk about it (we didn’t call this an “after-action review” back then). We soon discovered that the two igniters on ATVs had crossed the swamp without realizing it and had lit the other side. After some good-natured ribbing, we recognized that putting two people who weren’t familiar with the unit together as our principle lighters was a bad idea. We never did that again.

My Brutal Audit Occurs

After almost 6 years of prescribed burning and fighting fire in Florida under my belt—and possessing a solid love of fire, as well as the ecosystems that thrive on it—I accepted a job in Utah as the forest fuels specialist on the Uinta and Wasatch-Cache National Forests. It could not have been more different than Florida. Not just the topography, weather, and fuel types, but these two forests were in the early stages of building prescribed fire programs.

I was only 4 months into my new job when the audit occurred. The Cascade II Prescribed Fire on the Uinta National Forest was intended to reduce hazardous fuels and regenerate aspen on 600 acres (240 ha). I was the type 1 ignition specialist. By 5 p.m. the day of the burn, it was declared an escape.

The fire would eventually burn 8,000 acres (3,200 ha)—mostly private lands. The smoke from our escape was so bad in Salt Lake City that the street lights came on during the day. Salt Lake City International Airport nearly closed down. For several days school recesses were cancelled, football practices were moved indoors, and a few people even put their asthmatic children on planes to visit relatives elsewhere.

The smoke from our escape was so bad in Salt Lake City that the street lights came on during the day. Salt Lake City International Airport nearly closed down. -

Because of our burn, community relations with the Forest Service became strained, to say the least.

The media was harsh. Our forest’s public affairs officer was admonished—off duty—in the post office. Some of our firefighters were refused service at a local gas station. Members of the public wanted some of us fired.

Internally, it wasn’t much better. Some of our nonfire coworkers were just as angry at us as was the public. And the finger-pointing and blame deflecting even began to flare up between my work associates.

I woke up many nights trying to understand what went wrong on that burn—and what I could have done differently. I wondered about the decisions I made and how the outcome might have been different had I done something else.

Those of us in overhead and planning positions and some of the line officers endured a national-level investigation. When the report was released, many of us were unhappy because we felt it did not portray the events or the causal factors accurately. But I’m sure everyone who has gone through one of those investigations feels the same.

Several weeks later, some of us were notified that an administrative investigation was coming. I gave my testimony the Monday following Thanksgiving at a downtown Provo, UT, hotel. It wasn’t until well after

We displayed an unspoken spirit of teamwork and common goals.

Christmas that disciplinary actions were handed out.

High Reliability Concepts

So, what did I do? In the aftermath of this prescribed fire escape, no one would have blamed me—or any of us involved with this incident—if we had just thrown our matches away, put down our drip torches, and gone on with other things like fire suppression. But I couldn't do that. My land ethic wouldn't allow it.

Intentionally putting fire on the landscape was and is a part of who I am. So, I started writing more burn plans. I began to plan other burns with some of the forest's fire management officers. Yes, a handful of us got up, dusted ourselves off, and got back to work.

Our core group believed in the prescribed fire program. We didn't want to watch it die. And, frankly, we had something to prove—to ourselves, to our local communities, to the regional office, and to our coworkers: We knew how to burn.

The following May, I was in a hotel conference room in Santa Fe, NM, listening to two professors talk about High Reliability Organizing. I went on a staff ride of the escaped prescribed burn that became the Cerro Grande Fire. I listened to those on the staff ride who had planned and implemented that burn—like me they were just trying to do the right thing for the land—tell their story.

And when the two professors, Dr. Karl Weick and Dr. Kathleen Sutcliffe, talked about mindfulness and managing the unexpected (Weick and Sutcliffe 2001), something clicked in my brain. If I had known about these principles *before* our Cascade II prescribed burn, would the outcome have been different?

I did know that these new high reliability concepts would help me to do my job better in the future.

Exhibiting Resilience

On October 15 and 16, 2004—just 1 year after the Cascade II escape—we successfully implemented the 3,000-acre (1,200-ha) Halls Fork prescribed fire on the Uinta National Forest. Most of us on this burn had also been on the Cascade II burn and escape.

Once again, I served as the type 1 ignition specialist. During this prescribed fire, we looked for weak signals and when things didn't go as planned, we caught them early. We adapted. We displayed an unspoken spirit of teamwork and common goals. Of course, like most burns, it wasn't perfect. This burn, too, had its learning moments. But it was a huge step in the right direction.

Later, I relayed my story to Dr. Weick and Dr. Sutcliffe. They said it was an example of resilience—one of the five principles of a High Reliability Organization. Even after becoming a part of the cadre and then steering committee of the subsequent Managing the Unexpected Workshop series, I still sometimes have trouble with this principle. After many discussions with colleagues and with Weick and Sutcliffe, “resilience” still means different things to me.

At a recent meeting with Sutcliffe and Weick, Dr. Sutcliffe said that bouncing back from hardship or tragedy was not a “big deal, people do it all the time.” She emphasized that people who did so appeared to have one thing in common—they had dealt with hardships or adversity before, but on a smaller scale.

I immediately thought of my safe learning environment and experience in Florida, where I was once indirectly responsible for having a prescribed fire escape—and no blame was ever assigned.

When I reflect back on the Halls Fork burn, I think resilience was applied in its planning. And, we all had a desire to get back to work after our experiences that followed the Cascade II escape. We bounced back.

As for my personal resilience, I know it was due to the land ethic that I developed in Florida and the safe learning environment that I experienced there. I applied the hard lessons that I learned from Cascade II to this foundation and tried to do even better.

It is a personal quest that is ongoing.

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ASSESSING HIGH RELIABILITY PRACTICES IN THE WILDLAND FIRE COMMUNITY



Anne Black, Kathleen Sutcliffe, Michelle Barton, Deirdre Dether

The Office of Inspector General's 2006 audit of Forest Service fire management operations added yet another voice to the growing chorus calling on the Federal wildland fire community to get more fire on the ground (OIG 2006).

The 1995 National Fire Plan and the 2001 Implementation Plan identify the critical role of wildland fire use in reducing hazardous fuels conditions, reducing risk to property and natural resources, and reducing costs. Yet, meeting these goals poses significant organizational challenges, particularly when it comes to fire management's capacity to safely manage fire on the landscape.

The search for improving effectiveness of wildland fire management is not new. In 1914, California Regional Forester Coert duBois launched the Forest Service's first systematic approach to fire management with then state-of-the-art management science. The Incident Command System was developed

Anne Black is an interdisciplinary ecologist for the Aldo Leopold Wilderness Research Institute, Forest Service, Rocky Mountain Research Station in Missoula, MT; Michelle Barton is a PhD student at the University of Michigan, Ross School of Business, Ann Arbor, MI; Kathleen Sutcliffe is an associate dean for Faculty Development and Research and a professor of Business Administration and Management and Organizations, University of Michigan, Ross School of Business, Ann Arbor, MI; and Deirdre Dether is a fuels planner, Boise National Forest, Boise, ID.

to meet organizational challenges posed by complex fire situations.

Fire managers since have sought continual improvement of fire knowledge, tools, and equipment. The Incident Command System, for example, was developed to meet organizational challenges posed by complex fire situations. Attention has also focused on human factors—the way units are structured and how people interact—as well (e.g., Putnam 1996, IAWF 2005).

Many key concepts under-girding organizational effectiveness are captured in the theory of high reliability (Weick and Roberts 1993, Weick and Sutcliffe 2001, DeGrosky and other articles in this issue). Simplistically, a High Reliability

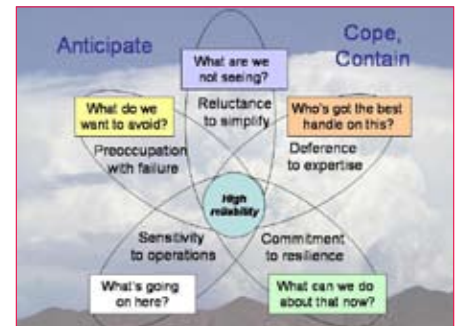


Figure 1. The Principles of High Reliability Organizing.

Organization (HRO) is one that consistently produces the results in a dynamic, often unpredictable environment in which the consequences of errors are catastrophic. Accordingly, the error rate of an HRO is substantially lower than other businesses in the same field. Traditionally, there have been two main approaches to reliability. One

The most successful organizations spend more time than their counterparts considering the following factors:

- **Preoccupation with failure**—detecting weak signals and examining failures or unexpected events in order to understand the health of their system.
- **Reluctance to simplify**—resisting the urge to simplify assumptions about the world.
- **Sensitivity to operations**—having the “big picture” or the “bubble” of what’s going on.
- **Commitment to resilience**—developing the ability to bounce back and improvise after weak signals are caught.
- **Deference to expertise**—locating local expertise and creating a set of flexible decision structures and operating dynamics that take advantage of those experts (fig 1).

Consolidating and improving reliability requires understanding where we are today—our strengths and our weaknesses.

seeks to anticipate events that must not happen, identify all possible precursor events or conditions, and then create a set of procedures necessary to guard against the undesired outcome. Anticipation focuses on picking up weak signals before they can incubate into larger, more catastrophic events.

The second approach to high reliability considers anticipation. In this view, reliability is finding ways to cope with and contain undesired events as they occur—and before their effects escalate.

Over the past decade, researchers have realized that the most successful organizations use *both* strategies.

Many units of wildland fire management seem to fit the definition of high reliability. Recent doctrine discussions, safety dialogues, peer reviews of incidents, the creation of the Wildland Fire Lessons Learned Center, and the sponsorship of the Managing the Unexpected Workshop series (Keller 2004) are clearly in support of the Forest Service's efforts to improve safety and effectiveness.

Ideally, these activities result not only in greater capacity to safely meet suppression needs but also meets the growing demand to manage *desirable* fires—prescribed and Wildland Fire Use fires.

Can We Build Upon This Base?

Consolidating and improving reliability requires understanding where we are today—our strengths and weaknesses. The University of Michigan's Ross School of Business, the Interagency Aldo Leopold Wilderness Research Institute, and the interagency Wildland Fire Lessons Learned Center have collaborated in a three-phase study to assess reliability in the fire community. We hope to discover how the wildland fire community thinks and talks about managing in an unpredictable environment, assess the breadth and depth of HRO awareness and behaviors, and better understand how new ideas diffuse through the wildland fire community. This effort will assist in creating an internal benchmark, identify examples of exemplary behavior, and feed important information into our training programs.

Building the HRO Image

The first phase, conducted in the late fall of 2006, sought to build an image of what High Reliability Organizing practices look like in the fire community (this article presents some of these findings). The second phase (Fall 2007) asked how common were these behaviors across fire organizations? The final phase seeks to identify key mechanisms of diffusion and adoption of High Reliability Organizing ideas.

To build our baseline understanding, we interviewed 19 qualified individuals from three broad levels of the fire organization (crewmembers, middle managers, and decisionmakers) within the Forest Service, Bureau of Land Management, and National Park Service.

We asked each to describe an event that went well and another that didn't go well—letting each

individual determine what “well” meant. While this information was primarily used to refine our quantitative survey, comparing these descriptions with the five principles of HRO also allows us to build an initial understanding of how members of the fire community think about reliability.

We found examples reflecting each of the principles, but not every aspect of each principle. Table 1 provides illustrative quotes of how the fire community embodies aspects of high reliability. In the second phase, we hope this snapshot will resolve into a clearer picture.

Some High Reliability Organizing behaviors are so mundane that people might overlook their value. Managing emergencies or accidents as “incidents within incidents” seems an intuitive way to organize and exemplifies a commitment to resiliency. Doing so ensures that the majority of the organization's energy remains focused on its primary objective (such as supporting a wildland fire incident), while making sure that the emergency is adequately addressed as well.

On the other hand, simply acknowledging the build-up of unexpected events—late supplies, late people, higher than expected winds, etc.—is insufficient to ensure reliability, and it is how individuals and the organization choose to use this information that influences the outcome.

We heard several examples of the situation:

“It's already 10 o'clock in the morning, there are no supplies out there, and all the people haven't arrived.” In some of these cases, recognition

Table 1—Comparison of fire intervals for each forest community based on dominant understory.

HRO Principles and primary aspects ¹	Example quotes
<p>Preoccupation with Failure</p> <ul style="list-style-type: none"> • Articulating mistakes that we don't want to make • Treating lapses as signals • Encouraging error reporting • Learning from near misses and errors • Being wary of complacency 	<p><i>"Hey, you know, you really want to be careful in here 'cause the winds are really funneling through. This is a point of concern. You don't want people in there at this point...and during this time of day."</i></p>
<p>Reluctance to Simplify</p> <ul style="list-style-type: none"> • Acquiring diverse perspectives • Taking deliberate steps to question assumptions • Being skeptical of received wisdom • Reconciling differences while maintaining nuances 	<p><i>"I wanted to get input from the other people too, to see if there were any different views ... because you have a wealth of experience there, so I like to use it all."</i></p>
<p>Sensitivity to Operations</p> <ul style="list-style-type: none"> • Puzzling through publicly • Paying attention to the front-line • Having situational awareness • Noticing accumulating deviations, update • Being sensitive to relationships 	<p><i>"It's already 10 o'clock in the morning, no supplies out there, all the people weren't even out there, winds were slated to come up in the afternoon."</i></p> <p><i>Continual status checking throughout the day.</i></p> <p><i>"Where you at? How's it going?</i></p> <p><i>I guess...more than anything getting the feedback back from the crews. Is this going to happen? Is this is not going to happen? What kind of problems are you encountering?"</i></p>
<p>Commitment to Resilience</p> <ul style="list-style-type: none"> • Knowing errors don't disable • Detecting, containing, and bouncing back from the inevitable • Improvising with fantasy/simulations • Gaining a deep knowledge of system 	<p><i>"We wanted to witness how our resources worked together...so we... had ...a run ... to see how everybody worked. That was really critical...to put everybody in play in a reasonably complex burn but not one that had values at risk such that if the burn were to get out of control, there would be critical losses."</i></p>
<p>Deference to Expertise</p> <ul style="list-style-type: none"> • Having flexible decision authorities 	<p><i>"You rely on those folks with that local knowledge wherever you go."</i></p>

¹The first column is adapted from Weick and Sutcliffe. 2007. *Managing the Unexpected: resilient performance in an age of uncertainty*. 2nd Ed. John Wiley and Sons, Inc.

triggered contingency plans and the task either moved ahead successfully or was postponed. In others, recognition seemed to increase the desire to proceed with the task—in the case reported, resulting in less than desirable outcomes.

Valuing Good Communications

The organizational science literature contains numerous references to the value of leadership, trust, honesty, and respect among members; and speaking up, and communication in achieving high performance and reliability (e.g., Argyris 1990; Detert and Edmondson 2006; Vogus 2005; Weick and Sutcliffe 2001).

Those interviewed also established communication as an invariable component to success and failure—what went well, and what didn't go well—prompting inclusion of these issues in our quantitative survey phase.

Communications was one of the most often cited indicators that a situation is not going well, “[If] there's no communication; people are all over the place. You just don't know what's going on.” “Communication...needs to be a two-way system...if it isn't, then things go to heck in a hand-basket and you got bigger problems.”

Many people remarked on the distinctions between their experiences with various types of fire assignments (such as prescribed, suppression, and Wildland Fire Use). The following quote, referring to when a prescribed fire transitions to a suppression fire, describes this distinction well:

“It was a weird transition of having to go from maybe marginal success

to complete total utter failure [as a prescribed burn], to suddenly it's like “oh, it's no big deal anymore [once the conversion occurred].”

We also heard multiple accounts of how an organization lost the benefit of observation because a person did not feel able or comfortable speaking up:

“It was a classic case of falling into a bad decision trap because nobody was willing to speak up...I didn't feel comfortable about it, but...I had the least experience of any of the permanent staff in those fuels, in that area, in that topography. So I was like it doesn't look great, but what do I know? I'm really pretty ignorant here.”

The interviewees often described a balance between confidence and humility—having the confidence to make a move in a risky environment, yet maintaining a humility that allows them to listen to quiet voices of dissent or dissonance.

Those interviewed provide the foundational information for further quantifying and validating high reliability behaviors in the wildland fire community. They underscore the value of communication and leadership skills in helping an organization take full advantage of the information and observation of its diverse membership.

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Some High Reliability Organizing behaviors are so mundane that people might overlook their value.

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PROCEEDINGS OF THE WILDLAND FIRE SAFETY SUMMITS



Martin E. Alexander and Bret W. Butler*

The International Association of Wildland Fire (IAWF) is a non-profit, professional association representing members of the global wildland fire community. The purpose of the association is to facilitate communication and leadership for the wildland fire community.

Since 1997, the IAWF has hosted nine Wildland Fire Safety Summits at various locations in the United States, Canada, and overseas. These summits bring together wildland firefighting professionals and others from around the world. Through presentations, displays, and group breakout sessions, participants exchange information on fireline safety, risk management, cultural changes, and wildland fire research.

In preparing the proceedings for the 2005 Eighth Wildland Fire Safety Summit, we made a concerted effort to consolidate the proceedings from the previous summits in a single CD disk. The intent of



In 2005, the International Association of Wildland Fire began publishing the collective proceedings of all their Wildland Fire Safety Summits onto a single, collective CD disk.

consolidating these records was to establish “an institutional memory for the IAWF and in turn the entire global wildland fire community” (Butler and Alexander 2005).

The CD of the proceedings for the Ninth Wildland Fire Safety Summit

held in 2006 has maintained that concept established in 2005. With each successive safety summit, the previous proceedings will be included with the current one, resulting in a very valuable wildland fire safety resource.

The proceedings of all nine Wildland Fire Safety Summits are available on a single CD disk from the IAWF for a nominal charge. Alternatively, they can be downloaded from the IAWF Web site free of charge. For more information about the IAWF and their safety summits, consult their Web site at <<http://www.iawfonline.org>>.

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*Marty Alexander received the 2003 IAWF International Wildland Fire Safety Award, given to a member of the wildland fire community who has made a significant contribution to wildland firefighter safety, either directly on the fireline or indirectly through management, research, or cultural changes. Bret Butler has served as a proceedings coeditor for three IAWF Wildland Fire Safety Summits (i.e., 2000, 2001, and 2005).

Dr. Marty Alexander is a senior fire behavior research officer with the Canadian Forest Service, Northern Forestry Centre, and an adjunct professor of wildland fire science and management in the Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada. Dr. Bret Butler is a research mechanical engineer with the Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT.

Past IAWF Wildland Fire Safety Summit Locations and Dates

- Rossland, British Columbia, Canada, September 29-October 2, 1997
- Winthrop, Washington, USA, October 26-29, 1998
- Sydney, New South Wales, Australia, November 2-5, 1999
- Edmonton, Alberta, Canada, October 8-10, 2000
- Missoula, Montana, USA, November 6-8, 2001
- Luso, Portugal, November 18-23, 2002
- Toronto, Ontario, Canada, November 18-20, 2003
- Missoula, Montana, USA, April 26-28, 2005
- Pasadena, California, USA, April 25-27, 2006

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