Organizing for Higher Reliability: Lessons Learned from Wildland Firefighters

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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 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.

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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

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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 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.

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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

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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 M*anaging 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 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

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

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

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.

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 information 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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