



# Coping with the Unexpected: Integrating HRO and Agile

by David Spann

There are many people who think, and probably rightfully so, that I am a bit of an oddball in terms of my journey through the agile landscape. I come to this world of daily stand-ups, small teams, and organized chaos through an education in wildland firefighting instead of through a computer science or engineering department. And yet it is exactly that hard-core experience of living and operating in a constantly changing ecosystem that is the foundation for my current work in agile-adaptive management situations. Whether I have been in the boardroom, the classroom, or on the fire line, success seems much more likely when just enough planning goes into the endeavor, great people are gathered to the work, and the lessons learned are applied quickly.

Most people see firefighting as a very strong command-and-control culture, but it is in fact agile by necessity. Researchers Karl Weick and Kathleen Sutcliffe have characterized wildland firefighting teams [3] as high-reliability organizations (HROs), which are organizations that manage to carry out high-stress, safety-critical activities with a surprisingly low number of errors. In this article, I will discuss the principles and practices of HROs and show how they can be integrated with agile concepts to keep people in both HRO and creative agile environments safe and productive.

I will also discuss a firefighting incident — the South Canyon fire that occurred near Glenwood Springs, Colorado, USA, in 1994 — to help illustrate how businesses can use HRO practices to prevent small problems from erupting into tragic results. But first, I want to show you what it really means to face a “trial by fire.”

## UP IN FLAMES

On 28 June 1989, I reported for duty as the youngest district ranger in the USDA Forest Service’s Intermountain Region of Idaho. The district comprised

250,000 acres, 110 employees, a \$2 million budget, and all of the political headaches that come with endangered wolves, cattle allotments, timber cutting, and ski slopes. My new hometown of New Meadows had 500 people, most of whom worked for me or contracted with me for their livelihood. I had never met any of these fine people before, but in one short month our organizational skills and our ability to respond to a crisis would be severely tested.

On 26 July, a red flag warning was announced for all of north-central Idaho (basically 100 miles to the north and south of the Salmon River). This meant that high winds, lightning, and extremely dry air conditions would be likely. By the time we were going to sleep that night, you could actually look up into the mountains, see lightning strike, and, in a few minutes, a red spark erupt into flames. On that day a record 248 fires started across the region, and 88 of them started in my new district (remember, I only had 110 employees total)! This began a two-month ordeal of ordering enough resources, housing enough people, keeping the community and fire personnel safe, and getting very little sleep.

What we did in that period of time was exactly what others had done before us in similar situations. It was what we were taught to do and were expected to do by the management structure above us: have a simple plan that is flexible, surround yourself with highly talented people who work well on a team and are self-motivated, and meet twice every day with your core team to review what worked well and what needed to improve. Even though we did not know it at the time, this was our approach to building and operating an HRO.

## WHAT IS A HIGH-RELIABILITY ORGANIZATION?

High-reliability organizations are those that operate “under very trying conditions all the time and yet manag[e] to have fewer than their fair share of

This article is dedicated to the memory of Jim Thrash, a friend, neighbor, and colleague in the USDA Forest Service. Jim died in the South Canyon fire.

accidents” [3]. They not only avoid dire consequences by catching problems early, but they have actually proven over time to have disproportionately fewer problems. These organizations do this by consistently noticing the unexpected, reporting it in an honest way, responding quickly and appropriately, learning from the things they did, and improving the process for the next time a challenge arises.

Typically HROs are organizations such as power grid dispatching centers, air traffic control systems, nuclear aircraft carriers, nuclear power generating plants, hospital emergency departments, and hostage negotiation teams. What these organizations have in common is a dependency on the human-technology interface and the potential for small mistakes to quickly transform into significant problems. They also depend on iterative learning processes, in which problems are caught early and dealt with appropriately and/or lessons are learned from near misses and tragic events so there is a better chance of avoidance in the future.

While you may not be threatened with being burned or becoming radioactive, your organization probably faces the threat of increased competition, loss of market share, and increased financing costs. In addition, your team faces such things as deadlines, quality criteria, and budget constraints. Problems do erupt and the consequences do affect us, whether it is through the loss of productivity or — in the most tragic cases — the loss of human life. The challenge for individuals and their organizations, therefore, is to anticipate possible threats, be able to respond well enough in case those threats do materialize, and try to avoid the same future consequences by learning from their mistakes.

To anticipate, respond to, and learn from mistakes, HROs rely on their culture of expertise, focus, and delegation. An HRO depends on:

a higher-level system of knowledge and experience, interacting with and supporting an [organizational framework] to transform a high-risk system into a high-reliability system. The delegation is controlled culturally by a powerful system of selection, training, and mutual monitoring, criticism, and advice. The result is a pattern of extremely efficient communications, which gives the system the ability to absorb damage and surprises. [1]

In their book *Managing the Unexpected* [3], Karl Weick and Kathleen Sutcliffe suggest there are five common concepts that help organizations manage the threat of failure, absorb damage and surprises, and thereby become an HRO. The first three concepts fall under the category of “Anticipate the Unexpected” and the final two are listed under “Contain the Unexpected.”

## Anticipate the Unexpected

In the process of becoming more prepared, organizations need to anticipate the unexpected by:

1. **Focusing on, and having a preoccupying dedication to, preventing failure and accidents.** Possible strategies include variation control, process improvements, reporting, and accountability.
2. **Being skeptical of simple answers,** because the accumulation of small mistakes is the precursor to large failures. There are plenty of examples in the modern business press about quick-fix accounting practices that turned into financial nightmares.
3. **Being sensitive to how things really work,** not just how they are supposed to work. For example, Toyota takes many more months to open a new plant than most auto manufacturers do because they want to make sure everyone actually does the work as intended.

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In addition to these generalized concepts, Weick and Sutcliffe found the following anticipatory practices to be common among HROs. These organizations [3]:

- Encourage analysis of the organization’s technology and production processes, establish practices that allow those perspectives to be heard, surface information not held in common, and train people to manage these processes
- Create a safe climate in which people can question assumptions and report problems or failures candidly
- Conduct incident reviews frequently and soon after something unexpected occurs
- Help people expand the number of precautions they consider and take
- View close calls as failures that reveal potential danger and consider them a source of lessons that need to be learned

## Contain the Unexpected

Things happen, even to those who are anticipating change. Left unchecked or overlooked, even the smallest issues can erupt into major problems. Weick and Sutcliffe observe that “the past settles its accounts when something unexpected begins to incubate” [3]. Therefore, while HROs first try to *anticipate* the unexpected, they must concurrently be prepared to contain change by:

- 4. Developing behaviors that enable individuals and their organizations to be resilient.** These include allowing improvisation, developing trust and familiarity among everyone involved, establishing communication channels across functions, ensuring that individuals become familiar with more than one role, developing and nurturing expertise within each level of the organization, and enabling people to disagree and say no when necessary.
- 5. Relying on those with the most expertise and experience.** This means involving those who are most capable of dealing with a problem and sharing lessons learned with others to improve organizational response in the future.

In support of these concepts, Weick and Sutcliffe [3] also found that HROs rigorously apply the following practices to contain the unexpected:

- Spending as much time on building behavioral capabilities as on planning
- Developing elementary structuring of personnel (i.e., distinctive roles for each layer of management, such as operations, tactics, and strategy)
- Allowing decisions to migrate down to people at the point of problem sensing — and up when events are unique or have political or career ramifications that require organizational experience more often found at higher levels

Probably the hardest HRO concept to implement is that of building sufficient trust and familiarity among all personnel. The ability to say what needs to be said when it needs to be said is much easier in theory than in practice. It really comes down to trust: trust that someone or some group will do what is expected without causing you harm. In the South Canyon Fire example below, we will see an example of how an organization of highly reliable firefighters and their supporting

agencies fell apart because of a lack of trust, eventually causing the death of 14 well-intentioned people.

## South Canyon Fire

On the morning of July 3, 1994, the site of a forest fire on Storm King Mountain in Colorado was wrongly recorded by the district’s Bureau of Land Management (BLM) office as taking place in South Canyon, thereby mislabeling forever one of the greatest tragedies in the annals of firefighting. That seemingly small human error foreshadowed the numerous other minor errors that, three days later, would be compounded into the deaths of fourteen firefighters.

— John Maclean, *Fire on the Mountain* [2]

Generally, wildland firefighting organizations are highly reliable and proud of the work they do. Imagine your company mobilizing hundreds of people, most of whom have never met one another, putting them together in a highly dangerous situation, and then expecting them to act almost as one single unit — all within a 24-hour period. This is exactly what these individuals and agencies do every summer.

The most highly trained groups within this firefighting world, such as the smokejumpers and hotshots,<sup>1</sup> spend years learning about and experiencing some of the most extreme conditions firefighting has to offer. Their pride is engendered by one overriding objective: everyone comes home safe! It should be no surprise — given their training, experience, and track record of safely and consistently putting out fires — that the organization that supports wildland firefighters was chosen by Weick and Sutcliffe for their study of HROs.

But if the wildland firefighting organizations are as good and as reliable as they are reputed to be, and if HRO concepts and practices are supposed to significantly reduce tragic mistakes, why did 14 people die in what some believe was a preventable tragedy? What can the business world (where the consequences may not be life threatening but are still very important) learn from this event?

## OBSERVED IN THE BREACH: THE FIVE HRO CONCEPTS REVIEWED

**1. Focusing on, and having a preoccupying dedication to, preventing failure/accidents.** All of the individuals who died in the South Canyon fire were among the most highly trained firefighters in the world. They

<sup>1</sup>Smokejumpers are highly trained to parachute, generally in small teams, onto fires far out into the wilderness. Hotshots have similar expertise but generally comprise a team of 20 individuals who get to the fire by more conventional methods.

understood the importance of preparation, communication, and appropriate firefighting tactics. Tragically, they went against their better knowledge, did not sufficiently focus on safety, and chose to fight this fire inappropriately. For example, they were digging the protective dirt line between the fire and the unburned brush downhill into the teeth of the fire, which is a well-known “situation that shouts look out,” and they didn’t have a clear safety escape route. These overly aggressive tactics were compounded by another act of inattention created by the agency dispatchers responsible for sending aerial support (e.g., helicopter and airplane water drops). If this support had arrived, it may have reduced the danger by dampening the fire’s heat, but without it the fire could grow quickly and cut off all escape routes — which it did. The decisions made by the various parties, from the firefighters to the agency dispatchers, put into motion events that compounded quickly into a tragic ending.

**2. Being skeptical of simple answers (the accumulation of small mistakes is the precursor to a large failure).** Most firefighters will tell you that someone who gives a simple answer to a complex problem probably doesn’t fully understand the situation and that more questions need to be asked. To the misfortune of everyone involved, someone, or a group of someones, failed to apply this concept on the South Canyon Fire. For example, the BLM office apparently posted, but never communicated to the field, a red flag warning (stating that turbulent wind conditions and very little moisture were likely) on the morning of 6 July that may have kept the crews on higher alert. Regardless of this miscommunication, however, the lookouts assigned on the ground to watch fire behavior and notice weather changes should have accumulated enough information on their own to be concerned and to get the crews out of harm’s way. Unfortunately, there was also confusion between the crews regarding who was in charge of the operation, and there was a compounding political dispute between agency offices that severely disrupted good communications. This was like a “perfect storm” in which small but important actions or inactions accumulated into one very large failure.

**3. Being sensitive to how things really work, not just how they are supposed to work.** In the late 1970s, the Incident Command System (ICS) was designed to help coordinate complex firefighting operations. When things went wrong previously — and they went terribly wrong way too often — finger pointing, political jousting, and angry debates soon followed. In response, firefighting organizations got together to build (and over the years to focus on and improve upon) ways of

better managing and communicating during wildland fire situations. In the case of the South Canyon fire, the ICS protocols would have been required. However, because the agencies did not give this fire sufficient priority for resource allocation and because crews showed up almost haphazardly to begin working, the ICS protocols for leadership, planning, and deployment were basically overlooked. Everyone knew there was a fire that needed to be put out. They all came with the “can do” attitude most firefighters bring, but they didn’t stop to think through how things ought to be organized and people should be deployed before they jumped in and began to work. In the end, even a well-thought-out ICS management structure was trumped by human error and politics.

**4. Developing behaviors that allow individuals and their organizations to be resilient.** In most fire incidents, there is an overhead team that manages the fire and several teams that work away from the fire to support the work of those who fight it. These crews of firefighters generally know each other and understand how their colleagues may respond in moments of crisis. They are also typically given the right to “say no to a dangerous assignment.” Regrettably, on the South Canyon fire, there was no overhead team managing the fire. In fact, the leadership on the ground shifted depending on the day and who was present; the crews were a mix of local, hotshot, and smokejumper personnel, very few of whom actually knew each other. It appears that none of them chose to “just say no” to an assignment that went directly against best firefighting tactics. In the end, these and other inappropriate actions took away all the options or resiliency the team needed to get out and “come home safely.”

**5. Relying on those with the most expertise.** One of the tough challenges of fighting fires is determining just who does have the most expertise. On the South Canyon fire, the local BLM employees got to the fire first. They probably knew the land and the vegetation the best. Second on the scene was a highly trained group of smokejumpers from Missoula, Montana. Even though they would have fought fires in similar conditions, they were not local. The hotshots, who arrived last, would have had an understanding of fire behavior and probably similar experience in fighting fires in other places. Generally fire management is initially conducted by local personnel, but when a fire gets out of hand, it is handed over to a better-trained group. In this case, it appears that the local team kept control of the fire and left the operational management up to the smokejumpers. While this may have been politically expedient, it did mean that the most knowledgeable firefighters, the

smokejumpers, were down in the brush cutting fire line instead of being up on the ridge where they might have made a more timely decision to evacuate.

## INTEGRATING AGILE AND HRO

Weick, Sutcliffe, and others interested in what makes certain organizations highly reliable were drawn to nuclear power generating plants and wildland fire-fighting teams because these groups seemed able to make sense out of crisis situations and apply that sense making in a way that helped them to be even better in future situations. In order for these organizations to be so highly reliable, they first had to create a “safety” culture in which people could learn from near misses and tragic events. The second thing these organizations did was to put in place practices and protocols to allow the organization to be resilient and respond to change quickly and appropriately.

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Like the practitioners who created the Agile Manifesto<sup>2</sup> and the Declaration of Interdependence,<sup>3</sup> HRO organizations focus on collaborative teamwork, iterative learning approaches, and the ability to communicate what needs to be said in a way that others can respond to appropriately. For example, daily stand-up meetings, having a sufficient response plan, incorporating good people in small teams, developing effective communication channels, and creating protocols for accountability and responsibility are recommended for software development *and* firefighting teams. Likewise, both approaches are interested in iterative review of even the smallest challenges and opportunities so that appropriate responses can be taken as soon as possible.

One area of difference, however, is the tendency for HROs to use external individuals to review failures, whereas agile teams tend to rely on internal review for improvement. In HROs, a failure or a near miss — that is, a situation in which people are either killed or

unintentionally put in mortal danger — is reviewed by an external group as soon after the event as possible. The review team documents what happened and presents the lessons learned. And while in the short term this is potentially humiliating to the individuals being investigated, the intent is to help the organization establish new and safer routines for the future.

In an agile environment, where the stakes are generally not quite so high, teams can learn from their mistakes without putting others at mortal risk. In fact agile teams take pride in “failing fast” by constantly finding, discussing, and resolving problems as they emerge instead of waiting for someone else to do it. Because of their highly self-critical practices, these teams may see an external review as intrusive and possibly redundant. However, there are situations in which agile teams, like all other teams, are too close to the problem to see a reasonable solution. In such cases, a review conducted by an experienced, external group could help that team realign its practices with its agile intent.

The point here is that even though HRO and agile originated in very different management environments, the concepts and practices found in both are similar and complementary. I have identified seven additional practices that help my clients see how good business management, regardless of the organizational model or the function within that organization, can help establish greater value, higher quality, and better customer satisfaction, thereby enabling the organization to be simultaneously more reliable *and* more agile:

- 1. Develop cross-functional cooperation and trust.** Searching for and developing managers who can build strong collaborative relationships is critical, because political infighting between and across organizational boundaries can lead to inefficient resource allocation, poor results, and very unfortunate and avoidable mistakes.
- 2. Sweat the small stuff.** Develop robust feedback systems and look out for and be concerned about small but meaningful mistakes. Small problems can and will compound to cause tragic results.
- 3. Learn from mistakes and make appropriate adjustments.** Daily stand-up meetings, iterative team assessments, and project retrospectives are great tools if the lessons learned are shared ASAP. The greatest fire safety lessons were learned on the 1957 Mann

<sup>2</sup>See [www.agilemanifesto.org](http://www.agilemanifesto.org).

<sup>3</sup>See [www.pmdeclarationofinterdependence.org](http://www.pmdeclarationofinterdependence.org).

Gulch fire, in which 13 smokejumpers perished. Yet many of the same mistakes were made on the South Canyon Fire. A lesson learned means nothing if the adjustments aren't made.

4. **Establish and follow common tactical routines among and within groups.** Agile and HRO practices can offer the familiarity and consistency teams and team members need in order to trust each other. If protocols are not agreed upon and followed, confusion and even tragedy can prevail, as they did in the South Canyon fire.
5. **Agree to leadership roles, responsibilities, and behavioral expectations in advance.** Managerial and leadership roles and responsibilities need to be designed and practiced in advance of a crisis. In the South Canyon fire, as in many matrix organizations, there were too many agencies making too many decisions and too many issues that went unresolved, all of which ultimately confused the people who really needed to understand the situation: the firefighters.
6. **Conduct external reviews when the internal actors are too close to the outcomes.** Organizations of people interested in improving their work will certainly learn something by doing their own retrospectives, but in some cases external reviews may be required to adjust behavior and performance. In the case of the South Canyon fire, the internal agency review captured many of the tactical errors that occurred, but the leadership and organizational challenges did not emerge until author John Maclean was authorized to do an external review [2].
7. **Establish a "clear-talk" protocol.** This was not a problem on the South Canyon fire because it had been resolved during the 1970s overhaul of the ICS. It is, however, one of the main challenges to productive and timely resolution of issues within most organizations. When a salesperson says he wants something "soon," and a software engineer says she will have it done "soon," do they mean the same thing? Or is the salesperson thinking in terms of hours or days while the developer is thinking in terms of weeks or months? The trick is to say what you mean and then make sure you haven't made any inappropriate assumptions.

## CONCLUSION

As we have seen, there are a number of business practices that are both common and complementary between HRO and agile. Those in a command-and-control environment may find that there are some basic agile techniques that can help their organization stay safe and productive, while committed agilists may discover that those very command-and-control techniques can actually offer a foundation upon which agile practices can flourish.

Unfortunately, mistakes will still be made, and people and their organizations will get hurt. The challenge for everyone in these situations is not to hide from the consequences, but to feel safe enough to say what needs to be said in a timely manner and in a way that others can learn from for future reference. As the example of the South Canyon fire shows, the smallest mistakes can compound into significant problems, which means the entire organization must pay attention to and respond quickly to the small things before they result in unintended and possibly tragic consequences.

## REFERENCES

1. Bierly, P.E., and J.C. Spender. "Culture and High Reliability Organizations: The Case of the Nuclear Submarine." *Journal of Management*, Winter 1995.
2. Maclean, J. *Fire on the Mountain*. Washington Square Press, 2000.
3. Weick, K.E., and K.M. Sutcliffe. *Managing the Unexpected*. Jossey-Bass, 2001.

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