Introduction

Navigating this Journey

This journey can be described as moving through three main areas of study: The first focused on how the USDA Forest Service arrived at the process delineated by the Serious Accident Investigation Guide (SAIG). The second addressed academic research that could be used to frame a different approach to investigation. The third was an empirical exploration of the application of theory and practice during actual investigations. These areas of study are viewed through the lens of social construction (Chapter 10).

Why was transformation needed? Traditional models of investigation ignored the voices of participants, communities and leaders in an effort to resolve the event to a single narrative that made sense to the team. Narratives, while espousing to be unbiased, offered a plausible explanation that was represented as a factual report. The stories created with this methodology were more linear, plausible and less messy than the complex events they were modeling (Dekker 2002). Often lost in the process were valuable perspectives that offered the context needed for those outside either the event or the investigation to make sense of the event themselves. In this way, learning became explicit rather than transactional. Facts were offered through reports that drew conclusions, made assumptions and defined cause in terms of the judgment of actions and decisions, leaving little room for individual or group sensemaking. However, when the conclusions of these investigations were deemed to be a surprise or well outside the societal construct of reality, they were challenged. This dissertation recounts a series of such challenges.

The case studies explored in this dissertation evoke questions that could not be explained or understood using the formal guidance or training that had been provided to me in the SAIG or formal accident investigation courses. Together the training and written guidance formed a process that advocated the search for what was absent in the system, environment or people involved in the incident. This approach avoids consideration of positive aspects of individual performance explored through positive questions (Whitney, Trosten-Bloom, & Cooperrider, 2010). “Positive questions are keys to treasure troves of best practices, success stories and creativity” (Whitney, Trosten-Bloom, & Rader, 2010).

Each accident posed unique issues, concerns, and opportunities to the assigned teams, which required conversations that explored contextual influences, adaptive responses and interrelationships. Actions were not seen as negative contributors to the event, rather they were explored as the best-fit solutions that were developed by well-meaning individuals. The conversation that emerged in the investigative teams was open, unscripted dialogue, largely absent the prescriptive causal guidance of the SAIG. An

alternative approach to investigation emerged that was based on inquiry and advocated for sensemaking and learning to take place at multiple levels of the organization.

My Evolving Role in Accident Investigation

My initiation to the investigative process came through military investigation training, where I was fully accredited in the organizationally approved processes common to traditional accident investigations. It was in the Coast Guard that I received my first experience with investigation, a helicopter fatality. In these early years, I worked diligently to bring individual flare to my creations and created factual reports (stories) that I fervently believed would result in corrections and fixes to specific problems uncovered during investigations. I also believed that my work would prevent the next accident. There were a lot of statistics that seemed to point to success and served to reaffirm that the process was working. Moreover, I liked what I did.

Some context is therefore needed to understand why I became compelled to move away from this path and to influence change in the way we conducted investigations. I was a Coast Guard pilot for 10 years and during that time, I knew three people who died in aircraft accidents. The Coast Guard touted the best flight safety record in the military, and statistics proved that our accident rate was better than most aviation operations. I believed that it was our actions and layered defenses that were delivering these great results and that the investigation process produced many of these defenses.

After the Coast Guard, I joined the Forest Service as a lead plane pilot. Lead plane pilots fly low-level over fires; establish tactics; scout routes for heavy air tankers loaded with fire retardant; and then guide them to the drop zone, in support of ground fire operations. In many ways, this world seemed similar to that of the Coast Guard, yet I would learn that it was also strikingly different.

I was hired in May with a report date of August, along with another pilot. I would learn later that the original solicitation asked for one pilot, but there had been a mid-air collision that took the life of a lead plane pilot, and thus the hiring official selected a second applicant. Clearly one of us was replacing this fallen comrade.

The national average for aviation fatalities for the Forest Service was 2.5 human losses per year. The wildland fire statistics were telling a very different story than the Coast Guard statistics. The investigation reports that resulted from each fatality unilaterally pointed to errors on the part of the flight crews. As my experience grew, I began to realize that it had to be more than just pilot error—something did not fit.

Each aviation fatality represented a friend to me; these were people with whom I had dinner one night and were gone the next day. Each accident report listed error as a cause,

often implying or openly stating that it was human caused and citing a friend at fault. I knew these people and at a deep level, I knew it wasn't as simple as error on their part. After all, I had made mistakes, and I was often doing the same things they were. This fueled a fire within me to learn more, which ultimately grew into a desire to change the system.

People were being blamed for accidents as though they had intended to crash, and in that way the process was creating second victims (Dekker, 2013). I saw good people—suddenly by the virtue of a report—transformed into flawed, error prone, risk-takers that clearly didn't have the right stuff. One day they were upheld as heroes for successful outcomes like saving a section of fireline, or a house, or in one case an entire town. Days later, these same people could find themselves labeled as “rogue pilots” (Kern, 1999) simply because they were involved in an accident.

My interest in safety became more intense with each fatality and after a few years I became a regional aviation safety manager (RASM) and began to pursue accident investigation as a collateral duty. I completed several civilian courses, which augmented my military training, and following a seemingly short apprenticeship; I was assigned as the chief investigator to the Norcross helicopter fatality accident. The incident would become pivotal to my own growth, as well as that of the Forest Service.

I went to the incident armed with all the latest techniques, tools, and the most recent interagency SAIG. I was nervous about the new responsibility and carefully reviewed the guide contents to ensure that I could deliver the product that the organization desired. What I found was that the guide offered too much help—step-by-step instructions that, in some cases, provided conclusions before any information had been gathered. The guide asked me to view the incident from the perspective that everything is knowable, discoverable, or observable and all I had to do was to look harder, deeper, or more carefully to find the single truth, the error. The SAIG specifically recommended that investigators judge human actions and decisions as bad or good, largely based on the assumption that there had to be a violation or error for an accident to occur (Wiegmann & Shappell, 2003).

The Norcross accident investigation, as will be explained later, inspired me to inquire—as I began to inquire, the thin veil of realism began to rapidly fall away. What remained challenged almost everything I had been taught in accident investigation training, uprooted the principles of the interagency SAIG and shattered my belief in causality. The very nature of these reports was based on factual accounts, and I found myself challenging the very existence of facts.

Three realizations paralleled the recognition that there was more to accidents and incidents than simply finding facts. First, I realized that humans are naturally biased and that our biases influence what facts we find or create (Kahneman, Slovic, & Tversky, 1982;

Kahneman & Klein, 2009). For example, if I enter into an investigation to find error I will find it (Hollnagel, 2008). This guidance can be explicit as it is in much of the SAIG. Or it can be implicit, embedded in the language or in investigative process itself. The classic example of this is root-cause analysis, which implies that there is a single or root cause, a truth that can be discovered (Hollnagel, 2008; Dekker, 2006).

My second realization and break from the established norm was an understanding that time is a significant construction, and it can influence judgments in ways that can be harmful to learning. For example, time is easily accepted as a fact, which is reinforced by the way time is incorporated into modern society as a measurable entity. However, its role in the review of accidents can point to individual human failures and omit important context. Statements like 'it took five minutes' can be interpreted in a number of ways—they had five minutes; they only had five minutes; or they had five minutes! Simple time references, without context, can be meaningless and yet can result in judgments that affect the creation and interpretation of an accident report.

The third realization was that the same adaptations that result in success could also result in failure. Our culture often rewards outside-the-box thinking, which encourages innovation and independence. Our heroes are often those who buck the system and stand as outliers, seemingly ignoring organizational guidance or even laws. We often uphold these individuals as the change makers in our society, and their success is heralded. However, following an accident or failure we commonly overlook that the same innovation and adaptation can also lead to failure. If cause-effect exists, then each action should deliver the same effect—clearly actions delivered a myriad of outcomes ranging from success to failure. To me this challenged the basis of the cause-effect relationship, a central principle of traditional accident investigation processes.

My accident-investigation role evolved rapidly, as I began to recognize and capture these three concepts in three particular fatality investigations, starting with Norcross, then Panther, and culminating in Saddleback. Through the reports and dialogue that emerged from these investigations, Forest Service leaders realized the importance of learning from events and began to tie learning to prevention. The most significant shift in my role occurred when I was asked to develop a guide to replace the accepted interagency SAIG. The creation of what became known as the Learning Review required deep personal introspection and challenged deep assumptions within me.

Purpose

The purpose of this dissertation is to demonstrate how the USDA Forest Service accident investigation process was transformed from finding cause to sensemaking and learning.

Case Study Format

When I consider the personal and organizational transformation described in this dissertation, I only see it as a story. Human beings are story-telling creatures—a point Fisher (1987) makes when he bestows the title *homo narans*. Stories knit together settings, actors, events, pressures, conditions, and ethical considerations. As such they can be an intense medium to help people make sense of seemingly related or unrelated factors (Schrader, 2004). Understanding the importance of story to the evolution of the Learning Review and presenting it in writing was challenging. The linear medium of writing by its nature makes it difficult to describe non-linear events. It became apparent that the only way to describe this story was to explore the stories that contributed to the transformation.

The research methodology needed to explore inter-related and embedded stories must be capable of integrating event, activity, progress, and influences for a wide variety of individuals. Case studies emerged as a qualitative method to achieve this goal. “Case studies are a strategy of inquiry in which the researcher explores in depth a program, event, activity, process or one or more individuals” (Creswell, 2009, p. 13). This is strengthened by the idea that the objects of a case study must be “similar enough and separate enough to permit treating them as comparable instances of the same general phenomenon” (Ragin & Becker, 1992, p.2).

The structure of the case study method also allowed for the emergence of concepts that would result from the recognition of connections during the study and writing. This happened on several occasions during the creation of this dissertation. As Ragin & Becker (1992) state, “What is this case of will coalesce gradually, sometimes catalytically, and the final realization of the case’s nature may be the most important part of the interaction between ideas and evidence” (p. 6).

Within the methodology of case study research there are provisions for the type of research conducted. “In case studies, sampling is purposive. They will be most instructive when they are methodologically based on open case-sensitive approaches like the narrative interview and ethnography” (Flick, 2009, p. 134). Each of the cases used in the dissertation fit this description. The selection of case study format for this dissertation also meets the intense guidelines for case study research described by George and Bennett (2005). These criteria are described in three parts (2005, p. 69):

> First, the cases must all be instances of… only one phenomenon. Second, a well-defined research objective and appropriate research strategy to achieve that objective should guide the selection and analysis of the…cases under investigation. Third, case studies should employ variables of theoretic interest for the purpose of explanation.

Case study literature clearly delineates a framework that is well suited for this study.

Mapping the Journey

This dissertation knits together a series of narratives and begins with a short history of the Forest Service, which is designed to provide context for the reader. This is followed by two chapters that explain the origin and concepts of technical investigation and the SAIG. Four cases (three Forest Service and one external) are used to demonstrate why transformation was needed and how it emerged in the course of this study. These cases demonstrate how sensemaking can be used to enhance learning and develop specialized learning products tailored to specific audiences. The case studies also demonstrate the emergence of the principle that accident prevention can take place without doing further harm to people.

Woven into the cases and their conclusions is the story of my personal journey from a realist to a constructionist.

Chapter 1: **The History of the USDA Forest Service** presents the way that information, beliefs and feelings merged in the national political landscape to shape a maturing land management philosophy. This chapter describes several ways stakeholders perceived the Forest Service. It also reflects how the agency views itself and the way employees tell its stories, thus introducing ways that they (we) construct its reality. Additionally, this chapter focuses on pivotal changes in the organization, which are reflected in progressions of language and perspectives. An apparent transformation from a simple model of land management to a more complex systemic view is described. This profound change from a realist perspective to a constructionist view was directly tied to the recognition that realist constructs are challenged by the uncertainty that emerges naturally in complex adaptive systems, such as forest ecosystems and the society that values and uses them (McDaniel & Driebe, 2005).

Chapter 2: **The Evolution of Accident Investigation** shows how early models of accident investigation seem to have shifted from a human centric view to a mechanical perspective and how this shift resulted in the construction of cause, creation of single truth, and epistemological self-confidence. This chapter exposes some of the major influences of this transformation. Consideration is also given to places where the realist perspective may be useful such as in the assessment of mechanical component failure. This material establishes a contrast between simple and complex systems and demonstrates how different approaches may be required for different situations.

Chapter 3: **The Serious Accident Investigation Guide (SAIG) – Pressure to Standardize the Approach to Investigation** depicts how realist values and beliefs about facts dominated attempts to prevent accidents and how they dominated the accepted investigation processes, the SAIG. Wildland fire is fundamentally a social activity, and it is

quite possibly one of the few work environments that is not significantly influenced by technology and human-machine interactions. Yet wildland fire is where socio-technical models/processes came to dominate investigative guidance through the SAIG. The chapter describes some of the safety improvements that resulted from this approach, as well as assumptions and beliefs that may have prevented people from learning from events.

Chapter 4: **The Norcross Case Study** was a helicopter fatality investigation on the Klamath National Forest in northern California. This case study represents the first departure from the espoused mechanical model of prevention. It avoided the traditional admonishment of participants (workers) by attempting to place actions and decisions in context. The study, while quite tempered, represented the first level of inquiry and challenge to the status quo and the SAIG.

Chapter 5: **The Panther Case Study** was a fire entrapment[2] fatality investigation on the Klamath National Forest in northern California. Panther was the first investigation to explore the concept of complex systems in wildland fire, which initiated a significant challenge to realist perspectives. During the investigation, it became evident that the cause-effect approach did not explain the incident in a way that could positively influence safety improvements in firefighting operations. The chapter explores how this investigation challenged the process (Serious Accident Investigation Guide or SAIG), as well as the epistemology of the traditional approach. The Panther investigation report opened a door, which led to the discovery of social construction and pointed out how the SAIG supported a realist perspective that was potentially harmful to leaning from events. This case study shows the growth of inquiry that initiated research, which ultimately challenged the way the Forest Service designed preventative strategies.

Chapter 6: **The Importance of Sensemaking Communities to Accident Prevention** uses an aircraft crash investigated by the National Transportation Safety Board (NTSB) as a case study to demonstrate how sensemaking naturally emerges, regardless of the desire of the organization to control or shape learning. It shows that even the most exhaustive and extensive factual report means nothing without the dialogue and honest inquiry of learners and that a questioning community forms relationships and connections that can exceed the limitations of even the most highly regarded investigative body (the NTSB); proving that relationships and connections can mean as much or more than the most complete technical report. The chapter recognizes that even the best ideas can only be carried forward through relationships—a community will try to heal itself despite the report quality or content. This exposes a shift in the role of the investigator beyond technical investigation to recognizing, understanding, and supporting community

[2] A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include *near misses*. (National Wildfire Coordinating Group NWCG, Glossary).

sensemaking, which the chapter demonstrates increased the potential for accident prevention.

Chapter 7: The **Learning from Error** chapter explores the importance of recognizing workers as assets to safety, especially in a complex environment. It explores five specific categories of the traditional approach, including language, and demonstrates the impact these have on the investigative process and learning. Ultimately, the chapter challenges the subjective judgment of actions and decisions that frequently result from traditional approaches and shows the importance of moving to the creation of dialogue-based learning without judgment.

Chapter 8: **Agreeing to the Concepts of the Coordinated Response Protocol and Learning Review** introduces the concept of the Coordinated Response and Learning Review and how a small group of dedicated advocates gained alignment and acceptance of the concept. The chapter shows how discordant positions in the leadership, safety, and law enforcement communities were ultimately brought into dialogue and how that dialogue led to the recognition of common principles. The discussion will focus on the conceptual process as it was presented to the community of safety practitioners and other stakeholders. This agreement allowed for the experimentation that resulted in the development of the Learning Review process.

Chapter 9: **The Saddleback Case Study** represents the first attempt to use the Learning Review process concerning a tree-strike fatality on the Modoc National Forest in northern California. This case study represents the first experimental application of a process that ultimately became the Learning Review. This was the first time that the learning needs of the organization and the field were addressed in separate products. It integrated the major concepts developed to this point, even before a guide had been created. It also represented an example of a shift from the previously accepted realist models based on causality and mechanical process to an approach designed to make information available, so that all levels of the organization could engage in their own sensemaking.

Chapter 10: **Reflections on Transformation through the Lens of Social Construction.** This chapter presents key aspects of the dissertation through a constructionist lens. Each chapter is explored through the lens of social construction, which is followed by contrasting the current accident investigation model with a constructionist approach to the organizational response to incidents.

Chapter 11: **Summary and Conclusions.** This chapter summarizes the shift in five key assumptions that support traditional investigations and then introduces and explains five key practices that emerged from the research and experience chronicled in the cases explored in the dissertation. It also presents recommended areas for further research and personal conclusions and experiences, which led to my transformation during the course of the research for this dissertation.

Chapter 1: History of the USDA Forest Service

Introduction

> *…where conflicting interests must be reconciled, the question will always be decided from the standpoint of the greatest good of the greatest number in the long run. –Gifford Pinchot, first Chief of the United States Forest Service*

In the late 1800s the western world seemed almost obsessed with the control and exploitation of land and the resources of the planet. The culture of the New World influenced people to view the United States as a limitless source of essential materials, with timber among the most prized of them all (Pyne, 2010a). Wood was the principal resource supporting the infrastructure of the burgeoning United States. There were wooden roads, buildings, wagons, ships, and sidewalks along with wood-burning locomotives. East coast timber was being harvested at a rate that far exceeded its ability to regenerate, in a process that was called "cut and run" (Steen, 1976). The forests of the East were being cut and cleared at an alarming rate and by the late 1800s many in Congress feared a "timber famine" (Staff, 1905).

The first attempt to protect the nation's forests began with the Forest Reserve Act of 1891, which allowed the President to set aside areas of land as public domain. This established what were called forest reserves but did little to guide the caretakers as to how these areas were to be managed (Pyne, 2010a). Several early leaders and visionaries, such as Theodore Roosevelt, Gifford Pinchot, scientists, conservation organizations, and newly trained forestry professionals, led the successful effort in developing ways to manage what became millions of acres of federal forest land (Steen, 1976). Their knowledge and principles would be challenged and changed as the nation reconstructed goals based on shifting views and priorities.

The history of the Forest Service and of wildland firefighting is not unlike a lot of professions and systems developed since 1900. At first, the agency seemed seduced by the power of man to control the environment and developed a simple approach to both fire and land management. Then agency leadership was influenced by the industrial and technical revolutions and attempted to make difficult situations seem routine by employing processes, procedures, rules, and regulations (barriers) to create safety and improve efficiency. One profound influence was the publication of Taylor's *Scientific Management*, which resulted in *Taylorism*. The Forest Service was profoundly influenced