

# Epic Human Failure on June 30, 2013

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**Abstract.** Nineteen Prescott Fire Department, Granite Mountain Hot Shot (GMHS) wildland firefighters and supervisors (WFF), perished on the June 2013 Yarnell Hill Fire (YHF) in Arizona. The firefighters left their *Safety Zone* during forecast, outflow winds, triggering explosive fire behavior in drought-stressed chaparral. Why would an experienced WFF Crew, leave ‘good black’ and travel downslope through a brush-filled chimney, contrary to their training and experience? An organized *Serious Accident Investigation Team* (SAIT) found, “... no indication of negligence, reckless actions, or violations of policy or protocol.” Despite this, many WFF professionals deemed the catastrophe, “... the final, fatal link, in a long chain of bad decisions with good outcomes.” This paper is a theoretical and realistic examination of plausible, faulty, human decisions with prior good outcomes; internal and external impacts, influencing the GMHS; and two explanations for this catastrophe: *Individual Blame Logic* and *Organizational Function Logic*, and proposed preventive mitigations.

**Keywords:** Wildland fire · Hot Shot · Human Failure · Drift into failure

## 1 Introduction

Per the *National Wildfire Coordinating Group* (NWCG), “Wildland firefighting (WF) is a high-risk occupation, evidenced each year by deaths or injuries in the line of duty” [1]. One way the NWCG recognized to help reduce these WFF fatalities is to “... identify factors responsible for past fatalities, ... [to] ... mitigate those factors in future fire seasons” [1]. This current article presents essential details and inferences about the June 2013 Yarnell Hill Fire (YHF), which resulted in the disastrous outcome of 19 WFF fatalities. The authors’ main goal is to provide a theoretical and realistic examination of the following subsections:

1. Wildland Firefighting Rules
2. Environmental Influences
3. Human Failure Theory
4. Organizational Cultures and Influences
5. Conclusion with Recommendations

The authors’ motivation is twofold: (1) to identify WFF Decision Errors specific to the YHF to recognize the dynamics involved in the adverse outcomes of this fatal event, and (2) to apply this understanding for training, procedural, and/or systemic change recommendations to prevent future WF disasters. As difficult as this is, the

following paper attempts to move beyond the desire to blame the fatalities on a specific offender(s), also known as *Individual Blame Logic* (IBL), but to seek further understanding of the systemic causes triggering the outcomes, i.e., examining the entire WF organization, known as *Organizational Function Logic* (OFL) [2].

The content of this paper solely reflects the views of the authors, both retired Hot Shot Crew Superintendents, not those of any current or former Agency or Department. Moreover, the authors are responsible for the inferences, suggestive evidence, facts, and accuracy of the information presented herein. Some analyzed content may contain subject matter judged by some to be graphic, disturbing, and/or offensive.

## 2 Wildland Firefighting Rules

All WFFs are trained with specific rules, crucial to follow to ensure good direction, leadership, preparedness, and safety. The Standard Firefighting Orders, organized in a deliberate and sequential way, are to be implemented and applied systematically in all fire situations [3]. Abiding by the WFF Rules promotes good decisions and outcomes [3–7].

The most critical WFF lists of rules listed in our Incident Response Pocket Guide (IRPG) [8] consist of:

1. Standard Firefighting Orders
2. Eighteen Watch Out Situations
3. Downhill Checklist
4. Lookouts - Communications - Escape Routes - Safety Zones (LCES)
5. Common Denominators of Fire Behavior on Tragedy/ Near-Miss Fires
6. Wildland Urban Interface (WUI) Watch Outs

Regarding Entrapment Avoidance, a USFS Risk Management pamphlet states: “If firefighters follow the Standard Firefighting Orders and are alerted to the 18 Watch Out Situations, much of the risk of firefighting can be reduced” [3]. Memorizing, understanding, and following the *Ten Standard Fire Fighting Orders*; and likewise memorizing, recognizing, and mitigating the *18 Watch Out Situations*; and the other WFF Rules, are responsible for saving tens of thousands of WFF lives each-and-every fire season [7]. It is common knowledge and practice in the WF community that the WFF Rules do work and that all firefighters must know and apply them [3–7, 12].

## 3 Environmental Influences

### 3.1 Fuels, Fire Weather, and Topography

Firefighters discuss Wildland Fires in terms of fuels (what is burning), weather (what are the influences), and topography (where is it burning). The YH Fire occurred in central Arizona in rugged terrain covered in dense, decadent chaparral brush that had not burned since 1966, creating an explosive fuel bed with extremely high rates of spread and extreme resistance to control. It was critically hot and dry for weeks.

As with the YHF, the strongest and most variable winds occur during thunderstorms, and generate extreme downdrafts, micro-bursts, outflows, and gust fronts, which adversely affect fire behavior, thus exacerbating and seriously complicating WFF choices and safety [9].

## 4 Human Failure Theory

*Human Failure* frequently has significant consequences. The prescriptive Ten Standard Fire Orders, created in the 1950s, and in subsequent years the cautionary Watch Out Situations [10] are perceptive resolutions against wildland fire fatalities, addressing risk management, grouping them based on their importance in the following logical sequence: (1) Fire Behavior, (2) Fireline Safety, (3) Organizational Control, and (4) Fight Fire [3, 8, 10]. Annually, thousands of WFFs and Supervisors validate the WFF Rules during required fire refreshers and trainings. Almost every WFF agrees that the YHF tragedy would have been impossible for 19 men to have died accordingly had they held to these tried-and-true WFF Rules [3, 7]. Arguing against the SAIT conclusions disclosed in the Serious Accident Investigation Report (SAIR), the authors examined the Human Failure associations of how, why, and when the GMHS considered their actions acceptable risk(s) for years, unsuspectingly and steadily heading toward a *drift into failure* [7, 9, 11].

### 4.1 Individual Blame and Organizational Factors

Catino (2008) established two distinct, possible approaches for explaining incident origin and dynamics: (1) Individual Blame Logic (IBL) and (2) Organizational Function Logic (OFL). Shown as two distinct reasons generating different outcomes, IBL suits societal demands to identify accident cause(s) and transgressor(s). Conversely, OFL is an organizational and functional approach, aimed at identifying the factors within the system supporting event occurrence. In the OFL method, expectations are similar events cannot recur or infrequently occur once these influences are removed [2].

The IBL method seeks out careless, inattentive individuals who are liable. In complex organizational systems, reprimanding an employee for an accident without examining the system deficiencies may entail inadvertently transferring the risk(s) to future employees [2]. The OFL emphasizes the avoidance of individual blame, however, it is dangerous to overlook legitimate individual responsibility. The collective approach may risk concealing accountability and avoiding necessary questions of where responsibility lies. It is possible to distort the emphasis in favor of wider organizational factors, avoiding individual fault(s), even when that is where it resides [2]. Clearly, both IBL and OFL infractions were present regarding the GMHS, based on a steady drift into failure from 2009 until 2013 [7, 11]. These same logics can be applied to all other WF fatality fires with similar conclusions.

Far-and-away the most critically devious and potentially treacherous decision and outcome pattern is the Bad Decisions with Good Outcomes. One can get away with this

combination without any consequences whatsoever for an entire career, indeed an entire lifetime. It is professionally safe to assert that this has been a fatal combination on most, if not all, of the fatal wildland fires, where firefighters were killed by fire, throughout the history of wildland firefighting, excluding those from other environmental deaths, where WFF were killed by lightning, rocks, trees, and the like.

Southwestern New Mexico HS and writer Hannah Coolidge (2015) recounts her Superintendent, "... talk[ing] about 'bad decision/good outcome' scenarios—how it's easy, once you've developed bad firefighting habits, to forget how dangerous those habits are after engaging in them 'repeatedly without negative consequences'" [4].

In the WFF realm, "*Bad Decisions with Good Outcomes*" (Fig. 1) is also referred to as '*The Rule of 99*' and the '*Normalization of Deviance*,' coined by researcher Dianne Vaughan examining the Challenger Space Shuttle disaster [13]. The authors allege ongoing and recurring Bad Decisions with Good Outcomes for years as well as the subtle influencing Fire Department attitude toward structures, a priority over WFF safety, which likely swayed those ultimately responsible for the YHF fatalities [7].

<u>Decisions</u>	<u>Decisions</u>	<u>Decisions</u>	<u>Decisions</u>
<b>GOOD</b>	<b>GOOD</b>	<b>BAD</b>	<b>BAD</b>
<b>GOOD</b>	<b>BAD</b>	<b>GOOD</b>	<b>BAD</b>
<u>Outcomes</u>	<u>Outcomes</u>	<u>Outcomes</u>	<u>Outcomes</u>

Fig. 1. Decisions and outcomes matrix

The Prescott City Attorney (PCA) offered the following account of the survivor GMHS lookout's story, related to him by the PFD Wildland BC, who disagreed with the account [14]. While moving vehicles with the Blue Ridge HS (BRHS), the GMHS lookout allegedly overheard radio traffic between DIVS A and the GMHS supervisor, with 17 Crew members, atop a ridge in the black. In the radio call, DIVS A told the GMHS supervisor to leave "the black," which was safe, and join him at the BSR. The GMHS supervisor protested, saying such a move would be dangerous. The radio exchange turned into a dispute [14].

"My understanding of the argument between DIVS A and GMHS was that GMHS supervisor did not want to go down," said the PCA [14]. Per the PCA's account, the GMHS supervisor objected until DIVS A gave him a direct order to descend. The GMHS supervisor acceded to the command to relocate to the BSR. He told DIVS A that he thought it was a bad idea. During one of the final radio transmissions, the GMHS supervisor told DIVS A the Crew was not going to make it [14, 15]. Due to a scarcity of actual recordings, these GMHS Crew Net radio '*Discussing Our Options*' [14] excerpts are alleged and thus hearsay dialogue, where the 'Arizona Rule 803, Hearsay exceptions' applies [16], allowing it as suggestive evidence in this paper [7].

John Hopkins University researchers found, "By narrowing attention, ... attention shifts from vision to audition caused increased activity in auditory cortex and decreased activity in visual cortex and vice versa, reflecting the effects of attention on sensory

representations.” The experiment was designed to create tunnel vision, but a completely unexpected event occurred. While *vision* was being tunneled, performance of the *audible* control center decreased” [17]. The researchers further found that tunneled vision leads to diminished hearing. Tunneled hearing led to diminished vision. The researchers concluded that a person intently listening to audible cues, like a radio or cell phone, could have diminished visual performance. In some cases, when the stress is severe enough, the hearing receptors in the brain may shut off completely, referred to as *auditory exclusion* [17]. This clearly relates to wildland firefighting.

Thus, the GMHS would primarily “*see*” the weather and fire behavior that they were focused on, however, their own brains may have sabotaged or delayed their ability to perceive and react to threats from those recognized hazards or even from the focus they were directing their attention to, typical of all humans engaged in this type of encounter [17]. Numerous cell phone and radio conversations occurred during the YH Fire, likely distracting them from truly ‘*seeing*’ the emerging weather and fire behavior hazards and reevaluating priorities contributing to their steady drift into failure [11, 17]. The firefighters were aware of the forecast weather that morning; the risk factor was high enough to make them think twice, but they deferred to their own judgment, unknowingly falling victim to distractions. The weather forecast warned of considerable thunderstorm outflow wind danger, but the GMHS seemingly discounted those warnings, and left their Safety Zone at the worst possible time [7]. Arizona is well known for its dynamic, sometimes tragic large fires; late June is considered extremely hazardous, i.e. the Dude Fire (1990) when 6 WFF died, where severe outflow winds also set the stage for potential deathtraps, and where harsh Human Failure also won out.

During an October 2013 YH Fire Site Visit, a Southwest HS Crew Superintendent stated during the Integration Phase, where participants can share their emotions, conclusions, and such: “*this was the final, fatal link, in a long chain of bad decisions with good outcomes, we saw this coming for years*” [7] and about 8 other HS Superintendents spoke up and stated they had all attempted unsuccessfully over the years through peer pressure to get the GMHS to alter their unsafe actions [7]. So then, what happened on that fateful afternoon to distort these experienced wildland fire supervisors’ individual and collective judgments to the degree they would put themselves, and their Crew, clearly in harm’s way? Did they all perish in a predictable, and therefore, avoidable death-by-fire incident? Indeed, per the conclusion of these authors, they did. However, this was not an “*accident*” as some have continued to falsely believe and advocate [7, 9, 12]. Strict compliance with the WFF Rules bolsters WFF safety and for those whom they were are ultimately responsible [3–7].

## 4.2 Abilene Paradox and Groupthink

The Abilene Paradox [18] is based on a parable about a family in Texas in July on a hot, muggy day. Someone in the family suggests they take a trip to Abilene even though they all know their car has no air conditioning. Throughout the trip, they are all agreeing what a wonderful time they are having even though deep inside their hearts, they are really hating it [18]. The Abilene Paradox succinctly means: “Go Along to Get Along” and “Don’t Rock the Boat” [18]. During a July 2013 News Conference at the

YHF Fatality Site, the PFD Wildland Fire BC commented: “*I would have followed them down there blindfolded*” [7, 19, 23]. “*They ... stuck together ... they saw and felt the same way ...*” [7, 19, 23]. Despite attempting to protect the integrity of his men and their decisions and justify the GMHS actions on June 30, 2013, these comments and others strongly suggest both the Abilene Paradox and Groupthink, both very hazardous attitudes [8].

Although the GMHS knew the stakes were high that day, none of them went to work on June 30, 2013 planning on injuring themselves or others. None of them thought this could happen. Likewise, they never considered they would be unnecessarily risking their lives or leaving family members brokenhearted for the rest of their lives. Unwittingly, they were merely a large and confident group with a herd mentality. *Groupthink*, occurs when a group makes faulty decisions because group pressures lead to a deterioration of “mental efficiency, reality testing, and moral judgment” [19]. Groups harmfully affected by Groupthink ignore safer alternatives such as occurred on the YHF when the GMHS decided to leave their Safety Zone [19]. Avalanche survivor Megan Michelson said once the plan to ski Tunnel Creek was made and they left the back-country gate it was difficult to think of removing herself from the group, [20]. There were broken conversations of how to manage the run but not a full group conversation on doing it safely [20]. These same ‘*broken conversations*’ likely occurred amongst the GMHS in the black and along the route to the Boulder Springs Ranch (BSR), bolstering and intensifying the devious, insidious power of Groupthink [9, 20].

### 4.3 The Morality of Obeying Stupid Orders

In the WFF realm, one is told to obey orders unless they are one or more of the following: (1) unsafe, (2) illegal, (3) unethical, or (4) immoral. Vietnam Veteran Reed argues to obey orders where the overall mission big-picture benefits are sufficient to warrant the risks. “If the superior won’t back down, the lower leader has a moral decision to make. If the lower leader thinks the mission is too dangerous for its benefits, he should resist the order to the point of refusing to carry it out” [21]. This is exactly what the Acting GMHS Superintendent was doing, however, he was using ‘*mitigating or hinting speech*,’ defined as “any attempt to downplay or sugarcoat the meaning of what is being said,” likely in deference to authority, instead of direct speech and actions to hold true to their ultimate obligation of maintaining the safety and welfare of those they supervise [22]. Gladwell described this in detail regarding a fatal aircraft mishap when the Junior Pilot conceded to the Chief Pilot regarding escalating inclement weather, rather than being more direct and persuasive in his safety concerns [22].

### 4.4 Public Decisions

“A factor that binds people to their actions is ‘*going public*’ when someone participates in and is *identified publicly with a decision*, that person will resolve inconsistencies to produce attitudes consistent with that choice” [13]. The authors contend that the GMHS ‘*public decision*’ to stay put in the black and not assist the Yarnell Structure Protection

Specialist and to send the BRHS instead [7, 13] were overridden by what the authors define as the stronger ‘*micro-level public decisions*’ during their discreet Crew Net “*discussing our options*” radio conversations [7, 9, 13, 14].

## 5 Organizational Culture and Influences

### 5.1 Human Factor Barriers to Situation Awareness

The IRPG [8] lists several Hazardous Attitudes in the overarching ‘*Human Factor Barriers to Situation Awareness*’ section. They include:

1. *Invulnerable* - That can’t happen to us
2. *Anti-authority* - Disregard of the team effort
3. *Impulsive* - Do something even if it’s wrong
4. *Macho* - Trying to impress or prove something
5. *Groupthink* - Afraid to speak up or disagree

The authors contend these hazardous attitudes exist in varying degrees in all WF fatalities where they are killed by fire. They reigned fatal that day, manifested as perilous attitudes, decision making errors, and engagements, ultimately resulting in their deaths [6, 7]. The authors and other WFF often expand on the Anti-authority attitude, to include: “*The rules don’t apply to us*” and “*Don’t tell us what to do.*” The authors argue that all the hazardous attitudes applied that day because they had gotten so used to bad decisions with good outcomes for years, and this was merely normal work to them [6, 7]. The insidious Groupthink mindset, discussed in more detail above, prevailed that fatal day, and very likely a major cause of many Wildland Fire Human Failures.

### 5.2 PFD Attitude and Influence

The PFD Wildland Battalion Chief (WBC) literally considered these GMHS men to be his sons; he was virtually in shock, attempting to defend their fatal actions as well as the Fire Department in a July 2013 New Conference at the YH Fire Fatality Site. He essentially held structure protection as a higher priority than individual firefighter safety when he stated: “*no WFF is satisfied sitting in a Safety Zone while structures were being threatened*” [23]. In addition, he used the Fallacies of Equivocation and False Analogy [7] by maintaining what the GMHS did was identical to firemen running into burning buildings [7, 23]. Indeed, municipal/structural firemen have much heavier personal protective clothing, SCBA oxygen tanks, and much more water to apply to the fire compared to WFF. All these are strong indicators of mixed and/or conflicting values contributing to confusion, frustration, and uncertainty, setting up for potential human failures on any wildfire, mainly those with threatened structures, as on the YHF and many others, and likely to continue with future fires unless WFF truly learn the costly lessons of these recurring tragedies [11].

### 5.3 The Marine Corps Viewpoint and Influence

The three GMHS Marines garnered immense respect from their Crew as well as considerable sway over them. The Marine ethos is one of a selfless group culture, where the group is held in a higher regard than the individual [24]. A feature story on the GMHS Marines stated, they “*went into the toughest fight they had ever faced with no second-guesses. They had a mission to accomplish—protect the community of Yarnell—and just like their time in the Corps, they were willing to lay down their lives to achieve that goal*” [25]. Indeed, honorable and laudable traits - until June 30, 2013. Truly, this is a rather dramatic statement, and hopefully merely intended to soothe the grief and pain of family, friends, and loved ones.

A [Military.com](http://Military.com) video interview with the PFD WBC reveals: “*at about 4:00 ... I clicked back on their frequency, and heard a couple things, ... that they need to move, that the fire was coming back on their position*” [26]. This contradicts the SAIT SAIR stating there was a “*gap of over 30 minutes in the information available for the GMHS* [9].” There was compliant GMHS communications at times, however, when they were on the move leaving the good black, the SAIT SAIR alleges there was none [9].

It is also noteworthy the PFD WBC listened in on their Crew Net frequency, which suggests he heard some ‘*Discussing our options*’ discreet radio conversations [14], talking about whether to stay in the good, safe black or head down through the unburned fuel in chutes and chimneys toward the BSR. It makes no sense. The GMHS were perfectly safe, with the best vantage point of anyone on the YH Fire, save Air Attack.

### 5.4 High Reliability Organizations (HRO)

HRO’s, such as aircraft carrier and nuclear power plant operations, are preoccupied with all failures, especially small ones. Insignificant things that go wrong are often early warning signals of deepening trouble and give insight into the health of the entire system. If you catch problems before they grow bigger, you have more possible ways to deal with them. Instead, we tend to overlook our failures, suggesting we are incompetent, focusing instead on successes, suggesting we are competent [11, 27]. For many WFF, this apparently is accepted guidance in theory, and not realistically, due to the recurring WFF fatalities for the same fatal causes based on bad decisions.

The primary author was the Operations Specialist for a 1996 Fire Shelter Deployment Investigation that occurred on the Coconino NF outside Flagstaff, AZ [28]. The Human Factors Specialist briefing began with, “*The first thing we are going to do is establish a conclusion, then find the facts to fit that conclusion.*” The question was broached: ‘*Aren’t we supposed to follow the facts to lead us to a conclusion?*’ The HF Specialist reiterated, we would establish a conclusion, then find the facts to fit it. The discussion concluded with: “*Then we could write anything we wanted to*” [7, 28].

The YHF Serious Accident Investigation Team (SAIT) followed that format of first establishing a conclusion when they discovered “*no indication of negligence, reckless actions, or violations of policy or protocol*” [7, 9]. Stated in the affirmative, this means they did it all right. Yet 19 men died. It is impossible to do everything right on a

wildland fire and 19 men burn to death in one fell swoop. That ‘conclusion’ smacks of Orwellian Doublespeak and even worse, Doublethink [29]. “To respect words and their conveyance of reality is to show respect to the very foundation of reality. To manipulate words is to seek to *manipulate truth* and to instead *choose falsity* and illusion over reality. The manipulation of words is itself a violent act. ...” [30]. The authors confidently argue, this ongoing, unsettling truth manipulation [30] has occurred with all wildfire SAIT Reports, Reviews, and the like where WFF were killed by fire [7].

Borrowing from Avalanche Fatality Human Factors, the “*Expert Halo*” heuristic comes to mind, in which the experienced believe that their expertise will keep them safe [31]. Several Individual, Organizational, and Social Factors likely contributed to and influenced the PFD, including the emphasis on Structure Protection, setting up WFF safety goal conflicts [11]. Avalanche human factors researcher McCammon writes that the *Default* or *consistency heuristic* concludes that when a venture is still an abstract notion, there are likely discussions about the various conditions, the pros/cons, and deliberate assessments of the risks of proceeding take place. But once the initial decision is made, deliberate calculations stop, that thought takes on deceptive power [31]. People generally have a powerful bias for sticking with what they already have, not switching course, and they let their minds default to what is given or what has already been decided. They rely on stay-the-course impulses all the time, often with deceptively satisfactory results [31, 32]. This was likely what happened on June 30, 2013, and other fatal WF, and cogently describes the bad decisions with good outcomes process.

## 6 Conclusion

The paper provided general information for in-depth discussions, education, and training. The authors and most WFF supervisors believe that WFF must do the following to practice responsible leadership and safe WFF practices:

1. Commit to memory, understanding, and following the Ten Standard Fire Fighting Orders as well as the 18 Watch Out Situations;
2. Memorize, understand, and follow the directives in the Downhill Checklist;
3. Memorize, know, and mitigate the Common Denominators of Tragedy Fires, including Human Factors.

As difficult as it may be, all WFF must move beyond blaming fatalities on an offender(s), and instead we must seek to understand the systemic causes triggering the outcomes, as concluded by Reason (1997) [33]. To reduce the frequency of WFF fatalities, a complete understanding of the human failures that led to these outcomes, including the human failures role, is critical. Continued identification of WFF Decision Errors and complete comprehension of the dynamics involved in both positive and negative outcomes are necessary. Furthermore, to truly improve WFF safety and performance, we must continue to know and strictly follow the basic WFF Rules discussed above and apply the following proposals regarding improved future training, existing procedural checklists, and overall support systems. Paraphrasing heavily from the municipal Fresno F.D. (2015) Cortland Incident Findings and Recommendations,

some suggestions generated from that persuasive investigation and this current article include:

1. Ensure effective operational Leadership, Human Factors, and Group Dynamics training for all WFF and Supervisors;
2. Effectively evaluate and cultivate competent, experienced, worthy WFF leaders [34];
3. Reconsider and substitute the flawed practice of simply accepting the WFF injury and death causes as just being part of the job, or the cost of doing business [34];
4. Disapprove of freelancing and independent action, i.e., when individuals or groups work independently and commit to tasks without the expressed knowledge and/or consent of their supervisor [34];
5. Effect positive change to avoid future WFF fatalities by requiring all WFF at all levels to memorize, recognize, apply, and mitigate the WFF Rules on every WF assignment, e.g. 10 Standard Firefighting Orders, 18 Watch Out Situations, LCES, Common Denominators of Fatality Fires, and the Downhill Line Construction Checklist [8], and
6. To effectively change a culture, this transition will succeed only when followed by, supported by, and mandated with a “top down” mentality [34], i.e., managers, supervisors, and firefighters working collaboratively, “*talking the talk and walking the walk.*”

While leaders at all levels of the organization must make their expectations clear, trust and accountability by all those within the chain of command will be critical to any overall success. The desired change must be clearly communicated, and those in positions of authority at all levels must be held accountable to set a good example, in addition to leading, supporting, enforcing, and creating these expectations [34].

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