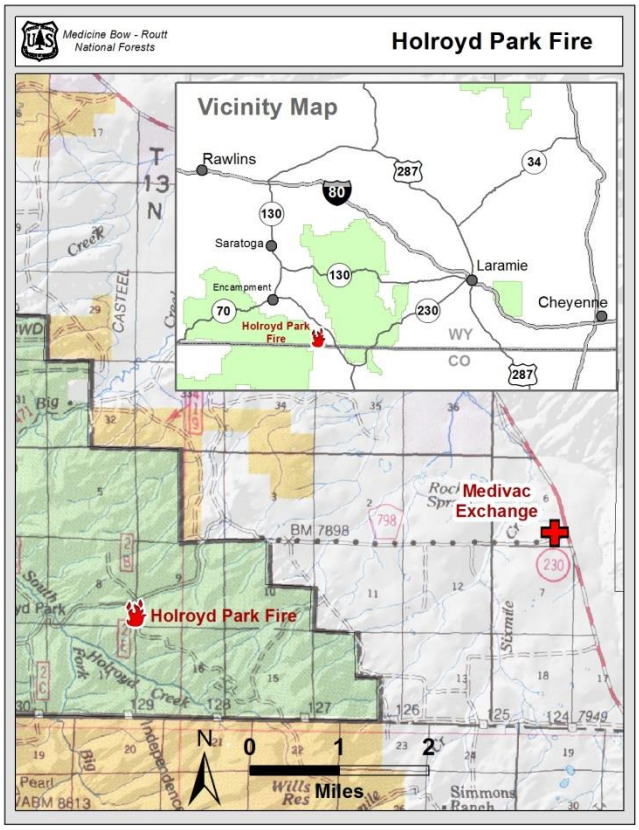
July 20, 2014

Facilitated Learning Analysis

Medicine Bow-Routt National Forests – Brush Creek/Hayden Ranger District, Saratoga WY

Holroyd Park Fire



Tree that struck firefighter

Summary

On Sunday, July 20, 2014, a firefighter was struck and injured by a dead lodgepole pine tree that fell during initial attack on the Holroyd Park Fire on the Brush Creek/Hayden Ranger District of the Medicine Bow National Forest. Initial size-up indicated a 1.5 acre fire creeping in dead standing and down lodgepole pine, with an understory of green grass on the upper 1/3 of a 25% slope.

"We deal with snags EVERY day."

The fire was located in a stand characterized by approximately 80% standing dead lodgepole pine, with average heights of 45 feet and average diameter at breast height of 7.4 inches. This particular area was heavily hit by the mountain bark beetle around 2004-2005.

Stand - fire in background

Story

Since the mountain pine beetles swept through southern Wyoming 10+ years earlier, leaving a swath of destruction behind, hazard trees have been on every Forest employee's radar. With dread and dismay, they've watched the landscape fade before their eyes—from green to red, to brown, to grey. Hazard trees have become the prime heads-up situation. Everyone who dares wander into the woods is faced with the perpetual dilemma; how do I keep from getting hit by one of these darn dead trees? So when resources arrived at the Holroyd Park Fire, it was natural for the discussion to turn immediately to snags, and for no reasonable solution to be unearthed. Still, they were briefed to be "heads-up" and encouraged to do what they needed to do to be safe.

Tommy and Bill were working on a mastication project to reduce hazard trees when the call came in. They knew the area well and the fire was only 30 minutes from their current location. It was their duty and they wasted no time in heading towards the smoke report in Holroyd Park. Bill and Tommy discussed the situation on the way to the incident and Bill agreed that he would be the IC on this fire. The decision was called in to dispatch and communicated to the other firefighters on scene and in route.

There was nothing particularly unusual about the jack-straw nature of this stand – it was the kind of stand that they work in every day, characterized by mainly standing dead with a few green trees and a couple of real nasty snag patches. However, Bill was concerned about the snags and the county VFD crew that was already engaged on the fire. Even now, thoughts of pulling back because of the overhead dangers were rolling around in his mind, bouncing off all the other data marbles that he was picking up.

This initial suppression strategy had worked for them before: surround with saw-line to reduce exposure to snags, hit the hot spots that might threaten the line, then pull people out of there and monitor as it burned itself out, assessing as things change. With private land lurking within a mile and an endless sea of impending inferno on every side, the firefighters set-out to do what they do best – work.

Bill carefully picked his way through the maze of material to tie in with the county firefighters. Explaining his concern over the expanse of snags, he had them pull back from their current line construction. He pointed up at the snags and discussed the possibility of bumping the line out around the thick pockets, letting the fire burn to the line. "There is no need to expose you to that amount of danger." Bill continued, "Take your time, pick a safe way with your line and look up more than you look down."

Fire activity was minimal and winds were fairly calm as the first sawyer advanced around the left flank of the fire. His goal was to remove snags, reducing the threat to the following saw teams. The sawyer's lookout, Todd, kept one eye on the sawyer and one eye on the surrounding snags. Noticing two small interior snags with burning bases, Todd made a mental note to direct the sawyer to take care of those next. Standing in the green and thinking he was safely out of range from the burning snags, the lookout held his post. What felt like mere moments later, one of those snags finally lost its battle against bug and burn, and fell directly toward Todd's position. With no time to respond, he was struck on the right side of his royal blue Bullard hardhat.

"It's deceiving. It doesn't matter how many snags there are. It only takes a couple."

Burned base of tree that hit lookout

Only 21 minutes had ticked by since they arrived on scene.

Others on the fire witnessed the hit and ran to their comrade as he lay on his side, the culprit tree suspended above his legs on the existing downed timber. Anxiety levels were high as they rapidly

assessed his condition. Seeing that Todd was conscious and able to wiggle his hands and toes gave the first responders a sense of relief. Knowing that spinal injury was a real possibility, they kept the injured firefighter immobilized on the grass covered ground. It didn't take long to figure out that the probability of additional trees falling was too great to leave him there until advanced care arrived. All hands were at the ready and within 20 minutes they had Todd duct-taped to a backboard with socks and shirts supporting his neck. Following a path sawed out by folks on the fire, they transported their friend out of the woods to an opening along the road where no snags loomed overhead.

Location where tree struck firefighter

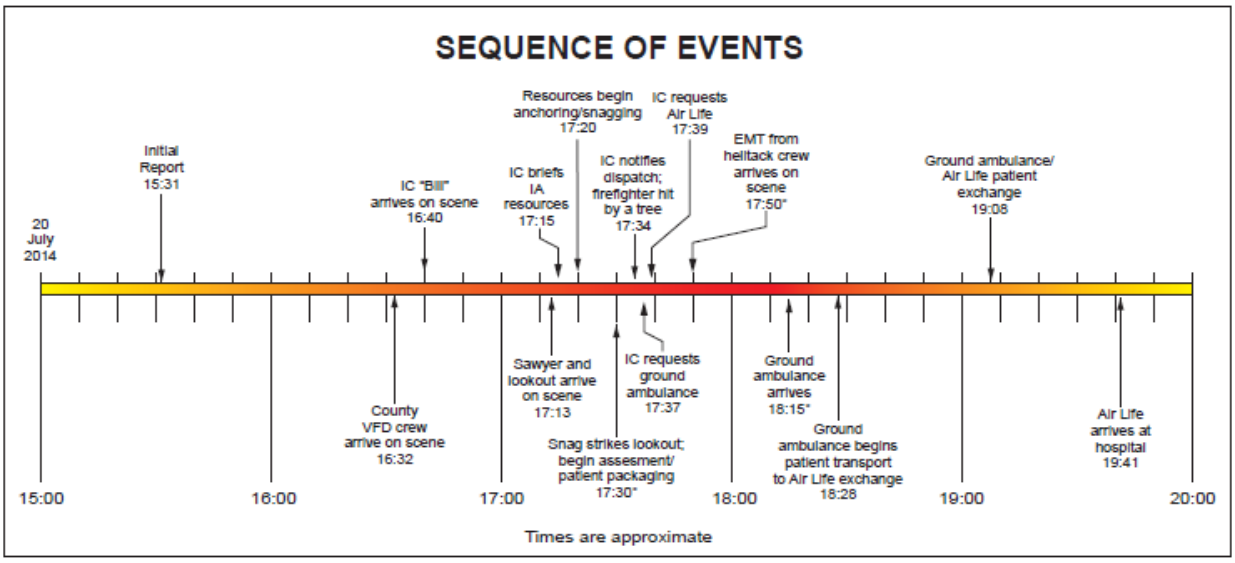
Dispatch was spot-on prompting the folks on the ground for essential information. The county resources jumped right in, helping with packaging, transportation, and communication. The exclusive-use helicopter, whose standard IA protocol left the ship unequipped for extraction, landed nearby and provided an EMT as well as assistance with communication.
Less than an hour after the tree strike, an ambulance arrived and continued patient care. Todd was then transferred to a life flight helicopter and flown to the hospital in Cheyenne. The medical evacuation was fluid and effective, even though it felt chaotic to Bill. Andy Palmer has not been forgotten – Dutch Creek protocol was practiced and implemented.

*"It was just- *snap* snap *snap -fluid."*

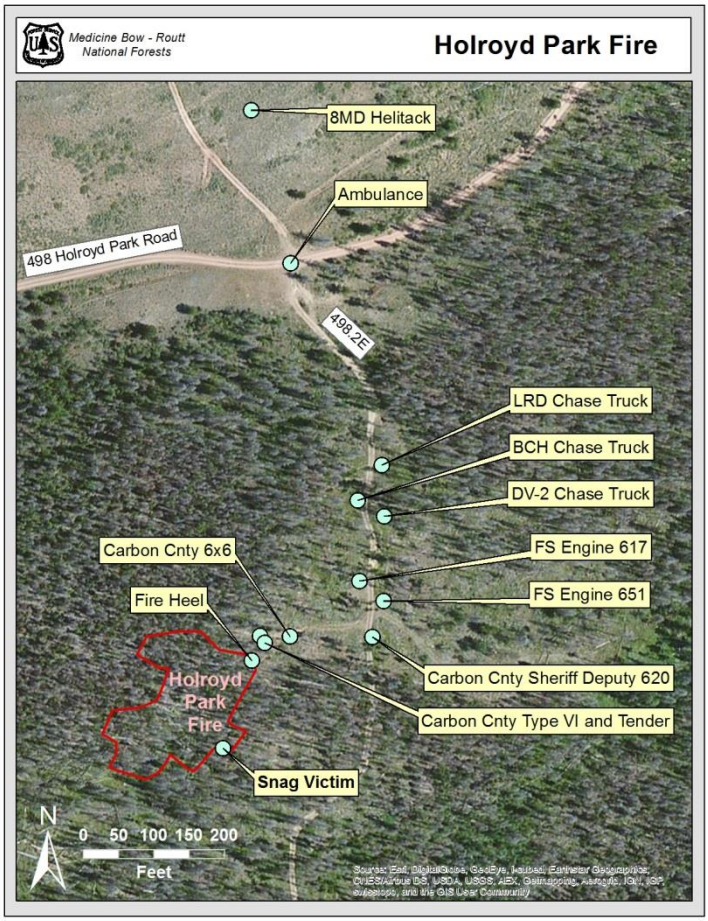
Water from the sprinkler ran over the curb and pooled in the dirt as blanket flowers waved in the breeze, greeting Todd as he gently walked up the sidewalk to the bunkhouse. His back was broken, but his spirits were still high. Doctors claimed that the fractured vertebrae would heal without surgery, but his movement would be limited for the next three months. Daytime TV rubbish would be his escape from boredom for the next week as he lay low, waiting for the pain to ease and for his chance to help out at the district office. Todd knew it was a close call—that he could have died out there. But thanks to his trusty blue hardhat, he's still here, much to the relief of the many employees who felt responsible for him and to his friends and family who know, without question, that no job was worth losing him.

"If I wasn't wearing a helmet, I wouldn't be here right now."

Timeline



Timeline for Holroyd Park Fire - Timeline constructed from WildCAD Incident Card.
Times from witness accounts are marked with *.



Lessons Learned

This analysis is intended to examine the learning opportunities shared by firefighters, overhead, line officers and the FLA Team. The following list has been compiled to help the larger Forest Service community learn from this unfortunate accident.

Stand conditions at Holroyd Park Fire

Snags

> *"None of it is safe."*

- *There is a high level of concern associated with working on a daily basis among so many snags in dead stands of timber by firefighters, leadership, cooperators, and all other Forest personnel.*
- *All personnel on this incident were aware of the snag hazards associated with the incident and were actively engaged in trying to reduce the risk when the accident occurred.*
- *The length of time that trees have been dead has a direct correlation to the amount of risk associated with working around them. In general, the longer a tree or stand of trees has been dead the higher the likelihood they will come down.*
- *By carefully observing snag lean direction, personnel can minimize risk by avoiding the "snag shadow." Personnel entering or exiting a stand of dead timber can slowly and carefully select a path to avoid the lean shadow of dangerous snags, thus reducing overall risk.*
- *Training could be made available in-house to help provide more consistency in determining tree height, "snag shadow" avoidance, and lower bole or butt rot across disciplines within the forest. The Danger Tree Indicators video from MTDC is a 34-minute long safety video program that shows you how to identify danger tree indicators while you work.*

"This is how we've always done it…we've got to learn to change our tactics."

"Last year, they'd be in there mopping it up."

Analyzing and Mitigating Risk

- *Taking adequate time to properly size-up the incident and analyze risk is critical to selecting the proper strategy and tactics that will minimize risk to personnel.*
- *Factors such as butt and root rot, trees showing ring or collar burn, tree lean, and the amount of time trees have been dead and/or burning should all be taken into account when developing strategies and tactics to minimize risk.*

Tree collar burn

Butt rot

- *Employees assess hazard tree risk in different ways depending on their experience and training. No standard quantitative risk assessment exists to guide decision making when working in high levels of snags. The Danger Tree Indicators video from MTDC is a 34-minute long safety video program that shows you how to identify danger tree indicators while you work.*
- *Use all the tools in the toolbox to lessen firefighter exposure to snags, including air resources and mechanized equipment. The MTDC techtip titled Danger Tree Mitigation Guidelines for Managers provides information to help evaluate common methods of mitigation.*

"No way am I going to commit anyone in there."

"I'm gonna do it with machines."

Trail dozer

Medical Evacuations

> *"Go over the medical plan. Hammer it into people even if it gets mundane."*

- *Having an established medical plan and practicing that plan is essential to providing the care needed when a serious injury occurs. This was a key factor in the victim getting professional and timely care in this case.*
- *Training in low angle rescue, wilderness 1st aid, as well as having EMT certified personnel could drastically reduce the severity of an injury. A lack of on-site EMT care was identified; however, all personnel involved felt that both experience and medical training provided by local agencies provided enough knowledge to safely package and begin moving the victim from the accident scene to the medevac site.*
- *There was a lack of specialized medical equipment on the engines. No C-collar, or oxygen, and few other smaller items. Support to procure such equipment and the training to use this equipment would give patients better care earlier.*
- *When leaving on an initial attack, local agency helicopters sometimes leave without medic/medevac gear; this was the case on Holroyd Fire. After the ship returned home, the crew revamped the IA load and capabilities of the ship. The changes that occurred will provide the ordering incident the ability to medevac an individual if necessary and provide patient assessment and care.*

The Underlying Issue

> *"We have to go out in the woods."*

The Facilitated Learning Analysis Team could not overlook the Underlying Issue on this assignment. Employees are working in a dead and/or dying forest canopy that has high associated risk to personal safety. The over story trees have had significant damage from pine bark beetles and employees have resigned to the fact they have to operate in a high risk environment to perform their jobs.

Employees on the Medicine Bow-Routt National Forest and Thunder Basin National Grassland are facing a challenge encountered by many other Forest Service employees across the Rocky Mountain West. The forested stands they are working in are dying before their eyes. They are very aware of the risk associated with working in this environment but do not see any other options to working within this environment to perform their jobs. They can mitigate some of the risk but cannot completely eliminate the risk from falling trees or snags.

Snags are a well-known hazard when working in a forested environment. However, this hazard has gone from being a minor component in their Forest to being the dominant feature within most of the forested stands where they work. This presents a significant threat to the safety of Forest Service employees, their contractors, and to the public as they recreate within these areas.

The beetle killed trees become weakened but the extent of the threat to falling down is not constant. Over time the trees will begin to rot at the base and become weaker each year they stand. Employees are aware of this but do not have a good way to quantify how the risk has changed over time and what the probability of each tree falling is. In other words, is the stand of dead trees they are entering more or less dangerous than the stand of dead trees they worked in on another portion of the Forest the day before?

"It all comes down to luck and odds."

Employees feel that the leadership of their Forest is engaged and struggling with this same issue. They feel empowered to make decisions of whether or not to engage in their work on a daily basis. The leadership of this Forest and on other Forests across the Rocky Mountain West is struggling with how to work in this environment and keep their employees safe on a daily basis.

There seems to be a lack of clarity how leader's intent (employee and public safety) is implemented on the ground by field going personnel. It is one thing to empower employees to evaluate risk and make decisions based upon their own safety and another thing to know you have a job to do in the Forest and nowhere else to do it. What are the specific things that leadership expects employees to do differently and what risk is ok? What is the threshold that would make them stay out of the woods? What decisions do employees need line officers to make for them? What don't line officers know regarding the hazard tree risks faced by employees?

"What's the goal?"

The implication of this lack of clarity between line officers and field going personnel is that employees at lowest level are faced with tough decisions on a daily basis—often times without line officers even being aware. Type 4 & 5 incident commanders are making decisions about how to approach initial attack. Should they go direct and stop the fire small or should they take an indirect approach and let the fire get bigger? Timber techs are marking stands and deciding on their own if they should spend the day in a stand of snags. It goes on and on - with very complicated decisions being inadvertently imposed on the lowest level of our organization.

"These are the trained professionals and I will support their decisions."

This Facilitated Learning Analysis Team does not feel they have the answers to all of these complex problems but feel they have a duty to share what is on employee's minds; especially when it comes to safety and risk management. This underlying issue is further complicated by the Forest Service Policy that guides their management. In addition, the Forest Plan they are operating under was developed long before the bark beetle became an issue and was designed for a "living" or "green" forest.

Some of the questions learned from interviewing Forest employees that the FLA Team could not answer within the confines of the FLA process are as follows:

1. How does the Forest operate within Forest Service Policies that were designed for a different environment? Specifically, our timber management policies were designed for a valuable commodity (green trees) not a low value hazardous environment (dead trees). This is just one of many FS policies that are in conflict with the current situation on the ground.
2. Does it make sense to do the same level of surveys (wildlife, botany, archaeology, soils, etc.) to manage vegetation that is "dead" compared to a "green or living" Forest?
3. Should employees be working in this environment the same way that they did before the bark beetle? They are aware of the dangers associated with a dead forest canopy but they are chasing the same targets and spending the same amount of time (exposure to risk) in these forested stands that they were when the over story was alive.
4. Should targets for this Forest be assigned, along with the accompanying budget, the same way it was prior to the bark beetle?
5. What role will fire play within this new environment and what should our approach be currently? Is a new fire plan needed or is the existing plan still applicable?
6. Should we shift to a more mechanical approach for initial attack to limit exposure to firefighters? Do we have the right tools and all of the tools needed in the toolbox for the current conditions?
7. How do we change public perception and/or expectations around a forest over story where it is now "dead"?
8. Are there opportunities for research to be done on the level of risk associated across these forests to provide employees with a quantitative method for determining risk?
9. Do Forest employees have the proper first-aid and trauma kits in place for the type of injuries associated with snags? Should they have backboards and advanced trauma kits in their engines and for all other Forest operations?

"It's not in our mindset to let it burn, but we might have to change our mindset."

10. How do Forest employees stay fresh with the hazards associated with snags and avoid "normalization of risk"? Is training available for this and other Forests dealing with this issue to minimize "normalizing risk?"

These are just a few of the many questions the FLA Team discussed. We do not know the appropriate way to bring this issue up, but feel it cannot be ignored. This is not an issue about money or funding. Employees are not complaining about funding but are genuinely spooked by the environment they work in.

Although this issue is severe on the Medicine Bow-Routt National Forest and Thunder Basin National Grassland, these issues are playing out in a similar way across the Rocky Mountain Region and other Regions in the west on most National Forests. Answers to their questions would help all other Forests faced with these same concerns.

Wildland Fire Helmet Equipment Report: Holroyd Park Fire Tree Strike

This report is based on site visits, interviews with the firefighters, and examination of the equipment. The firefighter stated "I saw the tree coming and had one second before it hit." The firefighter was facing the tree. The tree impacted the right side of the firefighter's helmet and knocked him to the ground. The impact was significant enough to remove the firefighter's helmet and sunglasses. A witness stated "the tree crushed the firefighter to the ground and popped the firefighter out" [from under the tree]. The firefighter ended up on his left side in a fetal position a few feet to the left of the tree. The firefighter was hospitalized and released with a fracture of the T10 vertebra. (Figure 1)

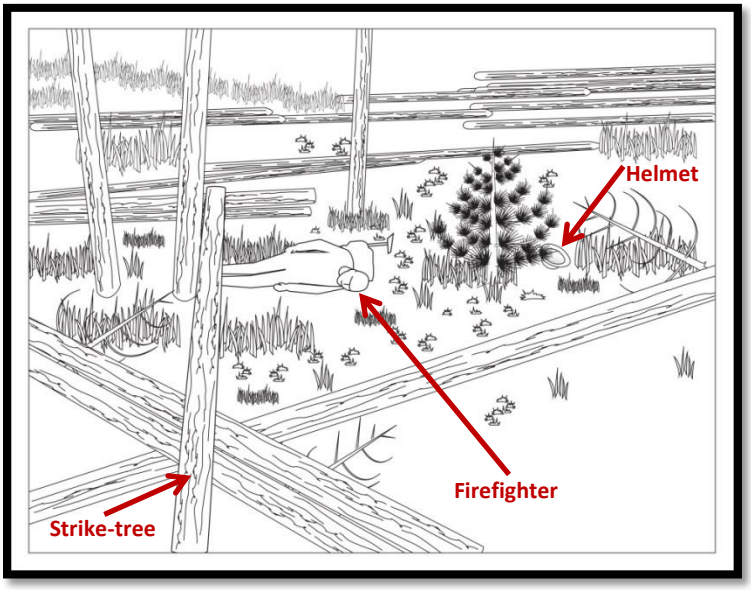


Figure 1

Strike-tree

Species- Lodgepole Pine
Condition- Standing dead. Fire weakened and burning at the base.
Diameter Breast Height (DBH) - 6.8 Inches
Estimated Height- 40 Feet

The strike-tree was still attached to the stump after impacting the firefighter. The tree did not contact the ground surface; it remained suspended by its branches and downfall. The tree impacted the firefighter at 32 feet from the tree's base. It was 5.5 inches in diameter at point of impact.

Holroyd Park Fire Equipment-Wildland Firefighting Helmet

Make- Bullard Wildfire Series Fire Helmet
Model- FH911H/911H
Date of Manufacture- April, 2013
Date Put into Service- June, 2013

Certifications- NFPA 1977 Standard on Protective Clothing and Equipment for Wildland Firefighting, 2011 edition; ANSI/ISEA Z89.1-2009, Type 1, Class E&G.

Shell Condition- The rear-right side of the shell has scuff marks that run diagonally towards the back brim area. The brim has scuff marks that run diagonally from front to back. (Figure 2)

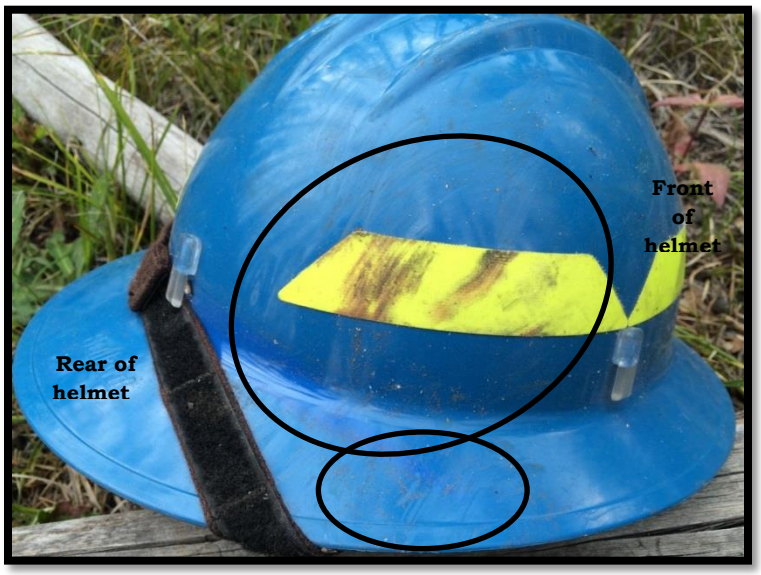


Figure 2- Helmet scuff marks

Suspension Condition- The suspension components (keys, T-posts, webbing, and ratchet knob) are intact and in working condition. The brow band (sweat band) and webbing are slightly dirty. This is consistent with seasonal use for a helmet that has been in service for 13 months. (Figure 3)

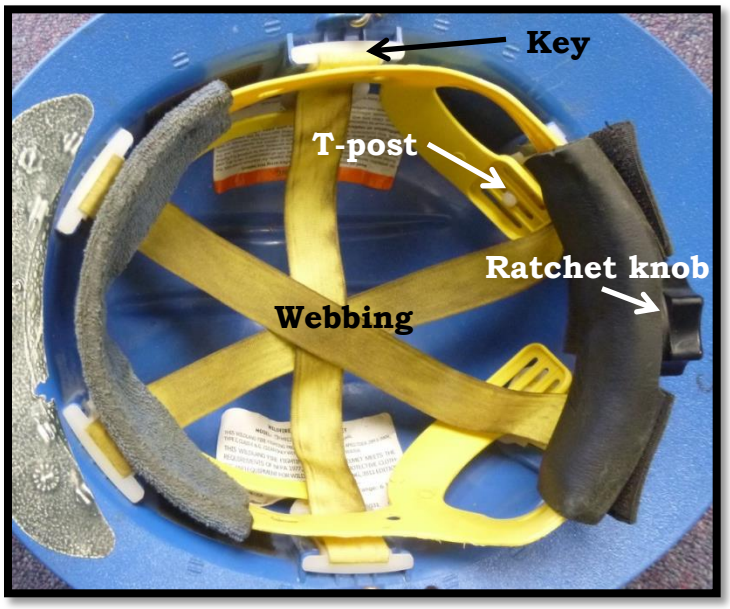


Figure 3 - Helmet suspension components

Helmet Analysis- Scuff marks and scratch marks suggest a glancing impact from the tree. Some of these marks may have occurred from the helmet impacting the ground as well. It is apparent the helmet performed its intended purpose. The firefighter stated "if I wasn't wearing a helmet, I wouldn't be here today."

Holroyd Park Fire Equipment-Firefighter's Sunglasses

Sunglasses- The strike-tree impact bent the firefighter's plastic-lensed sunglasses. (Figure 4)

Figure 4- Firefighter's sunglasses. Note: Tree shown is not the strike tree.

Helmet Protection Limitations

Helmets that are certified to NFPA 1977 and ANSI Z89.1 pass a battery of tests. Among those tests is the Force Transmission Test. This test is designed to emulate a brick falling one story onto a person's head. The falling brick generates 54 joules of energy on impact with the helmet. It is believed that additional energy will cause vertebral damage.

Additional Helmet Information

The Interagency Standards for Fire and Fire Aviation Operations Guide 2014(Ch. 7, Page 11) states that "personnel must be equipped with hardhats and wear them at all times while on the fireline."

Helmet components include an outer shell, inner suspension, and chin strap. These components require periodic inspection and maintenance. Helmet service life begins when the helmet is put into service, not the manufacture date specified on the helmet. Acceptable helmets for fireline use are certified according to the National Fire Protection Association *(NFPA) 1977 Standard on Protective Clothing and Equipment for Wildland Fire Fighting* requirements. A helmet certified to NFPA-1977 will meet ANSI Z89.1-2003 or 2009 Type 1, Class G. Type I helmets are intended to reduce the force of impact resulting from a blow to the top of the head. Class G helmets are intended to reduce the danger of contact with low voltage electrical conductors. NFPA 1977 compliance ensures minimum design, performance, testing, and certification requirements are met for protective items used in wildland firefighting. Additional information on helmets and inspection can be found in Missoula Technology and Development Center (MTDC) Tech Tip publication, *Your Hardhat: Inspection and Maintenance,* found at:
http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm02672331/index.htm

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