

320 Road Entrapment Avoidance

Facilitated Learning Analysis

August 12, 2011



Coal Canyon Fire

Hell Canyon Ranger District

Black Hills National Forest

South Dakota

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Summary

The 320 Road Entrapment Avoidance Facilitated Learning Analysis (FLA) was requested by the Black Hills Forest Supervisor to learn what occurred on the Coal Canyon Fire on August 12, 2011. An FLA Team was assembled to help firefighters identify Lessons Learned that could prevent entrapments and injuries in the future.

On August 11, 2011, during the initial attack phase of the Coal Canyon Fire, on the Hell Canyon Ranger District of the Black Hills National Forest an entrapment occurred taking the life of firefighter Trampus Haskvitz.

The fire was located mid-slope in a deep canyon with poor access. The resulting run on the afternoon of August 11 left the fire somewhere around 50 to 100 acres. The topography is fractured with steep canyon walls vegetated with a mix of open and closed ponderosa pine stands mixed with juniper and in some areas a heavy component of pine regeneration stands. There is no recent fire history in the area, although the surrounding areas have hosted several fires over the past two decades.

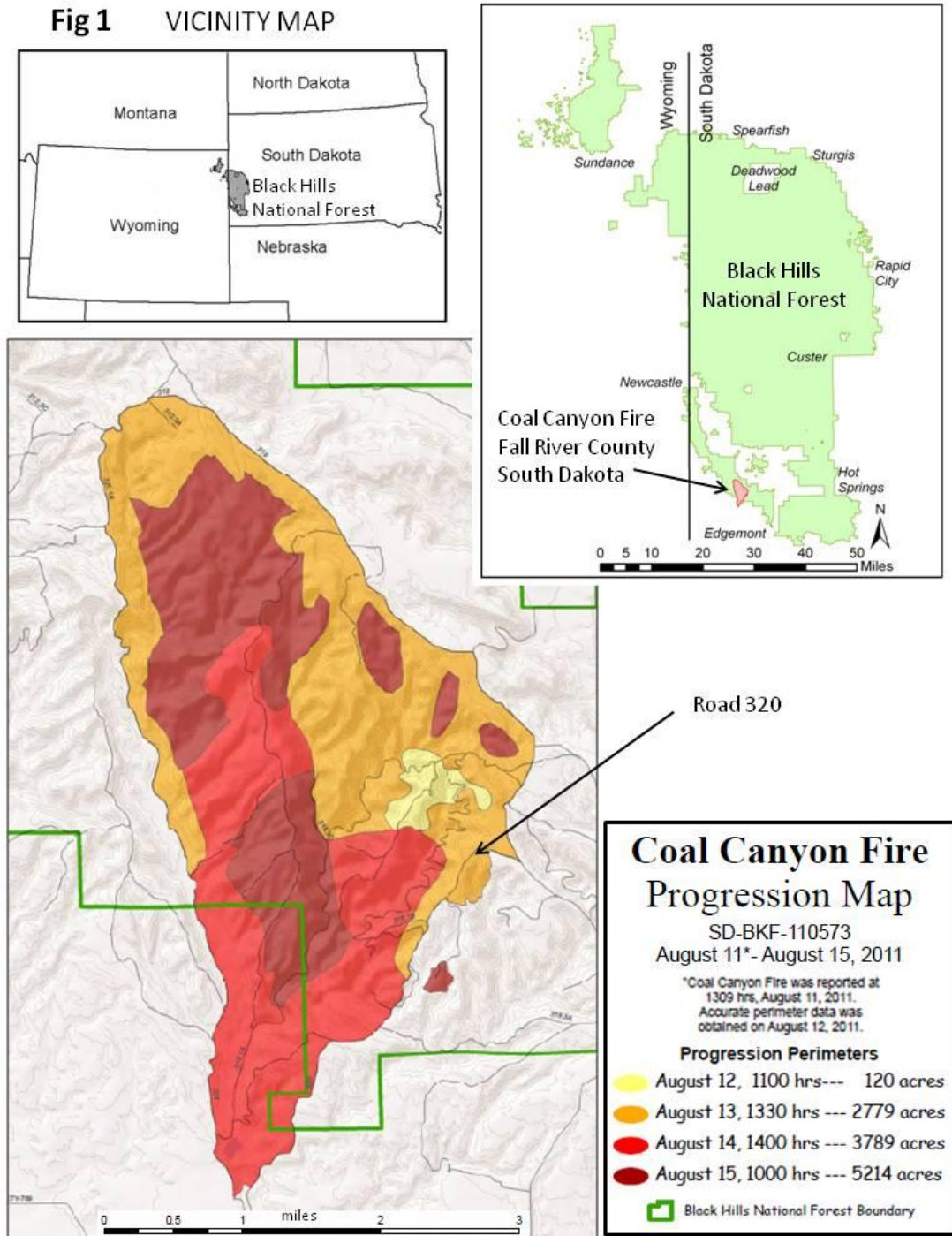
Prior to the fatality, a local Type 3 Incident Management Team (IMT) was ordered to take control of the fire. After the fatality, a Type 2 IMT was ordered. Resources began arriving during the late afternoon of August 11.

The afternoon of August 12 during burnout operations on Division Zulu, firefighters experienced a sudden increase in fire behavior and were forced to implement entrapment avoidance procedures that resulted in no injuries to personnel. During the event a crew vehicle caught on fire and sustained significant damage to the rear of the vehicle. The leaders involved made good decisions that resulted in a good outcome for their crews.

Following this event, the Type 3 Incident Commander (IC) decided to pull all resources off the line and reassess the situation.

On August 15, the Black Hills Forest Supervisor delegated authority to an FLA Team to help firefighters share their story and Lessons Learned on the 320 Road.

Figure 1: Vicinity Map



Conditions

Fuels

The canyons have patches and stringers of dense ponderosa pine, junipers, various shrubs and grasses. The plateau tops are thick with annual grasses, shrubs, mixed perennials, and various herbaceous plants.

Fuel loading is heavy in this region, as this is one of the few areas in the Southern Black Hills that has not experienced large fire in the past 30 years.

Fuels dryness levels in area of the Coal Canyon Fire were relatively normal for the time of year. Nearby Remote Automated Weather Station (RAWS) recordings for August 12 were as follows: Energy Release Component = 54, (average 57). The Burning Index was slightly below average at 42, (average 50). The 1000 hr fuel moistures were average at 11%. Many resources on the fire noted that the grass components appearance green but on closer inspection showed a significant dead component that was fully cured.

Weather

A spot weather forecast for the fire area was requested on August 11, at 1926. Weather for August 12 was predicted to be a max temp of 79 F with a min RH of 28%. The Red Canyon RAWS (approximately 2 miles east of the fires location) recorded 1500 temps of 82 degrees and 22% RH. Some of the resources took weather observations from various locations along Div Zulu the morning of August 12 and are listed in the table below.

Time	Temp	RH	Wind speed	Wind Direction	POI
0800	65	55	0-3	West	20
0930	70	47	0-3	West	30
1030	71	48	0-5	W/NW	40
1130	78	34	0-5	W/NW	60
1200	80	25	2-5	NW	60

Topography

The area lies at the extreme south end of the Black Hills. It is a limestone Karst formation of a highly dissected plateau furrowed by erosion that created steep, deeply indented canyons. These canyons run primarily north to south with multiple lateral canyons fingering up to the narrow plateau ridge lines. Locals call it broken country and even sometimes refer to the area as badlands.

Narrative

Arrival on Fire – August 11

Resources involved in the 320 Road incident begin arriving onto Division Zulu (Div Z) of the Coal Canyon Fire late in the afternoon on August 11. All five modules that arrive that afternoon and evening, are experienced local resources. Engine 1 is staffed with 2 people. Engine 2, Engine 3, and Engine 4 are staffed with three people each. Crew A is a 9 person hand crew that has a Crew Boss and Crew Lead firefighter. The crew is broken up into two modules, Crew A1 and Crew A2, with corresponding vehicle designators.

Earlier in the afternoon an entrapment resulting in a fatality occurred on the fire. A Type 3 management organization is transitioning into place and a Type 2 team has been ordered and plans to transition at 1800 on August 12. An indirect strategy is developed to prep and burnout a system of roads above the broken terrain where the fire is burning. Given the success of this strategy, the eventual fire size is estimated to be over 5000 acres. Firefighters are aware that the indices and fuel conditions in the area are average for this time of season. Resources note upon arrival to the area that some of the grass still looks green.

All modules are briefed on the fatality upon arrival. The Engine 1, Engine 2, and Crew A Module Leaders consult with their respective crewmembers to ensure that they are comfortable working on the fire, given the day's earlier events. Engine 1 and Engine 2 arrive first and are assigned to assist in securing the scene at the entrapment site. Upon completion of that assignment, the two engines spend the remainder of the evening along with Crew A, scouting roads for the indirect strategy to be implemented the following day. Firefighters observe little activity on the fire throughout the evening. The intent behind the indirect strategy on the fire is clear to everyone, and makes sense to them in light of their local expertise. All five modules bed down at the Staging Area on Elbow Canyon Road by 2300 [Figure 2].

Morning of August 12

On the morning of the 12th, firefighters are surprised to see the fire has not grown more than a few acres. It is estimated in the morning that the fire is approximately 50 acres and is still across the drainage from the 320 Road where the crews will be working. The forecast for the 12th calls for cooler temperatures and higher humidities than the previous day. The (IC) mentions to firefighters in the



Fire activity around 1030

Figure 2: Site Map



morning to expect warmer and drier conditions than forecasted, because of the prior day's inaccurate forecast. Crew A, Engine 1, and Engine 2 confirm with night Division Supervisor Z (DIVS Z) the plan to prep the 320 spur road for eventual burnout. Upon confirmation, Crew A, Engine 2, and Engine 1 spend the entire morning prepping from Drop Point 9 (DP-9) down the 320 Road [Fig. 2]. The three modules working together use a Bobcat with a grappler to assist in removing the heavy fuels generated from the prep.

For most of the morning, the resources are able to maintain a lookout into the fire area in the drainage below. Due to anticipated holding concerns, extra time is spent in the first saddle down the road due to the heavy fuels present [Fig. 2]. The Module Leaders first meet with day DIVS Z to discuss the day's plan when they are prepping through the saddle. Engine 3 and Engine 4 return from the Incident Command Post mid-morning to assist with prep, and an additional Type 2 crew shows up later in the morning. As resources work down the 320 Road and lose sight of the fire, Engine 3 and Engine 4 are assigned as lookouts on the Flat above the Saddle [Fig. 2]. Division Z Task Force Leader (TFLD Z) arrives late-morning, and DIVS Z Trainee arrives around 1200.

During the entire morning, the fire remains across the main drainage from where the modules are working. Fire activity throughout the morning is repeatedly noted as surprisingly quiet, with little growth occurring. Given this activity, Module Leaders question to themselves whether the strategy might change from indirect to direct. Due to local experience and the fatality the previous day, the Module Leaders clearly support the indirect strategy currently being implemented. The feeling from resources and overhead on Division Z is that the day will be spent prepping the road, and the hotshot crews will come in the following day to burn it out. Weather observations taken by the crews in the morning showed mild conditions (see Conditions).

Prep to Firing Transition

Between 1200 and 1300, fire activity increases, crosses the main drainage, and begins to advance towards the Staging Area and DP-9 in Div Z. Because of their location down the 320 Road, the resources only become aware of this increase in activity from radio traffic concerning retardant drops on Div Z. At 1300, Crew A is re-assigned to the Staging Area to help hold the road where the fire is approaching. Upon arrival at the Staging Area, the Crew Boss feels that



Fire activity near the Staging Area as it advances towards the Elbow Canyon Road

the fire activity is nothing out of the ordinary for the conditions. All other resources, including Engine 1 and Engine 2, continue to prep for the burnout down the 320 Road. The use of retardant at the Staging Area slows the advance of the fire in that area. Meanwhile, the main fire has approached DP-9. Crew A1, with the Crew Boss, moves to DP-9 to initiate firing operations where the fire has reached the road. Crew A2 with the Crew Lead remains at the Staging Area to assist in possible burnout operations with additional resources from Div Z.

Firing operation: Phase 1

By the time Crew A1 arrives at DP-9 at around 1300, the main fire has reached the road junction. The Crew Boss describes the fire behavior as increasing, with moderate flanking spread in the grass and sparse brush, and single and group tree torching in the timber in the drainage. As with the fire activity at the Staging Area, the Crew Boss describes the fire behavior at DP-9 as nothing out of the ordinary. Engine 4 joins Crew A1 as a holding engine, while Engine 3 patrols Elbow Canyon Road between DP-9 and the Staging Area. Crew A1 begins firing down the 320 Road with two lighters using drip torches. The intent of the burnout is to stay ahead of the main fire and tie into a check line that the TFLD and a dozer are constructing from the 320 Road to the edge of the drainage [Fig. 2].

As the burnout progresses, the Crew Boss, who is managing the firing, notices that winds have changed from being steady from the west/northwest to variable. The Crew Boss uses a flare pistol to develop interior heat to draw the fire off the line, and notices that the grass is igniting from the



Fire activity as the fire wraps around the dozer check line.

flare sparks and spreading readily before the flare hits the ground. Surprised by the increase in ignition potential, the Crew Boss stops using the pistol in an effort to reduce excess heat build-up. As the firing operation nears the dozer check line, activity in the timber several hundred feet from the line creates a fire whirl that advances the fire towards the 320 Road. The firing operation successfully ties into the main fire that has burned up to the check line at around 1400.

As Crew A1 returns to their vehicle, Engine 4 identifies a spot fire (Spot Fire 1) 75 feet off of the road in the timber, mid-way between DP-9 and the check line [Fig. 2]. Engine 4 quickly knocks the

spot fire down, and Crew A1 assists in lining it. The Crew Boss is surprised by the spot fire, and suspects it is from the fire whirl a few minutes earlier. He and the Engine 4 Engine Captain scout from Spot Fire 1 to beyond the check-line looking for additional spots, but surprisingly find no others. The Crew Boss notices the main fire has already flanked around the bottom of the check line, and discusses the need to continue firing with the TFLD Z. After agreeing on the need to continue firing, Engine 1 bumps up the 320 Road to help hold along with Engine 3.

Firing operation: Phase 2

The main fire continues to advance to the 320 Road just beyond the check-line. DIVS Z works with air attack to stop the fire spread with retardant and a light helicopter. Around this time, Engine 2 with the Assistant Engine

Captain plus one crewmember arrives at the Flat down the 320 Road from the firing operation. The Engine Captain from Engine 2 remains with the prepping operation running the Bobcat. Engine 2 remains on the Flat ahead of the firing to monitor for spots and changes in the main fire's activity.

Crew A1 anchors from the black and re-initiates the firing operation. Fire activity is still moderate, with variable winds.

The Crew Boss finds nothing unexpected in the fire behavior at this time. At this time, Engine 4 joins Engine 3 in the holding operation. Soon after the firing re-commences, Crew A2 is released from the Staging Area and ties back in with Crew A1. The Crew Lead from Crew A asks the Crew Boss whether he'd like A1 truck bumped up from DP-9 to the Flat along with A2 truck ahead of the firing operation. The Crew Boss considers at this point where to park the trucks as the firing proceeds. He initially considers the black in the Saddle, but was not comfortable leaving them near residual heat from the burnout. It is decided that two drivers from Crew A will bump both Crew A trucks ahead of the burn onto the Flat into a patch of grass in the green that has been matted down by previous traffic.

The TFLD Z meets the Crew A Crew Boss and the Engine Boss from Engine 1 to discuss the best use for the dozer. They discuss using the dozer to put check line down an old spur road off of the 320 Road ahead of the burn. The Crew Boss recommends the dozer focus on putting in check lines



Crew A burning through the Saddle. The Flat is beyond the single pine tree in the upper left hand corner of the photo.

closer to the firing operation, creating multiple options for hanging the burnout up before the evening.

The Crew Boss joins the firing operation as an interior lighter at the edge of the drainage so he can keep eyes into the main fire. He continually assesses the fire location in the bottom of the main draw as he proceeds. At approximately 1430, the two lighters successfully burn through the Saddle where the heavy prep occurred earlier. At the same time, the Crew Boss notices that the main fire has unexpectedly checked itself below a mid-slope horseshoe-shaped road in the drainage below the Saddle [Fig 2, 3]. This strikes him as unusual, and instills a new sense of urgency to the firing operation. Realizing the potential once the fire crosses this road, the Crew Boss consults with the DIVS Z and suggests continuing with the firing so they can establish a backing fire into the drainage below. Despite some hesitation, they agreed to proceed. At this point winds are adverse and the firing operation slows. The Crew Boss is still feeling comfortable with the plan. However, because of the deteriorating conditions, he recommends pre-treating the green with retardant as a precaution against spots. This occurs soon afterwards but with marginal success. During the air operations, a SEAT unexpectedly drops a load of retardant on the lighters, extinguishing the burnout. Soon after, the firing operation is paused and the lighters re-fuel their drip torches.

At approximately 1445, a spot (Spot Fire 2) is identified by Engine 3, 100 feet on the other side of the Saddle. Both Engine 3 and Engine 1 arrive on Spot Fire 2 at the same time. Because the two engines approached the spot from opposite directions, they are nose-to-nose on the 320 Road when action is taken. Soon after, Engine 4 arrives and backs down to the spot. All engine crews engage Spot Fire 2 and quickly knock it down. A light helicopter that was working the main fire edge makes one drop on Spot Fire 2.



Lighters re-fuel drip torches on the Flat prior to Spot Fire 2 occurring. The darker smoke in the left side of the picture indicates that the fire had begun to move up canyon towards the Flat

Reforming the Plan/Sense Making

At this point, operational tempo and friction are increasing noticeably. The volume of radio traffic on all channels is high, and distracting. Firing operations are simultaneously occurring on other

parts of the fire and the division where activity is increasing. A light helicopter and retardant planes are working the airspace above. Three engines are actively engaged on Spot Fire 2. All resources are tightly coupled, and dynamically engaged in the operation.

Noticing this, the Crew Boss expresses concern that continuing the firing before Spot Fire 2 is secured will stretch their resources even further. The Crew Boss decides to hold up the firing operation. He alerts the Engine Captain from Engine 1 that he is sending the Crew Lead from Crew A with one additional crewmember to assist the engines.

There is a noticeable increase in the fire activity in the draw below. The Crew Boss assumes that the fire has crossed the Horseshoe road. Upon noticing this, he tries calling the Engine Captain from Engine 1 several times on the radio to alert him of the changing conditions. He uses the intercrew



After the saddle has been burned. Notice the lack of smoke in the drainage below the saddle and Flats. This photo was taken only 25 minutes prior to the fire pulsing over Road 320 on the Flats.

channel that Crew A, Engine 1, and Engine 2 have been sharing all day, but cannot reach the Engine Captain. The Crew Boss is concerned that the engines may be in a bad spot when and if the fire runs through the Saddle. Despite this, he is still comfortable with the position of the firing resources on the Flat. From prior

experience fighting fire in the area, and from observing fire behavior earlier in the day, he expects to see the main fire take short, quartering runs at the ridge and then roll back into itself once it reaches the Flat.

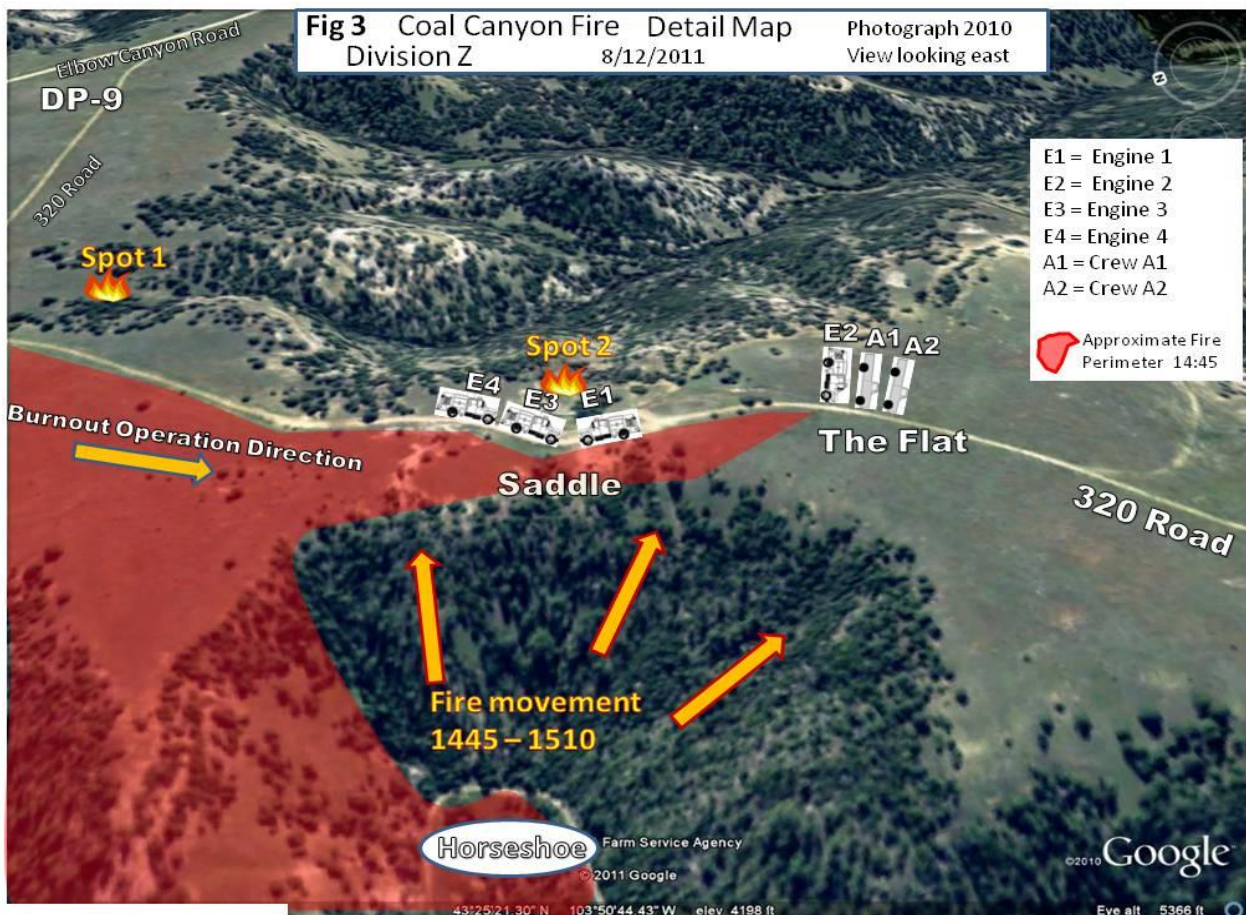
As fire activity continues to increase, it becomes evident that a large portion of the draw below is involved and is setting up for a push at the ridge. Noticing this, the Crew Boss realizes that the firing operation must continue if they are to stay ahead of the fire. After discussion, the DIVS Z

agrees to continue. At this time, A2 truck, A1 truck, and Engine 2 are parked side by side facing the fire just on the green side of the road in a patch of sparse short grass. A1 truck is parked in the middle. The two drivers from Crew A are still with the vehicles [Fig. 3]. The vehicles are slightly ahead of the burnout.

Firing operation: Phase 3

The Crew Boss re-initiates the firing operation with three lighters around 1455. Because of the significant amount of heat being generated from the main fire, the burnout is finally pulling off the line. The Crew Boss notices this and takes the opportunity to mentor his lighters with this observation. As they progress for the next few minutes, the Crew Boss feels that operations are proceeding along well. The large run in the drainage below is starting to crest the ridge top 150 feet from the road. It becomes apparent that the entire drainage below is involved. The fire behavior is impressive, and “sounds like a freight train” coming out of the draw. The Crew Boss is still expecting to see the fire roll back into itself once it crests the ridge and meets the light fuels on the Flat.

Figure 3: Detail Map



Entrapment Avoidance

Just after 1500, the wall of flames crests the ridge. Fire behavior is explosive and erratic with over 100 foot flame lengths. Several fire whirls are generated as the burnout meets the main fire. The winds are strong enough to blow one crewmember's hardhat off. The Crew Boss suddenly realizes that the operation has now shifted from an offensive tactic of burning out ahead of the fire, to a defensive tactic of firing out good black for the crew to step into if necessary. By this time, the firing has reached a few feet beyond the parked trucks. After a few more seconds of firing, the radiant heat from the main fire is too great for the crew. The lighters join the holders back on the road. Unexpectedly, the wall of flames pulses towards the line and lays over the Flat rather than rolling back into itself. The Crew Boss backs Crew A off the road to get out of the radiant heat.

With the crew backed off the road in a good position, the Crew Boss observes that the engines on Spot Fire 2 are still engaged. This concerns him due the similar fire activity he is observing funnel into the Saddle. He once again attempts to contact Engine 1 over the crew channel with an urgent message to "get out of there". The Engine Captain from Engine 1 responds that they were already disengaging. Profuse spotting begins to occur in the grass on the green side of the road as the fire makes a second pulse over the Flat.

As this is occurring on the Flat, the three engines on Spot Fire 2 experience a similar pulse of heat and flames. The fire lays over the Saddle and immediately litters the green side of the road with spots. This creates a sudden shift in urgency with the three engines and they begin to retreat from Spot Fire 2. However, unlike the fire behavior on the Flat, the fire in the Saddle quickly lifts back up and gives the engines a reprieve.

Once they return to the engines on the road, Engine 3 and Engine 4 back-up 50 feet and start to attack the spot fires. Crewmembers from Engine 1 join the effort briefly. Egress for Engine 1 is blocked by the other two engines,



Moments before the fire laid over the road at the Flat. A2 truck in the frame.

which are now on the road facing the Flat [Fig 3]. The Engine Captain for Engine 1 ties into Engine 3 and Engine 4, and encourages them to disengage and back up into the black. Conditions remain

favorable in the Saddle as the fire is drawn into heat generated on the Flat. Engine 3 and Engine 4 eventually back into the black between the Saddle and the original dozer check line.

Back on the Flat, the fire is still laying over the road and the situation has become chaotic. Engine 2, which is still parked next to the Crew A trucks, is being directly impacted by heat and flames from multiple spots. The Engine 2 Assistant Engine Captain considers attacking the spots, but quickly determines that it is time to exit the area. He tells the Engine 2 operator to drive the engine out of the heat down the road. The Engine 2 Assistant grabs the live reel and tries to cool a spot fire near the engine to assist in egress. The driver does not notice this effort and continues down the road. The Engine 2 Assistant is now on foot and realizes he has misplaced his radio. Concerned that the radio may get burned up, he searches around the site where Engine 2 was parked. Unsuccessful, he joins the rest of Crew A.

In the smoke and confusion, a Crew A crewmember that was located near the trucks gets separated from his crew. After determining that he cannot safely reach the vehicles or the crew, he proceeds down the 320 Road away from the fire. During his egress, he meets Engine 2, and continues down the road with the engine.

By this time, Crew A is backed off the road about 50 feet. The second pulse of heat has diminished in intensity, and the Crew Boss commands the crew to get into the black. As he does this, he notices a spot fire between the two crew vehicles. Up to this point the attention of the Crew Boss had been on the welfare of Crew A and the engines on the Spot Fire 2. The security of the vehicles had not yet entered his mind. Feeling that the crew is in a safe position at this point, he shifts his focus to moving the trucks. He yells “get the trucks”, and runs for the trucks. On his way, he drops his tool and begins to drop his pack so he can get into the trucks. He decides to leave his pack on and approaches the trucks. Three of the crewmembers follow him and drop their tools as well.

Vehicle Fire

As the Crew Boss arrives at the trucks, he notices that the strong winds are funneling fire “like a blowtorch” in between the two vehicles. Due to the heat on both of the driver’s sides of the trucks, he enters the A1 truck passenger



Damage to the A2 truck

side with his pack on. He reaches his leg over and tries to pop the clutch and roll the vehicle into the black. He realizes this will not work since the chock blocks are down. During this time, two of

the three crewmembers get in the back seat of the vehicle. The Crew Boss re-positions himself, starts the vehicle and drives over the chocks into the cool black straight over the road.

At this point, he turns and notices that A2 truck's rear tires and bumper are on fire. Access to the vehicle is hampered by the heat from nearby spot fires. The Crew Boss calls Engine 1 and requests that they drive to the Flat to put out A2 truck. The Engine Captain replies that they are not able to, due to the intensity of the fire between the Saddle and the Flat.

During this time, one of the Crew A crewmembers finds an opportunity to enter the A2 truck and drive it into the road and out of the heat. As this is happening, the Crew Boss grabs the fire extinguisher from A1 truck. He moves to the A2 truck and cools the fire in the rear of the truck enough for the crewmember to open the rear door of the topper and retrieve the other extinguisher. Between the two of them, they extinguish the fire, including the tires. Soon after the fire is extinguished, Engine 1 is able to access the Flat and foam down A2 truck as a precaution. The A2 truck sustains considerable damage, including damage to the rear bumper, tires and paint. Only minor damage occurs to the A1 truck and no equipment inside the trucks is damaged.

As all of this is occurring, the Crew Boss realizes that he doesn't know the location of one of the crewmembers (the crewmember that retreated with Engine 2). One of the nearby crewmembers attempts to reach the missing individual by radio. The missing individual replies over the radio that he is with Engine 2. He then asks the Crew Boss whether they should do a roll call. At that time, the two crewmembers that are with Engine 1 call the Crew Boss to report that they are still with Engine 1. The roll call reveals that everyone is accounted for and uninjured.

By this point, fire activity has subsided. The dozer engages in putting line around the slopover. Once it is confirmed that everyone is accounted for, the decision is made by the IC to disengage all fire resources back to DP-9. Crew A, Engine 1, and Engine 2 conduct an AAR immediately after the event.

Lessons Learned

Preparedness

The successful entrapment avoidance by the resources on DIV Zulu can be directly attributed to deliberate and focused pre-season preparedness. It is apparent that strong leadership, crew cohesion and good communication combined with training with other resources on the unit were critical to the successful outcome. Leadership and crew cohesion are often cited as factors in successful operations. It is important to consider that the leaders and crewmembers deliberately created their capacity for resilience. The FLA team considered the cohesion between leaders and followers decisive in the favorable outcome in this event. The FLA participants identified the following actions that contributed to the success of this operation:

- **Training and Cross Training**

Firefighters conducted training with other zone fire resources and cross trained crewmembers (cross training for engine and hand crew operations, joint simulations and Tactical Decision Games (TDGs), leadership development training, combined physical training, etc. Beyond allowing staffing flexibility, cross training provided leaders and followers the familiarity and coordination required to execute operations in a challenging and potentially compromising work environment.

- **Mentoring**

Crewmembers cited mentoring by leaders as a factor in crew cohesion. Mentorship was apparent during the firing operation on the 320 Road and during the FLA process (the participants included resources that were not involved with the incident as a means of sharing learning).

- **Standardization**

Standardization can improve performance. Standard Operating Procedures (SOPs) such as leaving keys in the ignition enabled the crew to move vehicles quickly. Standardization of vehicles such as fire extinguisher location combined with training allowed decisive and effective action by leaders and crew members.

- **Leadership**

Leadership skills were apparent at all levels. Firefighters participated in leadership training. This not only develops leadership skills and enhances crew cohesion but also develops trust between crewmembers and supervisors. This trust was clearly evident in the followership and leadership displayed by the crews on the 320 Road.

- **Lessons Learned**

Crews regularly augment training by using lessons learned tools such as FLAs.

Managing Change

The ability to successfully identify changed conditions and modify actions is critical to success in a rapidly changing and hazardous environment. A number of factors can inhibit the ability to make sense of rapidly changing conditions. Past experience, wet spring conditions, seasonally average ERCs, a green component observed in light fuels and observed fire behavior early in the burning period anchor the expectation of fire behavior (quartering runs vs. a slope run). Confirmation bias is the tendency to recognize information that confirms expectations (favorable burning conditions immediately prior to a slope run). The reluctance to simplify interpretations refers to the practice of deliberately developing a complete understanding of conditions, thereby short circuiting the tendency to favor confirming information. FLA participants discussed the following tools to interrupt operations to gain a more complete picture of operations:

- **Evaluation Triggers**
Identify and monitor changed conditions to prompt a reevaluation of operations. Examples include: change in relative humidity or probability of ignition, frequent spotting, unanticipated fire behavior, changes in tactics, increased operational tempo or communication overload on radio frequencies.
- **Tactical Pause**
A tactical pause is initiated when an evaluation trigger is identified. The tactical pause leads to a dialogue between resources and crewmembers to identify changed conditions. A pause can simply be a deliberate communication about what people are seeing. This can be accomplished by radio or face to face check-in with adjacent resources or crewmembers to discuss what others are observing.
- **Check in with a New Fire Fighter**
Feedback from a first or second year fire fighter can prompt a re-evaluation of expectations. Engaging new firefighters or others that think differently can help day light biased assumption or missed ques.
- **Plan for Worst Case**
There are a number of methods of identifying and planning for the worst case. FLA participants discussed the PACE model (Primary, Alternate, Contingency and Emergency) of emergency planning.

Tools/Equipment

A number of factors affect the attachment to tools while avoiding entrapment. Training firefighters to drop hand tools, saws and packs has been effective (crewmembers dropped hand tools without hesitation to improve their ability to move after the slope run below the vehicle location). Other tools are not as easy to give up. The consequences for a lost radio or a damaged vehicle are higher than a hand tool. The stigma of damaging or destroying a vehicle is a powerful motivator.

- **Leader's Intent**
Obtain leaders intent regarding risk vs. gain regarding equipment and vehicle loss or damage.
- **TDG and Field Exercises**
Exercise time critical risk management and decision making that requires a tradeoff between equipment or vehicle loss.
- **Protecting Equipment**
During firing or holding operations, consider worst case scenario when positioning vehicles and other equipment.

Radio Communication

Overloaded tactical frequencies made communication difficult during the firing operation and after the slope run below the vehicles. A common dedicated frequency enabled the resources to coordinate operations. While inter-crew frequencies are essential for safe and effective operations, it's also critical that crews monitor and communicate information on established incident frequencies. The FLA participants cited the following lessons learned:

- Inter-crew frequencies enable critical communication between crewmembers and resources when established fire frequencies are over loaded.
- During complex operations crew leaders need to prioritize monitoring channels based on the situation.
- Configure programmable radios to enable efficient toggling between channels.
- During high tempo operations when the volume of radio traffic is high, ensure that radio transmissions are necessary and concise

Vehicle Fires

After an assessment of the burning vehicle, the crews made a concerted decision to extinguish the vehicle. Several crewmembers had extensive fire service experience and were uniquely qualified to deal with a vehicle fire. Solid decision making and decisive action on the part of the crew leader and 2 crewmembers resulted in minimizing damage to the burned vehicle. Equipping crew vehicles with larger 5 pound extinguishers prior to the season and having trained crewmembers made it possible. The following was discussed by the participants:

- **Vehicle Fire Training**
Use fire service to provide vehicle fire training and vehicle fire hazard identification combined with fire extinguisher training. Simulations with vehicle fires would exercise time critical risk management and decision making skills.

- **Vehicle Fire Decision Point**

Without proper tools, an informed decision needs to be made when determining whether to address a vehicle fire. Consider basing these go/no-go decisions on considerations, such as, extent and location of fire; personnel experience; tools on hand; and overall risk vs. benefit

Roll Call

The crews initiated a roll call after fire activity subsided. The roll call was conducted using the inter-crew frequency and then confirmed over the tactical channel. This is one of the most important and affecting SOPs. The impact of the roll call was not only beneficial to the crew and the crew leaders, but to other resources on the division. Timely personnel accountability and communication of the accountability is critical.

Review Team

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