Rapid Lesson Sharing

Marble Fire Hoist

July 5, 2023

Klamath National Forest

"I had stopped sweating and was completely out of water. My mouth was so dry, I couldn't swallow without dry-heaving and my legs were cramping up. When I saw that snowbank, I clawed at it for a minute with my fingers before finally scraping some ice off with my teeth. I kept thinking I would be okay if I could just make it to the creek…"

– Jumper B

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Background

The Klamath National Forest sits in far northern California, within the Klamath and Cascade Mountain ranges. The Forest is home to four designated wilderness areas, including the Marble Mountain Wilderness, which is characterized by the distinctive “marbled” appearance created by the contrasting light and dark rock formations that characterize the complex terrain. The landscape is comprised of low-elevation canyons and creeks, high ridges, and is dotted with lakes and meadows.

Within the wildland fire community, the Klamath is known for being a challenging and unforgiving place to suppress fire, with a history of large, long-duration fires. Footprints from past wildfires are ubiquitous across the landscape. In recent years, impacts from wildfire have been especially devastating to local communities.

Incident Summary

On July 4th, 2023, 10 smokejumpers were hiking off a 2-acre fire in the Marble Mountain Wilderness when one of the crew members lost contact with the rest of the crew and suffered extreme dehydration and heat exhaustion. This resulted in an overnight effort to locate, stabilize, and treat the patient, finally ending with a hoist medevac by a CHP (California Highway Patrol) helicopter the following morning.

Initial Dispatch

At 1113 on July 1, 2023, a smoke was reported in the Marble Mountain Wilderness on the Klamath National Forest (KNF) within a burn scar from 2014. The Forest had been picking up small (less than 1 acre) lightning fires for the last couple weeks after a series of thunderstorms moved through.

Helicopter A (one of 2 Type 3 exclusive use helicopters based at the local helibase and staffed by Forest helitack) was dispatched and arrived over the incident at 1211. The initial size-up from the air estimated the fire to be one-half-acre burning on the upper third of the slope with limited access. It was named the Marble Fire.

Marble Fire on the July 1, 2023, from air attack.

Staffing the Fire

Three helitack personnel were on board Helicopter A and observed that the Marble Fire was burning in very steep terrain, with limited opportunities to land. The fire was burning with 2-3-foot flame lengths, mainly backing through timber litter with numerous burning snags. Helitack A (a captain on that crew) gave a size-up and requested permissions for: chainsaw use, landing in the wilderness, and use of a nearby lake for bucket work. He received all permissions and then ordered the other Type 3 helicopter stationed at the helibase, Helicopter B, to use for bucket work.

Looking for a place to insert personnel, the pilot of Helicopter A and Helitack A evaluated a potential helispot on a ridge about a quarter mile upslope of the fire. Helitack A was comfortable deploying the crew here from a fire behavior standpoint if they could safely land. Several snags were identified as potential aerial hazards during the initial recon, but as the ship descended lower it was clear that there was ample clearance. However, the available landing area was small and rocky, with scattered low brush, and a slight backslope. It was clear that touching down would be a challenge.

After a quick discussion with the captain and crew, the pilot shot an approach into the landing area. The two crewmembers in the back opened the rear doors to directly observe the skids as they approached the ground. The pilot maintained power while gently touching down, communicating with the crew through their inter-cockpit headsets, and repositioning the skids several times in order to achieve a flat pitch landing.

Around 1230, the crew offloaded and Helicopter A returned to the helibase to configure for bucket work. Helitack A hiked down to the fire and assumed Incident Commander (IC), putting the two crewmembers to work improving the helispot. They began clearing the brush and arranging rocks into a more suitable touchdown pad. The steep, rocky ground made hiking slow, but Helitack A made his way down to the fire and began a lap around the perimeter. It was clear to him that the fire was bigger than a half an acre. Near the bottom edge of the fire, he realized he could not safely proceed

after seeing several trees fall within a large snag patch below him. He decided to hold at his location, where he could direct bucket work and safely observe the fire.

Helitack A could not hit a repeater to reach dispatch with an updated size-up, instead utilizing a crewmember at the helispot as a human repeater. From the fire, Helitack A (Marble IC) had poor radio coverage. He was able to speak on the command frequency from the landing area but had to relay through air attack or the helitack folks at the landing area to communicate once he was down the hill on the fire. He reported the fire was 2 acres with significant access issues due to slope, terrain, and snag hazards. He also ordered a Type 1 helicopter and an air attack. Soon after, he also requested permission to utilize air tankers to keep the fire in check until they could get some troops up on the fire. Permission was granted by the Forest Supervisor just before 1400 and 2 tankers were soon enroute.

In the meantime, Helitack A considered ordering a hotshot crew that was staged for initial attack (IA) on the District. Surprisingly, he had enough cell service to call the District Duty Officer (DDO) directly to discuss a plan. The DDO concurred, and the interagency hotshot crew (IHC) began to drive to the helibase with a plan for the superintendent to recon the fire by helicopter prior to inserting the crew.

At the helibase, the IHC superintendent and an ICT4(t) from his crew boarded Helicopter B along with the other helitack captain on duty that day (Helitack D), lifting at 1430. Helitack D recalls, “It was poor timing for the recon flight from an aviation standpoint. You had the two tankers in orbit, and an incoming trainee air attack transitioning with the current ATGS… It felt a lot busier than a 2-acre fire should be.” Helicopter B had to make several orbits outside of the fire area prior to being cleared to enter the airspace.

As Helicopter B neared the helispot above the fire, the pilot and Helitack D agreed that, overall, it did not look great. Coming in on approach, the pilot held power and attempted several touchdowns without success. Despite the improvements to the site, the helicopter was unable to sit down evenly on the rocky ground. Additionally, the IHC superintendent did not wish to shuttle his crew into such a tight spot, offering to hike in his crew from another helispot if they could locate one. A meadow was identified updrainage as a possible helispot. But after seeing the terrain up close it was agreed that hiking into the fire from the meadow would take too long to be a primary plan. Helitack D and the IHC superintendent discussed the possibility of using smokejumpers to staff the fire.

Before leaving the fire area, Helitack D gave an update to the DDO regarding the “no-go” decision to shuttle the IHC as well as his discussion with the IHC superintendent about the viability of hiking in from the meadow versus the use of smokejumpers. The DDO had also been discussing plans with Helitack A via cellphone. Ultimately, the decision was made to place an order for smokejumpers. Per the dispatch log, this order was relayed by air attack at 1601. By 1610, 10 jumpers had a 12-minute estimated time enroute (ETE) to the fire.

***"When a difference in comfort-level between pilots comes into play during helispot operations, it's not necessarily a no-go, but it's an important time to discuss and re-evaluate."* – Helitack D**

The Marble Fire on July 1, 2023.

Marble Fire Transitions to Smokejumpers

Ten smokejumpers comprised the load that went to the Marble Fire. Nine of them were boosters (smokejumpers from bases out of the area) and one was a Redding rookie, a first-year smokejumper from the nearest base. The jumpers identified a jump zone in the same meadow the group in Helicopter B had reconned earlier. They were on the ground by 1707, beginning cargo operations and in touch by radio with Marble IC. The intent was to begin hiking to the fire once cargo delivery was complete. Marble IC briefed the jumpers over the radio, sharing information about the fire behavior, as well as the "no-go" decision to fly in the hotshot crew. The IC also reported that due to the high volume of snags, he had not committed his crewmembers to any line construction on the fire.

The jump site ended up being a farther hike than was initially anticipated, through very tall brush on steep and difficult terrain. The jumpers estimated it would take 6-10 hours to hike to the fire from the meadow. Jumper B (who would become Marble IC trainee) decided that it made sense to arrange for a flight to the fire in the morning. There had been a thorough transition over the radio between Marble IC and the jumpers and the jumpers had good radio communication with dispatch. Marble IC remained on the fire before getting flown out around 2000, approving the meadow as a helispot on the way back to the helibase. Before departing the fire, Marble IC reported to dispatch that the Marble Fire was holding within the retardant lines, the day's bucket work had been effective, and that

the fire should hold until the jumpers got there in the morning. Transfer of command was made to Jumper A, with Jumper B as IC trainee. Helicopter A picked up Helitack A, B, and C and flew back to helibase.

The next day, July 2, Helicopter A transported the jumpers from the meadow and long-lined their gear in sling loads to the landing area above the fire. Helitack A was staffing the landing area and had a face-to-face with Marble IC and Marble IC trainee when they arrived in the first load. They rehashed what they had discussed on the radio the day before. Helitack A also relayed that, due in part to varying levels of pilot comfort, the use of the helispot should be considered limited. The jumpers understood this and agreed that they would plan to hike out rather than rely on a pick-up at the helispot. After completing the troop transport and sling load missions, Helicopter A picked up Helitack A and returned to helibase.

The jumpers remained on the fire for the next 3 days and made quick work of it, calling it "out" on July 4.

The Hike Out

A trail had been identified just across the valley that led out of the wilderness to a road where the jumpers planned to be picked up the following morning. With consideration of the rugged, steep terrain, the jumpers had arranged for most of their non-essential gear to be flown out in helicopter sling loads. They kept only what they needed to complete their hike-out: fire gear, basic first aid supplies, radios, hand tools, and a calculated amount of food and water.

After completing a final grid of the fire area, they began their demob. One group stayed behind to handle the logistics of the sling load operation, while others went to scout for a favorable route from the mountain down to the identified trail. The first jumper to make it down to the trail reported back that he had found a doable route with heavy brush and a high concentration of poison oak.

> ***"We knew that the IC trainee had taken an alternate route and would probably be the last one to camp. I also figured the reason we couldn't raise him on the radio was bad batteries."***
> **– Jumper A**

It was midday. One by one, the jumpers had begun to make their way down the identified route. Jumper B, with a history of being very sensitive to poison oak, decided at the last minute to take an alternate route out to avoid the poison oak. He saw a less brushy ridge that he felt he could take to gain access to the creek and the trail on the opposite side. One other jumper was nearby and saw the ridgeline that Jumper B was heading down. It was communicated to the remainder of the group that he may take longer to make it to the rendezvous point.

Radio comms were good throughout the canyon. The jumpers were all able to communicate on their crew frequency and were regularly checking in with each other as they were making their way down the steep, rocky, and brushy hill.

As Jumper B made his way down the ridge, the terrain began “cliffing out”, eventually becoming unnavigable with the heavy pack he was carrying. He began side-hilling to find another route, only to encounter more cliffs and boulders. As evening closed in, Jumper B began to ration his water and realized his radio batteries were dying. He opened his pack to get the batteries he had grabbed that morning, only to find that he had a pack of AAA batteries rather than the AA batteries that his radio used. He could still hear his crew, but was frustrated that he was unable to transmit out. As he worked his way through the rough country, Jumper B ran out of water and then stopped sweating about halfway down. Soon after, he was having difficulty swallowing, dry heaving each time he tried. Increasingly fatigued, Jumper B lost his radio in the brushy rocks. His focus narrowed, concentrating on the need to reach the creek. He began to hoot periodically, hoping to be heard by his counterparts who he knew were somewhere on the adjacent ridge across from him. He came upon a remnant snowbank and tried to scratch at it with his hands. The old snow was more like ice, and he eventually gave up on using his hands and began gnawing directly on the snowbank.

The remnant snowbank that provided Jumper B with a little relief.

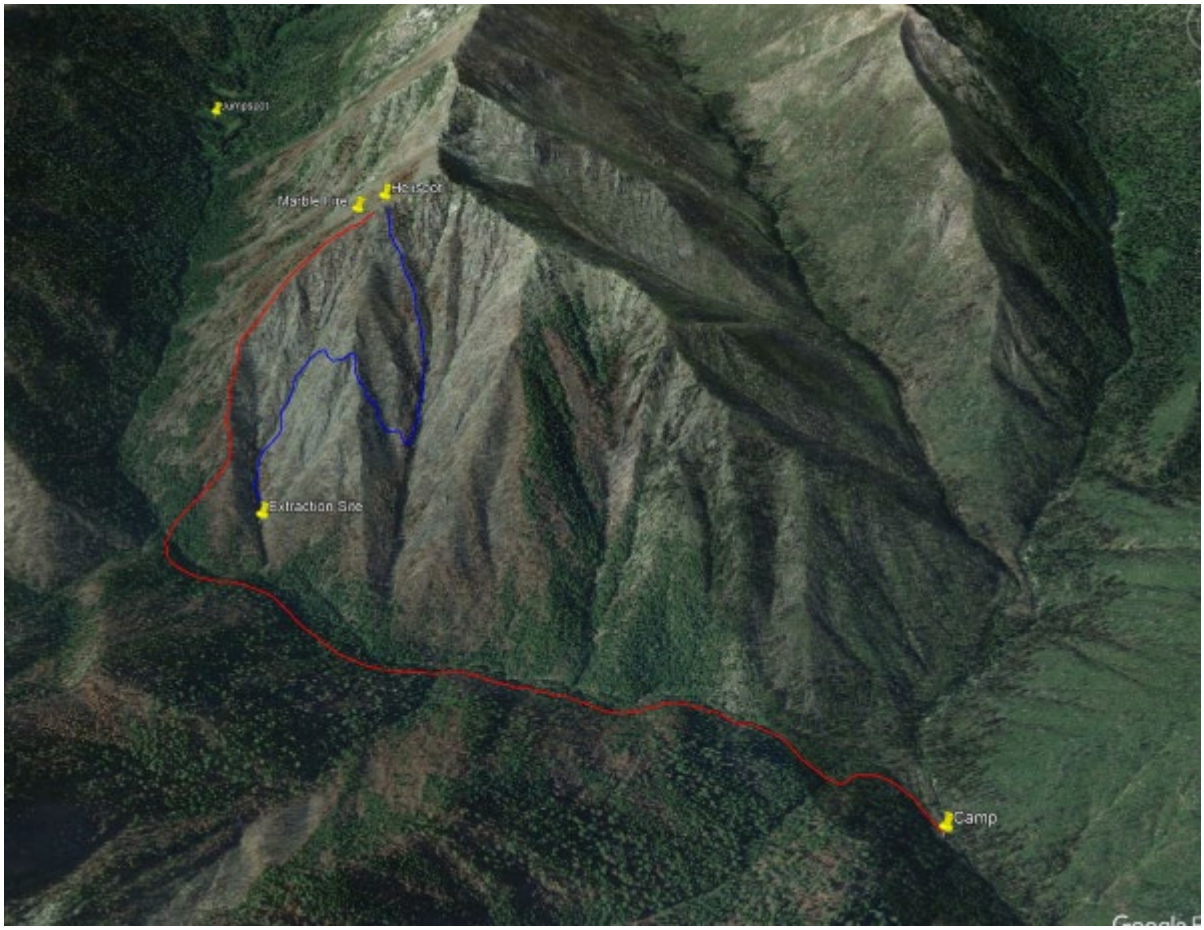
Reaching Jumper B’s Location

After Jumper B was overdue at the rendezvous point on the trail and not answering the radio, Jumpers C and D set out to look for him, assuming he was just having radio trouble. They grabbed their medical kit, but it didn’t initially cross their minds that Jumper B could be suffering from heat exhaustion. But as the pair picked their way back up the overgrown, rocky trail, they began cramping and were running out of water. They tried calling Jumper B every 10-15 minutes on the radio, each time with no response.

After an hour or so, with Jumpers C and D unable to locate Jumper B, the seriousness of the situation continued to emerge within the minds’ of the group. The IC sent two additional jumpers, both EMTs, to assist with the search and to provide care if needed.

The EMTs both recognized a need to pace themselves enough to show up ready to provide care and to avoid injuring themselves along the way. By now, the jumpers had missed their usual 2000 check-in with dispatch. Around 2045, dispatch tried calling Jumper B several times with no reply check. Jumper A came up on the radio and informed dispatch that a member of their crew was overdue and that a search was in progress.

Terrain and fatigue made progress slow for Jumpers C and D in the canyon. Dusk had quickly given way to darkness. They began to call and hoot for Jumper B. Thankfully, soon after, they began to hear returning hoots in the distance. They tried to move in the general direction of the hoots, but the echoes between canyon walls were disorienting. As they continued to slowly zero in on the hoots, they were relieved to see Jumper B's headlamp across the drainage. As they got closer, Jumper B was able to tell them that he was not hurt but would need help getting out of there. Jumpers C and D shared this information over the radio with Jumper A. Around 2200, Jumper A let dispatch know that they had found their missing crewmember, who was having heat-related issues, and that EMTs were working their way to him.



Map of the Marble Fire and surrounding area. The Red Line is the originally scouted route. The Blue line is Jumper B's path of travel, which is 1.5 miles in length and traverses 4,800 feet of elevation change.

After crossing the creek and scrambling up and down the steep and brushy canyons in the dark, Jumpers C and D tied in with Jumper B. He let them know that he had run out of water hours ago, was experiencing full-body cramps, and couldn't stop dry heaving when he tried to swallow. Jumper C

relayed this back to the group and advised that they would need help getting him down to the trail. Jumper D fortuitously found a spring in the area and filled their canteens. Jumper B vomited immediately after drinking the water. The other two dug the salt packets from their MREs and gave them to Jumper B, knowing that this could help him keep water down. Jumper B had started shivering and his skin was clammy. Jumpers C and D helped him remove his damp Nomex, gave him a puffy jacket, and covered him with a sleeping bag and a parachute. After consuming the salt, Jumper B was finally able to keep sips of water down. Jumpers C and D monitored Jumper B's vitals and kept the EMTs up to date on his condition as they worked their way into their location.

It took the EMTs two hours to reach Jumper B's location. In the backs of their minds, they were still planning to help Jumper B hike out. The hike into Jumper B's location was arduous, with rock hopping and crawling on hands and knees in places where the slope was too steep to walk. When they reached Jumper B's location, they knew they would not be able to get Jumper B out themselves. They were totally spent, and the country was very difficult. Getting a litter through what they had navigated to get there was not going to happen. They started talking about a helicopter.

One EMT took the incident within an incident (IWI) IC, while the other took primary EMT duties. Jumpers C and D built a warming fire while the other EMTs gave Jumper B electrolytes, took off his wet shoes and socks, and rearranged the chute and a piece of cardboard under him. The electrolytes were effective, allowing Jumper B to absorb the fluids and help to bring his spirits up. The IWI IC spoke with Jumper A about options: Plan A would be the helicopter extraction; a Rapid Extraction Module Support (REMS) team would be plan Z. REMS was really not an option—it would have taken a really long time to get there. The EMTs contacted Jumper A on the radio and briefed him on what was going on. They said they would need a helicopter to get Jumper B out, and that they would get him the 8-Line Medical Incident Report (MIR) information to relay to dispatch. Just after midnight, Jumper A relayed a patient update to dispatch: Jumper B was alert and oriented, with stable vitals. He had initially rated out as a "Green" MIR priority, but EMTs were upgrading him to a "Yellow" due to their remote and inaccessible location. About a half hour later, an additional patient update was relayed, stating that the patient was unable to move without pain, with pink and dry skin and an elevated heartrate.

The Hoist Operation

Dispatch had been working on ordering a medevac helicopter, querying three separate agencies. They also contacted a Search and Rescue Team (SAR) as a contingency. From the dispatch log: "Coast [Guard] ship unable [due] to risk to craft. CHP ship will take mission at first light. Talked to SAR officer. Turned down rescue as they would get there after CHP ship." The CHP (California Highway Patrol) hoist-capable helicopter had accepted the mission. Jumper B's condition remained stable through the night with regular updates provided to dispatch by the EMTs.

At 0548 the CHP helicopter launched from Redding for the mission. When the helicopter arrived in the area around 0615, the jumpers used a strobe to signal their location. The pilot saw the strobe immediately and the helicopter made an approach into the steep ravine. Hovering lower within the narrow canyon, an officer was lowered to the ground where he hooked up Jumper B and directed the

ship to hoist him up. Once Jumper B was in the ship, the officer was also hoisted up. At 0629 the CHP helicopter radioed to dispatch that the patient had been extracted and was enroute to the helibase.

The extraction site with Jumper B packaged in a sleeping bag.

It was a long and sketchy hike back to the trail for Jumpers C and D and the two EMTs, who were all exhausted after the night-long ordeal. They made it back safely to the rest of the group. Together, they all hiked the remainder of the trail where they were picked up.

Upon arriving at the hospital, Jumper B was met by a Forest Fire Management Officer who had also ordered a trained Hospital Liaison. The Liaison arrived and handled the initial paperwork after ensuring the patient's immediate needs were met. The Liaison also took the time to outline follow-up instructions for Jumper B to ensure that his Workers' Compensation Claim would be adequately supported.

Jumper B was treated for heat exhaustion and released later in the day. He was released back to full duty a few days later and has since jumped several fires.

Lessons Learned

1. Stick with Plan A if you can.

During a group dialogue session with the group of smokejumpers and the RLS Team, Jumper B, the Marble Fire IC trainee, identified his last-minute decision to take an alternate route down the mountain as a key contributor to the chain of events that would follow.

The main factor influencing his decision in that moment was his wish to avoid poison oak exposure, something he had dealt with recently that had required a hospital visit. With the scouting report of "lots of poison oak" on the planned hike-out route, he had kept his eyes open and his hopes up for an alternative. While this is understandable, the group collectively concluded the following: "Go with Plan A, especially if you know Plan A works. Think before changing the plan if it's just to save a little bit of time or effort."

2. Avoid hiking alone in remote, hazardous terrain.

Smokejumpers often staff remote fires with minimal personnel. Compared to their ground-based counterparts, they are much more accustomed to splitting up and independently performing tasks on the fireground.

During their AAR, the smokejumpers identified that hiking with a partner can be considered a best practice in hazardous terrain. Partners can be directly accountable for one another and provide physical assistance and decision-support to better avoid or overcome obstacles. Another simple but significant advantage to pairing up is having two radios and two sets of spare batteries available. Redundancy is an effective way to avoid or prevent a single point of failure within a system.

3. Recognize problems early and ask for help.

During their AAR, the smokejumpers reflected on the need to recognize and communicate problem situations as early as possible:

"Be realistic with the situation you are in. If things don't seem to be going according to the plan, communicate that early and recognize when it has gotten to a point that requires more people to accomplish the task."

"Recognize early on that a situation is deteriorating and communicate it with others before it's too late."

The Forest had been intentional about staggering the start-times for the two helicopters to ensure maximum availability of aircraft to support the jumpers. Unfortunately, by the time dispatch was

made aware of the missing crewmember, it was just beyond the safe range of daylight required to launch a helicopter.

4. Plan and prepare for worst-case scenarios.

In planning their hike-out, the group made a calculated decision on how much gear and supplies to keep with them. This is a typical practice for smokejumpers. While their estimates may have been sufficient for an uneventful shift, the group found themselves short on water and supplies during their search and response to the missing jumper.

Another factor brought up by the jumper group was the timing of their demobilization. In hindsight, they felt that planning the arduous hike-out during the hottest part of the day (high temps around 110 F) was not ideal. Hiking out earlier in the day would also have allowed a greater margin of time and daylight.

Practices Worth Sharing

1. Effective response to the incident within an incident.

When the emergency was realized, the smokejumpers notified dispatch and took decisive, organized action. Jumper B was located quickly despite compounding factors, including: darkness, hazardous terrain, and the general fatigue of the responders who had worked all day on the fire. Everyone involved worked together to recognize and meet needs, including: scouting for egress and creek crossings, relaying communications to each other as well as dispatch, starting and stoking a warming fire, and assessing and treating Jumper B.

The presence of four EMTs was also recognized by the group as an advantage, allowing the IWI workload to be shared.

2. Crew Resource Management by the helitack crews.

During the initial attack, the helitack crews demonstrated a bias for action as well as a commitment to safety. Getting boots on the ground as rapidly as possible was a critical objective toward keeping the Marble Fire small and minimizing future risk to responders and communities.

While attempting the initial landing at the helispot, the helitack crew's inter-cockpit communication and utilization of backseat crewmembers to clear the skids are elements of Crew Resource Management (CRM) in action. These

Crew Resource Management

Crew Resource Management (CRM) can be defined as "the effective use of all available resources for flight crew personnel to assure a safe and efficient operation."

CRM encompasses a broad range of range of knowledge, skills and attitudes, including: interpersonal communications, situational awareness, problem solving, decision making, and teamwork.

The value of developing techniques and training based on the elements of CRM has been recognized worldwide as an effective way to reduce accidents in aviation and other high-risk operations.

deliberate techniques, coupled with the pilot's comfort level, helped achieve a safe landing at the helispot.

Helicopter B's "turn down" of the same helispot is, in fact, another example of successful CRM. Pilots and crews can feel pressure (even if it is not implied) to push their limitations during an operation that another pilot or crew has already performed. Their decision not to land was firmly rooted in risk management.

That night, a post-shift AAR was conducted with both helitack crews and pilots. Information and perspectives were shared and a collective decision emerged: Helicopter A would shuttle the jumpers into the fire in the morning, and from there, the helispot would be used as little as possible.

3. Forest support throughout the incident.

The Forest took steps throughout the duration of the Marble Fire to be prepared for an emergency. In addition to ensuring maximum availability of aircraft, dispatch transitioned to 24-hour staffing to ensure communication coverage. These preparations paid off when the medical emergency was declared and helped to expedite the response. Dispatchers and Duty Officers also did an exceptional job of developing plans and contingencies for the medevac.

During a final interview, Jumper B expressed his personal gratitude to the Forest Fire Management Officer and the Hospital Liaison who responded to the hospital to support him. This allowed him to make early notifications to his loved ones. During the following days, the Liaison was instrumental in helping to successfully navigate his Workers' Compensation Claim.

"With OWCP, I don't always know where to start and how to proceed," Jumper B explained. "It was great to have the Liaison's support with paperwork and process. By the end, I had zero questions and understood what to expect moving forward."

4. Tech Tip: Get yourself a strobe light.

The use of a strobe by jumpers on the ground alerted the CHP hoist ship to the patient's precise location almost immediately. A strobe is a small, lightweight and inexpensive tool that is highly effective when working with helicopters from the ground. As Jumper B explained, "Strobing a helicopter is by far the easiest way to get them dialed-in. Every firefighter should have one in their gear."

The Marble Fire Hoist RLS Team

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