AVALANCHE DATA

The avalanche broke at about 11,000 feet in a steep, rocky chute. The failure layer was faceted snow near the ground. One newspaper account describes the avalanche as 150 to 300 feet wide. The debris ran 375 vertical feet.

TYPE	TRIGGER	R SIZE	D SIZE	BED	ASPECT	CHARACTER
SS	AS	3		G	NE	

COMMENTS

The group claimed to ski in the backcountry almost every day and to be aware of the avalanche risk they faced. "We choose the safest routes we can. You can never eliminate that risk entirely,"[124] Palmer noted. The skiers reportedly all carried avalanche rescue gear, and while that gear enabled them to conduct a relatively quick and efficient companion rescue, it wasn't fast enough to save Brown.

Despite (or perhaps because of) their experience, the group chose to ski a very steep, rocky chute on a day when the avalanche danger was rated High. Dale Atkins, a forecaster at the CAIC at the time, pointed out how a sense of experience can be misleading. "Typically what we find is the more trained and knowledgeable people tend to be, they also tend to perceive the danger as less than it is. You start thinking, 'I can handle it.'"[125]

The toddler in the backpack, Abel Palmer, grew up to share his father's passion for backcountry skiing. "He never left a flake unturned. He was always up for it,"[126] reported Jaime Palmer. Sadly, Abel Palmer died in an avalanche outside Silverton, Colorado, in January 2018.

19920401b TWIN PEAKS, SOUTH OF SNOWBIRD SKI AND SUMMER RESORT, UTAH | April 1, 1992

One sidecountry rider caught, buried, and killed. The rider skied a convex slope while a friend filmed him. The rider triggered the slope and was buried deeply. Despite timely companion and professional rescue efforts, he did not survive.

SITE

Twin Peaks (11,489 feet) is the prominent peak just south of Snowbird Ski and Summer Resort in Utah's famous Little Cottonwood Canyon. It is the highest peak on the Little Cottonwood/ American Fork divide and is informally known as "American Fork Twin Peaks," to distinguish it from a similarly-named peak on the Big/Little Cottonwood Divide. On the northeast face of the east peak (11,433 feet), a 30- to 40-degree snowfield rolls into a very steep (50-plus-degree) chute that empties onto a large, low-angled apron in Mineral Basin. At the time of the accident, this terrain was outside the boundary of the ski area.

WEATHER AND SNOWPACK SUMMARY

The snowpack during the 1992 winter was "one of the worst ever seen in the Wasatch."[127] The original concerns focused on weak layers that formed during dry conditions in early season. Storms in February produced large avalanches in Mineral Basin on February 21 and 22; crown faces from these slides were still visible on April 1. Later in the season,

concern shifted to a layer of facets that formed at or near the snow surface during clear weather in mid-March. By the end of the month, this layer was buried 18 to 24 inches deep and was one to three centimeters thick. It was the weak layer in at least eight human-triggered slides reported to the UAFC between March 15 and 28. Three people were caught and carried in these slides.

During the last week of March, 21 inches of snow accumulated in four different events. The last, on March 31, involved dramatic thundersnow but only 0.5 inches of snowfall. Despite that snowfall, the snowpack in the Wasatch was only 30 to 60% of average at the end of the month. Air temperatures were mild, with lows in the 20s and highs from 30 to 40. Winds were westerly and light to moderate, with some 15 to 30mph gusts during convective activity.

On the morning of the accident, the overnight low was 20 degrees at Hidden Peak (11,000 ft; 0.7 mi north) and the high was 31 degrees. The UAFC rated the avalanche danger as Moderate on northeast-facing slopes steeper than 35 degrees. Patrollers had posted the forecast at exit points from the ski area.

ACCIDENT SUMMARY

Mark Marria (21) and Chris Patterson (21) planned to shoot some footage on Twin Peaks for a ski film they were making. They anticipated finding corn snow on the northeast face. On April 1, they and three friends—Eric Fall (21), Mark Frederick (21), and Matt Maloley—rode the 09:15 tram at Snowbird. At the top, the group entered the ski patrol building, where Bob Allen (23) joined them. Patrollers advised the six skiers of the resort's policies for exiting and re-entering the ski area and the hazard of the warming temperatures forecast for that day.

The group signed out and exited the ski area at an open gate, where they passed a sign stating the day's avalanche danger. Then they hiked up a ridge towards the east summit of Twin Peaks. At least one person in the group was on a snowboard. Several had taken avalanche awareness courses, and all carried shovels and avalanche beacons. Many had ridden in the local ski areas or backcountry in the previous few days.

As they hiked, several members of the group discussed shots for the film. Patterson stopped at about 11,000 feet and set up to film. The rest of the group continued to just below the summit, where Maloley and Allen traversed onto the peak's northeast face and dug what Allen later described as a hasty pit. They identified the mid-March weak layer. The others followed, and then various skiers continued traversing across the face to the east ridge. "All five never got together as a group or discussed the snowpit in detail amongst themselves, and several did not look at the pit closely. Fall [did] recall Allen pointing out the weak layer."[128] Nor did they seem to make much of the fact that the snow surface was not the corn that they had expected. Frederick and Fall thought the soft snow was the product of wind-loading and not typical of the snowpack at that elevation and aspect.

Three of the skiers—Maloley, Allen, and Fall—continued down the east ridge to investigate chutes known as The Bookends. That descent meant they could no longer see the northeast face clearly. Allen had concluded the snowpack on the northeast face looked "sketchy,"[129] while Fall simply preferred a different line. Marria and Frederick were last across the traverse, and stopped at the east ridge. They radioed Patterson, who reported he was ready to film. About this time, Rachel Henry (35) and Ron Penner (37) joined Frederick on the east ridge, and Dave Powers (41) booted up to Patterson.

Marria did a partial ski cut below the traverse, stopped, and waved with his ski pole to confirm Patterson was filming. Then he skied down the snowfield towards the steep

chute below. After three turns, he skied out of view from Frederick, Henry and Penner. After about 15 turns, at about 10:20 AM, a slab released a few turns above him. Marria made two more turns, then tried to ski off to skier's right. He fell as the slab broke up. Patterson and Powers lost sight of him in a powder cloud formed as the snow went over a rock band. The falling snow triggered a second, larger avalanche on the apron below before the debris from both slides stopped about 800 feet below the crown.

Terrain trap

RESCUE SUMMARY

Only Patterson and Powers knew the slide had caught Marria. Powers immediately put on his skis, skied down from the ridge to the debris field, and began searching for a signal with his beacon. He yelled for help to the three skiers on The Bookends. Frederick skied down to Fall, and both traversed in to help. Patterson joined them. It took the other four riders—Maloley, Allen, Henry and Penner—some time to work their way back to the ascent ridge to avoid the hangfire, then ski down.

Sometime between 10:20 and 10:25, Snowbird snow safety worker Randy Trover noticed the crown face while riding up the tram. He alerted other patrollers via radio. A few minutes later, a snowboarder reported the avalanche to the patrol building. Snowbird Ski Patrol notified local authorities and rescue organizations: Salt Lake and Utah County Sheriffs, Alta Central Dispatch, Life Flight, Wasatch Powderbirds and Wasatch Backcountry Rescue.

Fall picked up a transceiver signal, and the rest of the group converged on him. They pinpointed Marria's location and confirmed it with a probe. They started digging. Once off the tram, Trover looked down at the debris, saw the group digging, and requested medical gear rather than search dogs. The final two members of the group finished the traverse and skied down to the rescue site. Trover and another patroller followed to help dig.

Rescuers uncovered Marria's head at about 10:40. He had been buried seven feet deep, face-down, with his head downhill. He had no vital signs. Seven other Snowbird patrollers, including a medical doctor, arrived shortly after with medical equipment. The Life Flight helicopter landed at 10:50; rescuers loaded Marria almost immediately and Life Flight transported him to LDS hospital. He arrived there at 11:22 and doctors pronounced him dead at 11:31, just 70 minutes after he triggered the avalanche.

Due to rising air temperatures and increasing avalanche danger, rescuers had helicopters airlift the 20 people at the accident site out of Mineral Basin.

AVALANCHE DATA

The crown face of the avalanche was at 11,200 feet; the toe of the debris was at 10,400 feet. The slope angle in the start zone was 38 degrees. The track consisted of steep rock bands with gullies up to 50 degrees between them. The initial slab, on the upper snowfield, released 150 feet wide and 1.5 feet deep. The secondary slide in the deeper snow below the rock bands broke 300 feet wide and two feet deep. The combined debris was two to 10 feet deep.

In the upper snowfield, the snowpack was shallow (less than a meter). It may have avalanched earlier in winter, been scoured by strong winds, or both. A profile on the lower crown face confirmed that the avalanche broke on mid-March facets and did not step down.

TYPE	TRIGGER	R SIZE	D SIZE	BED	ASPECT	CHARACTER
SS	AS	3		O	NE	PS

COMMENTS

Marria's death marked the first avalanche death in the central Wasatch Mountains since 1987. That fact, combined with the accident's proximity to Snowbird and the number of people involved in the rescue effort, engendered much discussion. Newspaper accounts highlighted the filming of the accident.

Other commentary focused on the choice of terrain and conditions. UAFC Director Bruce Tremper remarked, "If you were looking for an avalanche Wednesday, this was exactly the kind of place you'd expect to find one."[130] Similarly, "the route Marria had chosen would have required him to skirt some cliffs by skiing into a difficult, steep chute and is considered too dangerous to ski by anybody but the most experienced backcountry skiers who specialize in radically extreme skiing."[131] And in their season report, the UAFC commented that the accident "seemed a result of a blatant lack of respect for the conditions."[132]

Indeed, the northeast face of Twin Peaks is unforgiving terrain, because there is little room to escape even a small avalanche and any ride in debris involves getting carried over rocks and cliffs. Choosing to ride such terrain that day, after a string of human-triggered avalanches in similar terrain over the prior week, seems a risky proposition.

But the derisive tenor of the commentary—that Marria was reckless, showing off for a camera, and lacked requisite experience—seems misplaced. With the hindsight of 25 years, this accident seems less of an outlier and more a harbinger of future accidents and developments in backcountry riding and avalanche education.

Cameras and video body cameras are common enough as to seem omnipresent at times now. It is clear that their presence sometimes induces riskier behavior. So Marria's and Patterson's plan to film the descent did not help matters.

More importantly, however, Marria and his friends seem to have fallen into the full catalog of the heuristic traps outlined 10 years after the accident in Ian McCammon's seminal paper, "Evidence of Heuristic Traps in Recreational Avalanche Accidents."[133] It was a large group (five to start) that got larger as the morning progressed. At least one person in the group, Frederick, was familiar with the slope, having skied it four times the previous spring in corn conditions. The fact of other people joining the group provided social proof that skiing the slope was a good choice. The group displayed a high level of commitment to that slope that day; Frederick noted that filming a run on the slope was "in the plan for years,"[134] and Fall observed that they had "already made up [our] minds to ski the slope. The only decision was to pick the line."[135] And lastly, it was April 1; a dry season with few periods of good skiing was winding down, so scarcity may have also been a factor.

These heuristic traps likely contributed to the group's undisciplined discussions and decision-making. On their ascent, the group seems to have discussed camera angles more than conditions. They expected corn snow conditions, but when they found soft snow at the snowpack surface, they did not recognize it as indicative of a cold snowpack that retained the near-surface facets formed in early March. That layer showed up in Maloley and Allen's hasty pit, but the group as a whole never discussed its implications. Allen chose not to ski the slope because of what the pit revealed, but either did not communicate that decision to the rest of the group or did not attempt to talk Marria out of the line. Most of the group did not position themselves so they could watch Marria throughout the run, likely because they did not recognize that chances of the slope avalanching were higher than they expected.

Commentary at the time ascribed the accident to a gap between the party's skiing skills and snow stability skills. They were considered excellent skiers, but their knowledge of snowpack conditions and ability to evaluate stability was less developed.[136] However, current avalanche education does not focus on snow stability evaluation. In large part, that is because slope-scale stability evaluation is very difficult, even for professionals. Instead, educators try to hone people's communication and decision-making skills—that is, how to choose appropriate terrain for the day's conditions, how to avoid heuristic traps and other factors that negatively influence decisions, and how to discuss conditions in ways that better people's chances of avoiding accidents.

Riding terrain like the northeast face of Twin Peaks has become commonplace. It is no longer the domain of select seasoned experts, and it is no longer reserved for the few days of corn conditions in the spring. Nor is it considered extreme terrain. A fourteen-year-old has skied laps on the Grand Teton.

In part, that change in perspective on consequential terrain results from more nuanced understandings of decision-making, such McCammon's catalog of heuristic traps, and avalanche release. Forecasters and riders can better describe the dangers posed by a snowpack of variable but generally shallow depth on a steep, unsupported face. And more accurately recognize when slabs on a slope like that are unlikely to release. Thus, people no longer need to write off such terrain as always dangerous and dismiss the choice of such terrain as inherently reckless. It does, however, remain riskier than lower-angled terrain, so careful consideration of conditions and clear, disciplined communication remain paramount.

19920403 FOUR PINES, SOUTH OF JACKSON HOLE MOUNTAIN RESORT, WYOMING | April 3, 1992

Two sidecountry skiers caught; one partially buried, one fully buried and injured but recovered alive. A sidecountry skier traversing a steep slope triggered a slide that caught two skiers below him. One skier was partially buried to his waist. The other was found after 90 minutes, buried about four feet deep, but alive. A dog scented him, and rescuers heard him yelling under the snow.

SITE

Four Pines is a local name for a small knob (approximately 9,870 feet) at the east edge of a bench below Cody Peak, less than a mile south of Jackson Hole Mountain Resort (JHMR). A number of runs drop off the knob's southeast, east and northeast sides. On the latter, a hanging snowfield drops into Green River Bowl over two slanting rock bands 40 and 80 feet high. Short, steep chutes break the cliffs. Riders can access the area through gates from the ski area. At the time of the accident, JHMR only allowed access into adjacent backcountry areas during periods of Low avalanche danger and required riders to sign out.

WEATHER AND SNOWPACK SUMMARY

Early on April 3, the Pocatello office of the National Weather Service forecast that a "record-setting warm airmass"[137] would prevail over Teton Range. The avalanche forecast for that morning from Bridger-Teton National Forest Avalanche Center rated the avalanche danger as Low to Moderate but rising through the day, particularly at