PARTNER RESCUE SKILLS: AN ORGANIZATIONAL AND INDIVIDUAL ASSESSMENT OVER THE 2010-11 AND 2011-12 WINTER SEASONS AT BIG SKY RESORT

Jonathan Binger* and, Chelan Babineau-Z
Big Sky Resort Professional Ski Patrol, Big Sky, Montana

ABSTRACT: Avalanche hazard mitigation work is one of the more hazardous aspects of professional ski patrolling. Ski patrollers rely almost entirely on their partners to locate and dig them out of debris in the event of an avalanche burial during mitigation work. The Big Sky Ski Patrol requires patrollers to perform weekly beacon drills, but these drills often lack realism and pressure to perform. During the 2010-11 and 2011-12 winters, the Big Sky Resort ski patrol tested and observed patrollers' ability to locate, pinpoint, and excavate a beacon in a backpack buried 90cm deep, simulating a partner rescue scenario under stressful conditions. After researching acceptable rescue times used by other organizations, as well as medical data on how long one can be without oxygen before brain death begins, rescue scenario organizers decided on seven minutes as a goal. The tightly regulated scenario was designed to assess individuals' and the entire patrol's rescue skills. Veteran rescue evaluators set up each scenario while timing and observing individuals completing the drill. Sixty one tests were performed. This paper identifies problems and successes associated with individuals' rescue skills including beacon skills, probing technique, digging strategy, and physical ability. Beacon technology, brand and patrollers' experience levels are compared and a year-to-year comparison is presented. This drill was enlightening for the entire ski patrol, providing valuable insights into rescue gear, rescue techniques, and individuals' skills.

1. INTRODUCTION

It is well known that avalanche mitigation work is one of the more hazardous and necessary parts of professional ski patrolling. In the event of an avalanche burial during mitigation work, ski patrollers rely almost entirely on their route partner(s) to locate and dig them out. Starting in 2010-11 and continuing through winter 2011-12, the Big Sky ski patrol conducted an assessment of each patroller's ability to locate, pinpoint, and excavate a beacon in a backpack buried in the snow. The process is simulating a partner rescue.

2. METHODS

The tests were conducted individually in a 50 meter X 50 meter area delineated by flags. Each patroller started from the bottom of the simulated debris area at the "starting" point, located 25 meters from either edge. Each bag was buried 90cm deep on an arc 33 meters from the starting point (Figure 1). Every test was a new location on the arc excavated vertically, minimizing disturbance to the original snowpack. The beacon antenna orientation was always horizontal and perpendicular to the starting location. The hole was backfilled, compacted, and the area tracked up.

**corresponding author address:* Jonathan Binger, Big Sky Ski Patrol, 718 So. 12th Bozeman, MT, USA 59715 tel: 406-570-5502 email: jonobinger@gmail.com

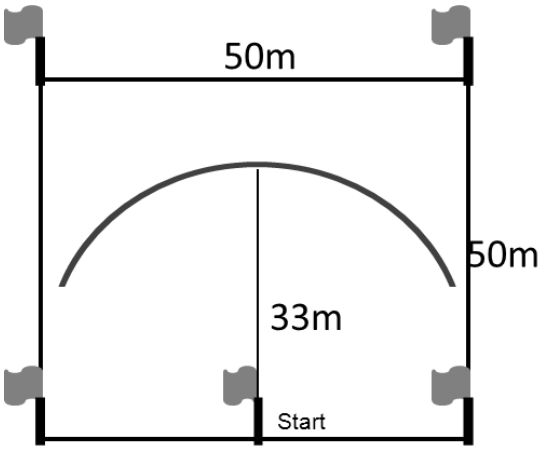

Figure 1: Testing site layout

Each patroller participating in the drill was the informed that they were being timed on their ability to pinpoint, probe, and excavate the buried bag and beacon within seven minutes. Patrollers were allowed to start out of their skis, touching the starting point, with their beacon out but not receiving. Timing started when the beacon was switched to receive. Times were recorded for the pinpoint, probe strike, and digging. Finally, time was stopped when the bag was fully extricated from the snow.

3. RESULTS AND DISCUSSION

In the 2010-11 season 59 drills were completed by 48 patrollers, 44 of which were under seven minutes. Of the 59 drills, there were 15 tests that

were either incomplete or over seven minutes. The following 2011-12 season, 61 drills were completed by 52 patrollers, 9 of which were retests after failures. The average results for 2010-2011 and 2011-2012 are seen in Table 1.

Table 1: Results from testing (time in minutes:seconds)

2010-11	**Pin Point**	**Strike**	**Digging**	**Total**
Average	2:22	1:33	2:23	6:01
Std dev	0.07	0.05	0.13	0.14
Median	1:54	1:10	1:17	5:01
Range	9:27	5:15	14:53	15:23
Max	10:20	5:20	15:05	17:43
Min	0:53	0:05	0:12	2:20
2011-12	**Pin Point**	**Strike**	**Digging**	**Total**
Average	1:33	1:20	2:16	5:09
Std dev	0.026	0.041	0.073	0.09
Median	1:22	1:03	1:36	4:44
Range	3:19	5:08	8:15	9:58
Max	3:55	5:23	8:40	12:00
Min	0:36	0:15	0:25	2:02

The 2010-11 season had a first time pass rate of 69%, with an average time of 6:01 minutes. At that time 25% of the patrol used analog beacons and 75% used digital beacons. The following year (2011-12) saw a 52 second improvement in the average time to 5:09 minutes. The pass rate increased to 89% with 18% using analog and 82% using digital. As seen in Table 1 the average decreased in time from 2010-11 to the 2011-12 season for pin point and strike, and total time. However, the median digging time increased by 28 seconds. The digging time increase can be accounted for by the increase in burial depth and bag size between the two seasons. The bag was changed to more accurately represent a victim and to give a larger target to strike when probing. The increased bag size improved the average strike time from 1:33 minutes in 2010-11 to 1:20 minutes in 2011-12. Though the actual time spent probing was short, the majority of the time was spent accessing and assembling shovels and probes. The individuals with quicker total times had easy access and assembly to probe and shovel and got both tools out and assembled at the same time, staging the shovel for later use. The implementations of a probing grid (e.g. ever expanding box) in conjunction with probing perpendicularly to the slope were seen in faster times.

From 2010-11 to 2011-12 season there was an improvement in the spread of pinpoint times during the test. This is illustrated in Figure 2 which breaks down the pinpoint times by the most common beacon models. The Tracker 1 and 2 show a strong consolidation in the distribution of the pin point times from 2010-11 to 2011-12, while the other beacons stay more consistent. There was an average 31 second improvement year to year. The F1 and M2 had a larger pinpoint time range in comparison to the Tracker 1, Tracker 2, and The Pulse.

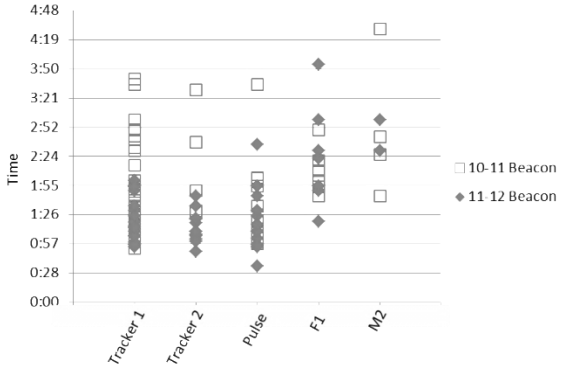

Figure 2: Two year comparison of pinpoint times and beacon type

When comparing the average pinpoint times for analog and digital there is a 1:04 minute difference (Figure 3). This time difference represents the benefits of digital compared to analog technology.

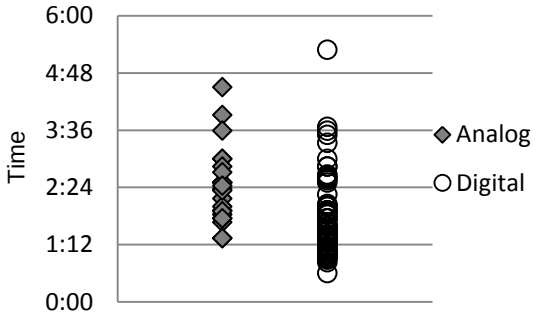

Figure 3 Two year comparison of Analog vs. Digital Pinpoint times

During the tests and during the course of regular ski patrol work, patrollers pushed their gear to the limit and sometimes beyond. Several probe cables broke during the test, causing delays in probing time. Others found physical limitations prevented them from achieving the goal. Specific inadequacies resulting in non-passing times are shown in Figure 4. These inadequacies include pinpoint, probing, digging, beacon or physical. The evaluators noted that an inadequate pinpoint came down to a change

in the beacon orientation while pin pointing or not preforming a detailed fine search. While probing some failures occurred from false positives or random probing. Digging errors that lead to failure were; staring with a small hole, digging off course, or digging strait down.

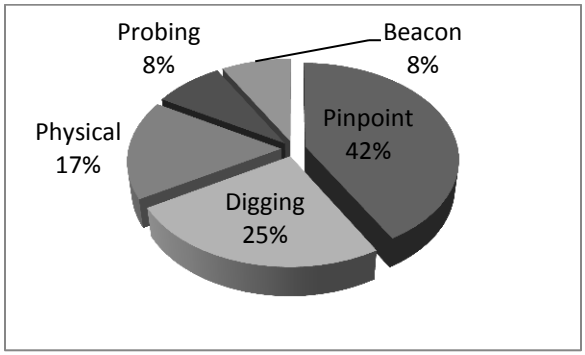

Figure 4: Failed tests: specific skill inadequacies

When looking at the years of patrolling in relation to pin point, search times, or beacon technology the data was inconclusive, which was not expected. As this drill is continued over the years a possible correlation could emerge as more data is compiled.

4. CONCULSION

The majority of the feedback from the patrol was positive, saying they liked the challenge and that it helped them hone their skills. Some patrollers noted that it was good to work under the pressure of the clock while experiencing the challenge of quickly and efficiently excavating a hole large enough to gain and maintain an adequate airway.

Based on the spread of data points and search time, the most important component of quick rescue is familiarity with the equipment used and keeping avalanche rescue gear current and up to date. This was seen in the overall improvement of times from 2010-11 season to 2011-12 season. The pinpoint times of an analog beacon were slower than that of a digital beacon. While the digital had a faster pinpoint time it was observed that the most important factor was operator skill.

Those that preformed the best knew the range of their beacon and traveled quickly up the center of the debris area until a signal was obtained. When assembling gear from their pack they assembled both the probe and the shovel at the same time. The fastest probing times occurred when the participant probed perpendicular to the slope in a consistent grid leading to a positive strike. Storing their beacon and leaving the probe in, they moved 1.5x the strike depth down the hill and began digging a wide hole toward the probe ramping down. This combination is very important for successful rescue. In short, those who stuck to textbook rescue strategies tended to have the shortest total times, giving their partners the best chance possible to survive a potential burial while on avalanche mitigation work.

5. AKNOWLEDGMENTS

A special thanks to the Big Sky Ski Patrol and Scotty Savage.