

IMPACT OF ADVANCED (ELECTRONIC) TECHNOLOGIES USED IN AVALANCHE PROBES

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ABSTRACT: While the necessary time for beacons search had been the major focus of beacons manufacturers and has been reduced to almost a minimum, the time needed for direct recovering (shovelling and excavating) can't be affected significantly. It simply depends on factors like burial depth, consistency of the snow, the adequacy of the used shovel, the right shovelling technique and finally by the physical constitution of the rescuer. In the past, one factor of the overall time, the PROBING, hasn't been paid much attention for. While manufacturers did improve avalanche probes in general with the major focus on lightness and quality of the probe tubes and locking systems, the principle together with the educated technique of probing hasn't been touched systematically. A newly introduced probe using additional electronic technologies claims to have a significant impact to the overall rescue time for avalanche victims. This study analyses this impact based on a large number of field tests.

KEYWORDS: pinpointing, probing, shovelling, avalanche transceiver, companion rescue, ART

1. INTRODUCTION

In general, ongoing development and improvement of avalanche transceivers had a significant impact in the overall rescue time. Many important analyses and studies have been published about this issue. Most of them have been based on using classic avalanche safety gear (transceiver, probe, shovel). Therefore studies of Frank Tschirky (SLF; 2000) and Dominique Stumpert (France; 2002) draw a good picture about the reasonableness of different rescue equipment and methods.

This study takes a close look to the impact of "pinpointing and probing" within the total time of rescue and excavation of totally buried avalanche victims.

2. BACKGROUND

In open terrain - off the secured slopes - every individual is faced with the danger of slab avalanches. In the case of such an emergency a totally buried victim without an air pocket (primary assumed in rescue operations) has a respectable chance to survive within the first 10 up to max. 15 minutes (Figure below).

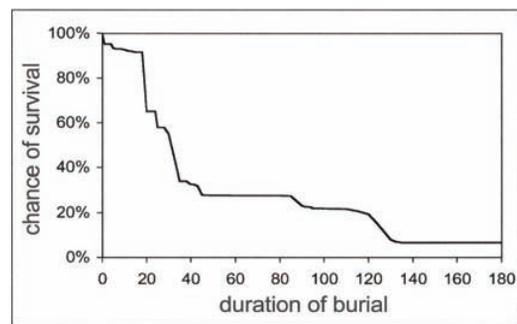


Figure 1: Chance of survival for persons who have been caught and completely buried in an avalanche in open terrain (Switzerland 1981-1998, n=735) as a function of burial time in minutes. Authors: Hermann Brugger, Markus Falk

Within this short period no organized rescue team can be up there and the companion rescue is the only chance for the buried victim.

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The most critical and time consuming steps during companion rescue operations are:

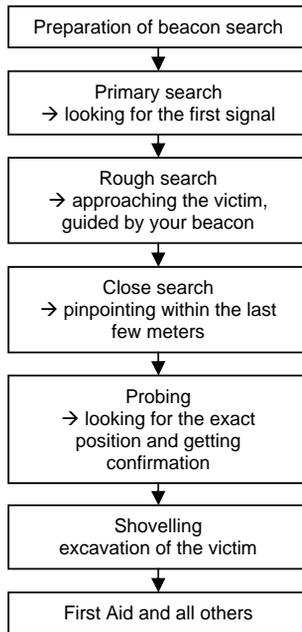


Figure 2: Critical and time consuming steps during a companion rescue operation

Various studies show, that each single step has its own parameters of significant influence (i.e. Primary-Search → dimensions of the slab avalanche / primary searching area and search strip width, shovelling → burial depth, snow conditions, equipment, technique...)

In the past a major focus of avalanche beacon manufacturers had been put on reduction of the necessary time for beacon search.

Due to a further progress in beacon technologies, like introduction of direction indication (in 1996), digital signal processing, circular range, 3rd antenna (all in 2003), the time consumption for the beacon search itself could have been brought down to almost the minimum – given by physics.

But the time needed for direct recovering (shovelling and excavating) couldn't have been affected significantly. It still simply depends on factors like burial depth, consistency of the snow, the adequacy of the used shovel, the right shovelling technique and finally by the physical constitution of the rescuer.

In the past, one factor of the overall time, the PROBING, hasn't been paid much attention for. While manufacturers did improve avalanche probes in general

with the major focus on lightness and quality of the probe tubes and locking systems, the principle together with the educated technique of probing hasn't been touched systematically.

And, there is an important correlation of time, spending for pinpointing as accurate as possible and time needed for probing (with all kind of problems, like probing perpendicular to the surface, doubts about "did I really hit him?"...)

A newly introduced probe - the PIEPS iProbe using additional electronic technologies - claims to have a significant impact to the overall rescue time for avalanche rescue.

This study analyses this impact based on a large number of (still ongoing) field tests.

3. FIELDWORK AND METHODOLOGY

During final exams (-> avalanche companion rescue and beacon search) of various organisations, like the Austrian UIAGM mountain guide education a special developed survey has been used during this exams and have been collected now since 2005.

During their final exam in beacon search the following detailed time critical events had been collected:

- Start of "Rescue Operation" (primary search)
- First Signal → start of rough search
- Start Pinpointing → start of slowly working on the surface
- Start Probing → start of using the probe
- First Hit → internal timing when using a training station equipped with a hit detection, without informing the examinee!
- "Found" → final recognition of the examinee



The preferred size of a test field is 70x70m (no first signal at rescue start).

To get a detailed result about the coherency of time for pinpointing and time for probing a smaller field has been used (30x30m, beacons already had a first signal).

The typically used burial depth always has been about 1 meter and the “size of the target” has been defined with 40x60cm (in most cases simulated with blankets).

As it’s completely up to the examinees, which beacon they are familiar with and which they want to use for their “final run“, a broad variety of available beacons had been used.

In most cases, also data about 2nd and 3rd victims had been collected the same way.

4. OBSERVED DATA

From out the data of several test runs, done from 2005-2007 we got the following general breakdown of separate steps during the beacon search:

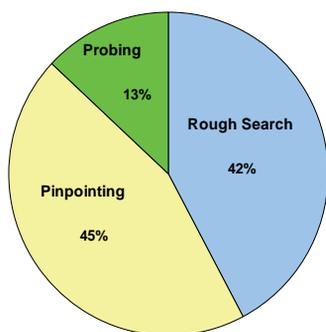


Figure 3: Time brake down, data collected during final exams “Austrian Mountain Guide education”, 2005

The first and astonishing result is, that the step “Pinpointing and Probing” together is roughly **58%** from the total beacon search time!!

And also the fact that roughly the same time is needed for “Pinpointing” (**45%**) and “Rough Search” (**42%**)!

To evaluate the coherency between “Pinpointing” and “Probing” with or without using the electronic iProbe, we made a special test series in Spring 2008 with a special focus on the time brake down for this individual steps.

Only a larger number of different runs using different targets gave a representative result!

In this test series we had also volunteers with different skill levels (mountain guides, advanced users and amateurs).

Time break down: Pinpointing vs. Probing using a classical probe

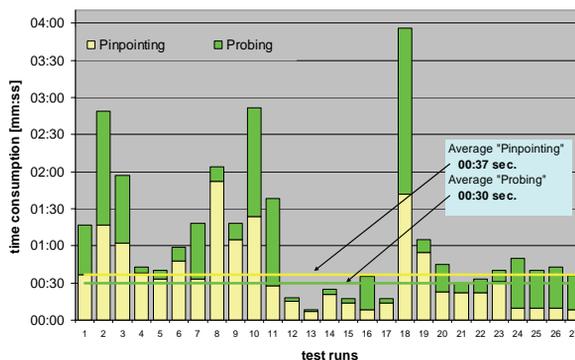


Figure 4: Test result, July 2008, „Dachstein Glacier“, time brake down of beacon search time, using standard probes

As can be seen from the data, little more time has been needed for pinpointing in comparison to data from field tests in 2005 (only professionals). Due to the mixed structure of test persons (we also had amateurs during this series) the time for probing is slightly higher.

Time break down: Pinpointing vs. Probing using a iProbe

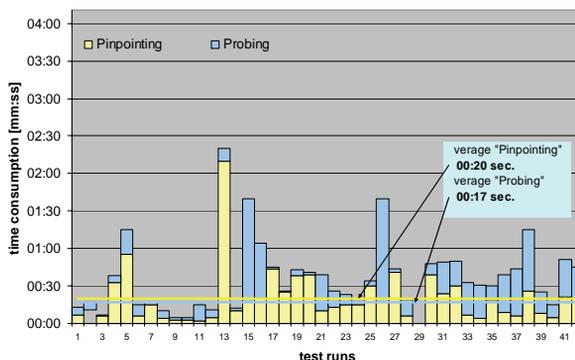


Figure 5: Test result, July 2008, „Dachstein Glacier“, time brake down of beacon search time, using PIEPS iProbe

After the first test series had been finished, a second series has been done with the same group of test persons, at same conditions but at a different test field, now using the iProbe with electronic target indication.

A significant drop of both, the time for pinpointing and the time for probing is clearly given by these numbers.

The average time for pinpointing dropped from 37 seconds down to 20 seconds (reduction of **46%**) and average time for probing dropped down from 30 seconds to 17 seconds (reduction of **44%**)!!

5. INTERPRETATION and CONCLUSIONS

If all available test series from June 2007 until July 2008 are taken into account, the average time for pinpointing vs. probing with and without iProbe can be estimated!

	Pinpointing	Probing
Classic Probe	52 sec.	21 sec.
Using iProbe	21 sec.	12 sec.
Reduction	60%	43%

Figure 6: Time brake down for pinpointing vs. Probing, all test series from June 2007 until July 2008

Furthermore, if it is taken into account, that pinpointing and probing together was roughly 60% of the overall search time, a reduction of about 50% in pinpointing/probing will result in a reduction of

30% of the overall beacon search time!

The following important conclusions can be achieved from this study:

Conclusions using avalanche safety gear with classic probes:

If you take all field tests into account, a clearly shown coherency between time for pinpointing and time to get the confirmation with the probe is obvious.

Using a classic probe, you have to be more accurate with your pinpointing (i.e. you have to invest more time) to reduce the time for probing.

But there is still the problem of doubts about the probing result.

In dependence with snow conditions, burial depth, gradient of the slope and skills of the test person up to 20% of the cases indicate a “found victim” without an actual target hit!

During the final exams of the Austrian Mountain Guide education approx. 10% of the examinees failed there “final run” due to insufficient accuracy of pinpointing and timeout while probing.

Especially doubts and uncertainty while probing have significant influence to the final time.

While using a training station - equipped with a probe hit indication - a time period up to 6 minutes could have been identified, beginning from a target hit indication

(given from the training station) until the final recognition from the test person.

Conclusions using avalanche safety gear with the iProbe:

When using the iProbe, the time for pinpointing can be reduced by almost 50%. There is no need anymore for being too precisely. Time can be saved!

In most cases the time for probing also can be reduced to the half.

Doubts or uncertainty hasn't been observed anymore.

6. ACKNOWLEDGMENTS

Thanks to all test persons, volunteers and education staff members helping us gathering detailed field test information.

7. REFERENCES

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