

GETTING TO THE POINT?

Avalanche victims must be rescued quickly. Each minute saved increases the chance of survival. Before digging is possible, the victims first must be precisely pinpointed! It is the pinpointing, however, that causes difficulties for rescuers. Do the new digital beacon models have an advantage here?

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- Original: DAV Panorama www.alpenverein.de/panorama.html; authors Chris Semmel and Dieter Stopper (2/2004).
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 - Comments: text between [...] has been freely added by the translator for purpose of further clarification.
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During courses with the DAV [German Alpine Association], it becomes evident that participants have difficulties searching with avalanche beacons. Valuable time is lost especially during pinpointing. The searchers often execute the pinpointing in a chaotic manner and without clear structure while the survival-clock is ticking relentlessly. But the searchers' skill shows only one side of the story. The other side is in respect to avalanche beacons. There are serious differences evident especially amongst modern digital beacons with distance display and microprocessing regarding the support for the searcher.

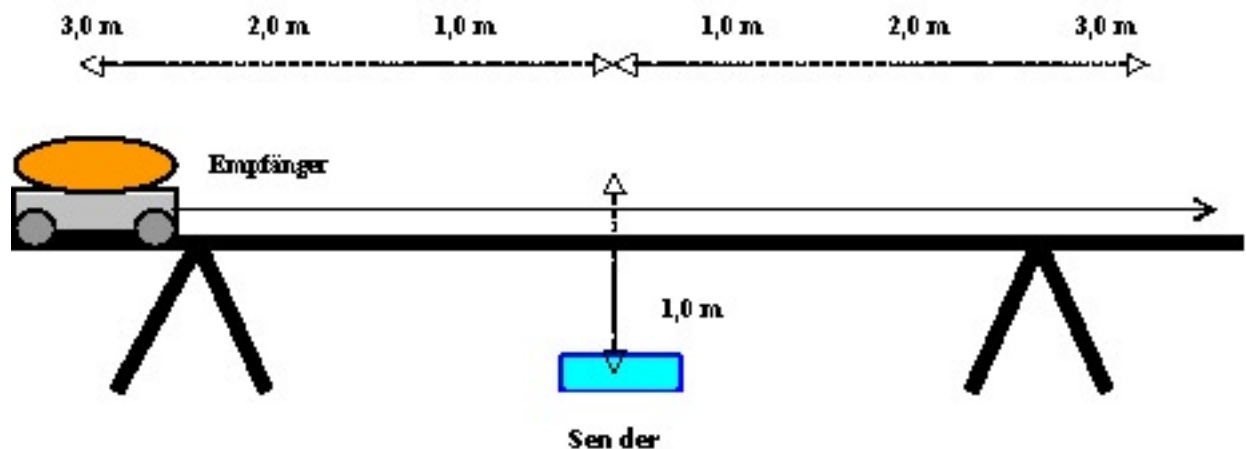
The "ideal" pinpoint procedure would work like this: The searcher, moving on a flux line, reaches a point within close proximity of the victim. Usually, the flux line describes an arched and then a straight line to the victim. During pinpointing, the searcher works just above the snow surface, slowly and without rotating the beacon. The distance display shows a continuously decreasing reading when closing in on the victim. Above the victim, the beacon shows a minimum distance reading. Moving away from the victim, the beacon's distance display shows a continuously increasing reading. The searcher is clearly led to the exact location at which to probe.

Experiment—In our experiment, we simulated the ideal pinpoint procedure.

- A receptor beacon was moved at a constant speed of 0.25m/s horizontally above a transmitter beacon.
- The transmitter-antenna was positioned exactly parallel to the trajectory of the moving receptor beacon.
- We moved the receptor beacons directly above the transmitter.
- The minimal distance between transmitter and receptor beacons was exactly 1m.

In case you don't have a feel for how slow 0.25m/s is, try this: Walk a distance of several meters, while each meter takes 4 seconds to complete. Field observations show that most searchers work at a higher speed in most cases. (see Fig. 1)

Fig. 1



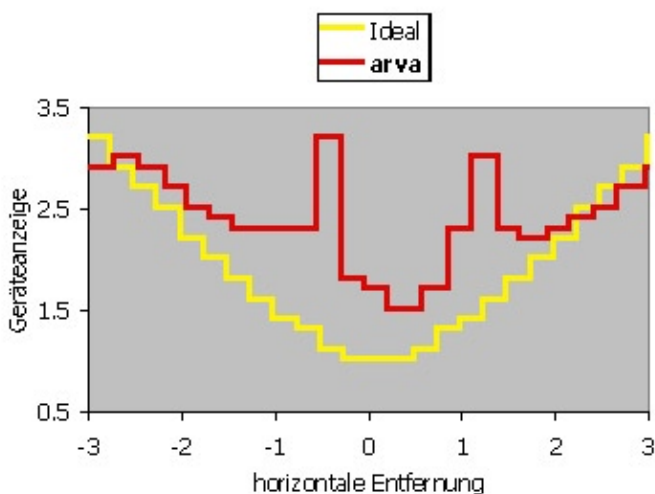
While the receptor beacon moved above the transmitter beacon, we recorded distance readings and exact locations of the receptor beacon (see “individual beacon display graphs” below). The yellow “ideal curve” shows what we consider the best display readings: The searcher continuously moves down the “yellow graph-staircase” towards the victim [indicating decreasing distance readings]. From step to step, the searcher knows that she/he is getting closer to the victim. The rescuer will recognize immediately when going beyond the victim’s position, as she/he has to ascend the “yellow graph-staircase” [indicating increasing distance readings]. Additionally, the low-point of the “ideal curve” matches with the transmitter’s exact location.

Short technology primer—The search for a buried victim is a spatial problem. The victim is not located somewhere on top of the avalanche area (two dimensional), but rather beneath the snow surface (three dimensional). To come as close to the “ideal-curve” as possible, three receptor antennas are needed that “put out their feelers” in all three spatial directions. Only the PiEPS DSP is equipped with three antennas. The MAMMUT Barryvox, Tracker DTS and the Ortovox x1 (2003 and 2004) each work with two antennas. The ARVA Evolution has only one antenna. Due to the lack of a 2nd and/or 3rd antenna, the following problem arises: On the approach to the buried victim, the distance display at first shows decreasing readings, but before reaching the victim’s location, the display shows higher readings again [false distance-maximas]! It is thus not a display of what happens in reality- the searcher closing in on the victim- but rather an increase in distance between the searcher and the victim (see “individual beacon- display graphs” below). The untrained user will be prompted to reverse her/his steps as a result of the false distance display. The projected location of the victim now is significantly before the actual location. The manufacturers of the Tracker DTS have avoided this problem by interrupting the display readings. Instead of an unrealistic increase in distance, the Tracker DTS displays “SE” for “search” at that point. But this solution, too, is confusing for a user who is not familiar with the beacon. Certainly, an expert is able to interpret these display readings, but doing so requires detailed knowledge about flux line patterns and the specific beacon models. This is a major issue for the layperson who commonly is wasting valuable time at this stage of the search.

Interpretation of the results—You can get a first impression by comparing the red curves (individual beacon model) with the yellow curve (ideal curve). Basically, the more similar the two curves, the better!

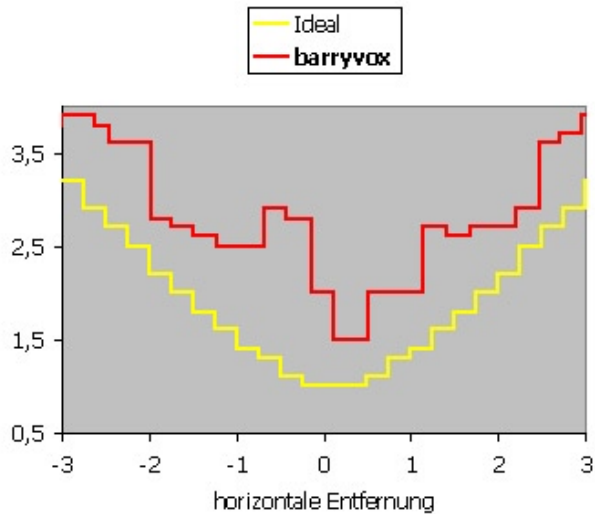
In detail, watch the following points:

- Does the curve point continuously downward all the way to the transmitter’s location?
- Does the curve point continuously upward beyond the transmitter’s location?
- Does the lowest point of the curve match the actual location of the victim?
- Are the steps [in the curve] short and small; meaning that the searcher receives constant new information during pinpointing?



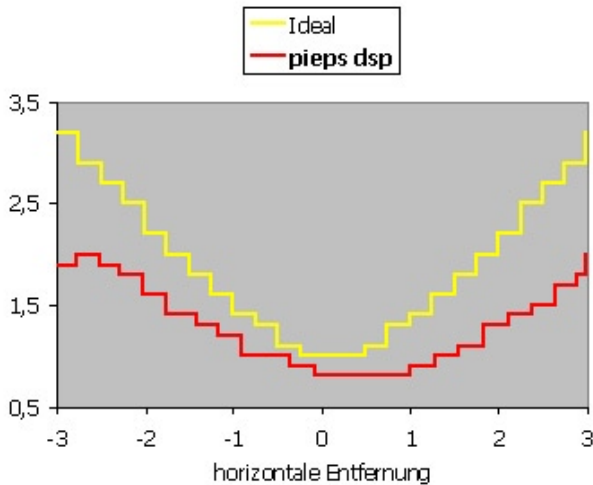
The curve of the ARVA Evolution for the main part shows short steps, which lead the searcher in direction of the victim. The two distinctive false distance-maximas are disturbing, which can confuse the layperson to start probing at the wrong spot. The middle of the deepest step is about 0.5m off in respect to the transmitter.

The curve of the ARVA Evolution shows short steps, which lead the searcher towards the victim. Both- some are the two strong false distance displays.



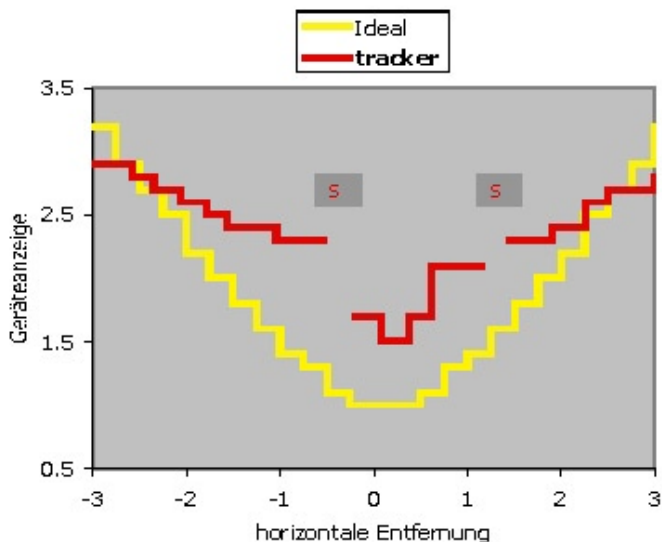
Things are similar with the MAMMUT Barryvox. In contrast to the ARVA, the steps are more irregular. In practice, this is barely disturbing. With the Barryvox, too, there are two false distance maximas, which the searches must correctly interpret. The middle of the deepest step is 0.35m off in respect to the transmitter.

Also the MAMMUT Barryvox shows to significant false distance displays, which the searcher has to correctly interpret. The middle of the lowest step is 0.35m away from the victim's location.



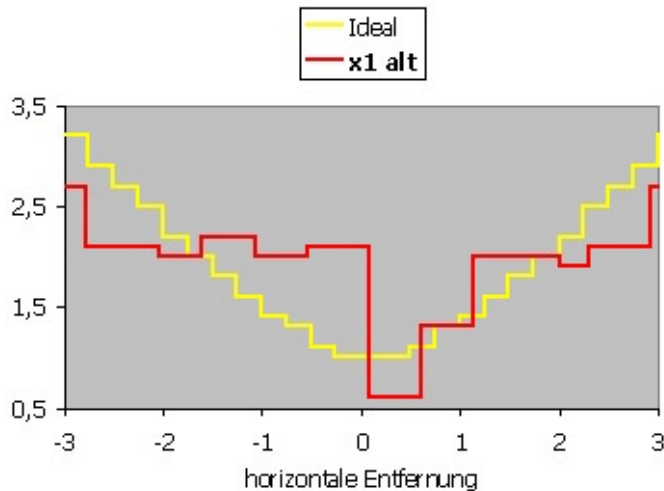
The PiEPS DSP fully performed with its 3 antenna technique. Continuously down in regular short steps to the transmitter and then the same way up. Disturbing is the excessive width of the deepest step. With over one meter in width, the middle of the deepest step is 0.5m off in respect to the transmitter.

It takes 3 antennas to match the ideal curve as much as possible. The PiEPS DSP is the only beacon model that has 3 antennas.



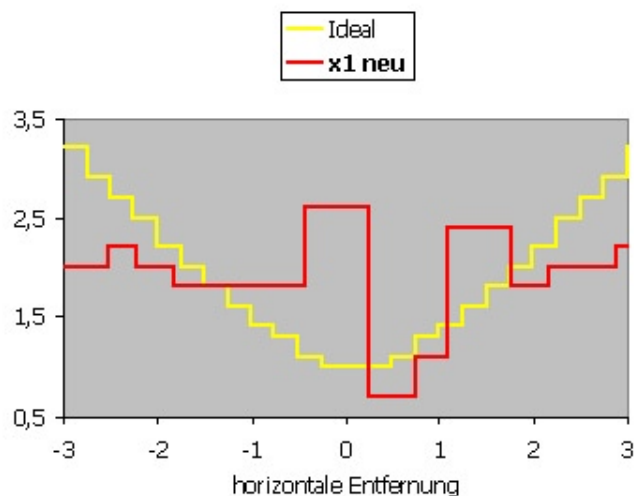
The curve of the Tracker DTS shows short steps, which descend continuously to the transmitter and back up. Unfortunately, the steps are interrupted and the display reads "SE" twice. If "SE" is interpreted correctly then there is little to worry, if not, "SE" is confusing. The deepest step is 0.25m off in respect to the transmitter. In our tests, the Tracker DTS was processing the incoming signals the fastest.

Interruption of the distance-display: Instead an unrealistic distance increase on the way to the transmitter, the tracker shows "SE" for search.



The curve of the ORTOVOX x1 2003 goes up and down. Whether the searcher is moving in the correct direction is not displayed. Above the transmitter, the curve decidedly drops to the deepest step with its middle being 0.35m off in respect to the transmitter. On the other side of the transmitter, the curve at first goes up and then continues indifferently. Unfortunately, a leading of the searcher to the transmitter is not recognizable, though there are no false distance-maximas either.

With the ORTOVOX x1 2003, its up and down—the beacon does not indicate whether the searcher is moving in the right direction.



The ORTOVOX x1 2004 is the upgraded version of the x1 2003. The curve of the 2004 is comparable with the one of 2003. Unfortunately, the 2004 shows two false distance-maximas, which leads the searcher to probe in front of the actual transmitter location. Furthermore, the deepest step of the 2004 is 0.4m off in respect to the transmitter.

Unfortunately, the ORTOVOX x1 2004 shows two false distance—maximas, which can lead the searcher to probe at the wrong location.

Move slowly—The searcher must work slowly and precisely while pinpointing. That’s easier said than done! Put yourself in the situation of the searcher. You are under extreme stress, it’s about life and death and you’re very close to the victim. And yet, you have to go slowly while pinpointing. Unfortunately, today’s beacon technology leaves out one thing: very fast and very precise.

The reason lies with the measurement technology. All models with antennas arranged perpendicular have to measure them one after the other, which is time consuming. Only the Tracker DTS can measure both antennas at the same time, due to its antennas being arranged cross-wise. In addition, there is the slow signal-pulse. The processor is calculating only once every second. In between signals, the processor is unoccupied and therefore cannot feed the searcher with new information. That’s why—when pinpointing— being patient will be faster!

Digital or analog? First of all, the current digital models differ greatly from one another. They work with one to three antennas and often include analog technology as well. While the new digital beacons are not perfect, they offer advantages when following flux lines and when pinpointing. For humans, it is easier and faster to interpret visual information than it is to differentiate acoustic signals, with which analog beacons work. Nevertheless, it is true also for digital beacons: Practice is necessary to search fast and precisely!

A wish for the future—It would be desirable to realize the “ideal curve” avoiding the display of false distance maximas using a 3-antenna-technology or other solutions. The same is true with respect to faster signal processing with real-time and precise distance display. Furthermore, working a multiple-burial scenario should not require much more know-how than a single-burial scenario. We are convinced that these wishes can be realized in the future!