

EXPERIENCE WITH AVALANCHE RESCUE TRANSCEIVERS

J.G. Lawton

Introduction

The practicality of avalanche rescue transceivers has been established beyond any doubt by the successful rescues which have been carried out by means of this equipment. Several accidents in which rescue transceivers were used to locate victims who were completely buried by avalanches will be reviewed (the fact that Skadis were used in these rescues is a reflection of the data available to the author, who, to date, is not aware of any successful rescues by the use of transceivers of any other manufacture). Errors which have occurred in the use of rescue transceivers, some of which have resulted in fatalities, will be discussed (again the fact that none of these cases involved Skadis reflects the data available to the author). No fatalities due to misuse or failure of Skadi have been reported. However, in at least one case, a skier equipped with a Skadi was killed by an avalanche in spite of being promptly located and the immediate availability of medical help. This accident underscores our warning that a rescue transceiver cannot protect one from the dangers of avalanches -- all it can do is to speed up locating a victim. Finally, we will report on an accident which appears to have set a record for the least elapsed time to locate a victim who was completely buried by an avalanche.

Transceiver Operation

Because it is impossible to predict the conditions and personnel who may become involved in avalanche accidents and rescue operations, it is essential that rescue transceivers be simple to operate, foolproof as possible and extremely reliable. It is emphasized that the simplicity of operation does not imply that better performance, i.e., a reduction in time required to locate and recover a victim, cannot be attained by training and additional equipment. In fact, it has been repeatedly demonstrated that even a few hours of training and practice greatly improves both performance and confidence. It is also strongly recommended that small avalanche shovels be carried in addition to the rescue transceivers. There is at least one accident on record in which over an hour was spent digging with hands and skis in an unsuccessful attempt to recover a victim whose position had been approximately located with the aid of a rescue transceiver (Pieps). Upon the arrival of the ski patrol, who were equipped

with shovels and Skadis, the body of the victim was promptly recovered. This particular accident occurred in 1975 in Colorado.

The principle on which avalanche rescue transceivers of the Skadi/Pieps variety operate is that all persons who may become exposed to avalanche hazards will carry a transceiver which must be switched to transmit at all times. The transmissions result in a beeping signal in any other unit which is switched on to receive and located within range of the equipment. (Approximately 30 m for Skadis.) The strength of this signal increases rapidly as the rescuer approaches the victim. Since the transceivers are carried in the transmit mode, the potential victims need do nothing if an avalanche should occur. If someone should become buried, his comrades switch their transceivers to receive and can quickly locate the buried victim provided that the transceiver is still located on his body. There was an accident in Austria in 1974 where an avalanche, which killed three people, also knocked a Pieps out of the pocket of a fourth person, who, as luck would have it, escaped and eventually recovered his transceiver. The lesson here is obvious -- carry the transceiver in such a way that it cannot become separated from your body. (Personally, I carry my Skadi in a shirt pocket with a securely closed flap and with the lanyard around my neck.) Obviously, one cannot make contact with a transceiver which is either switched off or switched to receive. In a somewhat unusual accident in Austria in 1973, a man had used his Pieps in an unsuccessful search for some people buried in an avalanche. When the search was discontinued, he forgot to switch his Pieps back to transmit and was then himself buried by another avalanche. His body was eventually recovered.

The only sensible policy is to switch the transceiver on upon departure (in the morning) and to leave it on all the time until you return. Skadi uses rechargeable nickel cadmium batteries, so there is no incentive whatsoever to switch the transceiver off in order to save the batteries. (The Nicad batteries will actually perform better if they are discharged all day than if they are used only for part of a day.) A possible solution to the problem of having the transceiver switched to receive would be to equip these units with a spring-loaded switch which would automatically switch from receive to transmit unless the switch is deliberately held in the receive position(s). A foreseeable problem with this approach is that one cannot guarantee that everyone in a search party will be able to hold his transceiver in the receive position until the search is completed. One might have to release one's grip for any one of a number of reasons, e.g., to use another piece of equipment (such as a radio) to dig out

the first victim to be located, etc. If the unit automatically switches to transmit, when the grip is released its transmissions will be received by the other searchers and the search will be disrupted.¹ One can certainly devise a remedy for this problem, but the complexity of the cure may be worse than the disease. Furthermore, it will be of no use if the equipment is left in the off position.

Simplicity of operation, reliability and compatibility with other rescue transceivers in use in the area, are the key properties to consider when selecting an avalanche rescue transceiver. There was an accident in Canada in 1974 in which rescue transceivers of three different manufacturers were used at the same time. Only two of these, Skadi and Pieps, were mutually compatible. Skadi and Pieps both operate at a frequency of 2275 Hz and, as far as I know, are the only ones which operate on this frequency and are compatible.

The need for extreme simplicity is illustrated by the following observation. Early model Skadis, the so-called Hot Dog models, used a three position switch (Transmit - Off - Receive) and a separate volume control, all clearly marked. Next to the volume control there was a large arrow labelled "Louder" and the first item of the instructions stated: Search: All Skadis on Receive, Volume Loudest. Nevertheless, every once in a while someone would set out on a practice search with the volume turned all the way down and thus would not be able to complete the practice. (Also, sometimes the switch was not in the receive position.) In the latest model Skadis, the Flat Pack, there is only one knob which controls all functions. The unit is arranged so that when it is on transmit it gives off a beep which is loud enough so that it can be heard with the cover closed. But again, Murphy's law applies, just because the unit is beeping does not guarantee that it is transmitting. It will also beep if it is switched to receive and another unit is transmitting nearby. Several people, both here in Alberta, and in the U.S. have been rather surprised when this was pointed out to them. It is, however, very easy to assure oneself that the unit is switched to transmit; the transmit position is the extreme clockwise position of the knob. When the knob is turned to that position, a safety lock snaps into position and prevents the knob from

¹On February 28th, 1977 an accident occurred where one person in a search party forgot to switch his Skadi from transmit to receive. The signals from his transmitting Skadi led the search party astray. Fortunately the victim was found in time by a second search party and did not suffer any ill effects.

being accidentally backed out of the transmit position. It requires a deliberate effort with two hands to release the safety lock, but it can be done easily, even in darkness, and with mittens on.

Before reviewing some actual rescues, I want to again stress that although operation of avalanche rescue transceivers is simple, practice is definitely necessary. For example, we have found that almost always the amount of time required to locate and to dig out a transceiver which is buried about 1.25 m deep can be cut in half with two practice sessions. The problem is not in picking up the signal but in reducing the time spent in searching for the exact location and in digging. Pinpointing the location is very important - it takes a lot less time to refine the position from an uncertainty of 2 m to 0.5 m than to dig a pit which is 2 m across. One more point - there is nothing wrong with taking the transceiver into the pit to refine the estimate. I have seen a pit dug $\frac{2}{3}$ m deeper than the Skadi was buried when the pit wall just missed the Skadi. Rescue transceivers, practice, and a good shovel, are the key ingredients of efficient avalanche rescue. Incidentally, a good way to get more out of training sessions is to tie a red string (avalanche cord) to the buried transceivers. The transceivers should be buried over a meter deep with the string coming straight up to within a $\frac{1}{2}$ m of the surface. The problem is considered completed when the searcher uncovers either the transceiver or any part of the string. Thus, if the location of the transceiver is precisely determined, one needs to dig only $\frac{1}{2}$ m to reach the string. But if the location is not accurately determined, a much wider and deeper pit must be dug. Since digging a large pit represents a fair amount of work, the trainees have additional incentive to be as accurate as possible.

Case Histories of Transceiver Rescues

Skadis have been in use since 1970. Prior to the winter of 1971/72, there had been several close calls where Skadis had been at the scene of an avalanche accident but some part of the victim, or his equipment, was visible above the surface. To the best of my knowledge, the first person who was completely buried by an avalanche and rescued by means of Skadi was Mr. Roy Fisher of Calgary, Alberta, Canada. The accident occurred on January 10, 1972 in the Bugaboos range of the Canadian Rockies. I have received letters both from Mr. Fisher and Hans Gmoser of Canadian Mountain Holidays which describe this accident and the successful rescue. There is no doubt that this would have been a fatal accident if Skadi had not been available. Excerpts from both Mr. Fisher's and Hans Gmoser's letters are reproduced below.

Excerpts from Mr. Fisher's letter of 21 January, 1972:

..."You are no doubt aware that Hans Gmoser is utilizing your Skadi radios for avalanche rescue for his guests in the Bugaboos. I wish to report to you that your Skadi was responsible for saving my life while I was skiing there on January 10th.

My friend Bob Kimoff and myself had started our descent when a fracture took place about 100 feet above us. According to the guides, the avalanche was a good sized one; it ultimately travelled about 400 yards. Bob, who was near the side, ended up near the bottom with his head and arm exposed. He suffered four fractured ribs and a punctured lung as a result of colliding with a tree on the way down. My ride was somewhat gentler, except for a rocky ledge which caused one broken tooth and many sutures in my lower lip. I came to rest at the bottom, completely buried, with my head closest to the surface at a depth of about three feet, the guide and my companions hurriedly rescued Bob and switched his Skadi off of transmit. Approximately ten minutes from the time the avalanche stopped, two of my friends had located my position with their Skadis and in another five minutes my head was exposed and everything was on the mend.

The extensive area of the slide, coupled with limited manpower would have made it virtually impossible to locate me with the probing technique. There is no doubt in any of our minds that without Skadis I would not have been found in time. ..."

Excerpt of Mr. Fisher's letter of 4 February, 1972:

"... I am sure that I lost consciousness very rapidly; probably within one minute after the slide had stopped. I can recall only three thoughts:

- the one to try to move (which movement was completely impossible);
- the second was that I was breathing rapidly and should try to slow the breathing rate; and
- the third was that I had the Skadi and that I would be found.

I don't recall swallowing any snow or having difficulty breathing while the avalanche was

moving. However, my rescuers said that one of them used a finger to remove snow from my mouth before I regained consciousness.

My rescuers did mention that the snow was packed fairly well and it was hard digging to uncover me. ..."

1972: Excerpts from Hans Gmoser's letter of 18 January,

"...Last week the Skadi saved one of our skier's life. The man was buried three feet under the snow. He was found in ten minutes on a slide that dropped 600 vertical feet. He had just turned unconscious and was revived within minutes. ..."

1972: Excerpts from Hans Gmoser's letter of 7 February,

"... The first avalanche happened on January 10, 1972 at 11:00 a.m. The weather was overcast with light snow, a southwest wind of ten knots, temperature about 15 above. The slope had a due East exposure. Four days prior we dug a profile about 300 yds. from where the avalanche occurred, right at the fracture line of an old avalanche and determined that the snowpack itself was quite stable. However, since then the slope had been loaded by shifting snow. The prevailing wind up there is Southeast blowing almost across the slope. Between the slope where we had dug the profile and the one where the avalanche occurred is a very slight ridge with small trees acting as a windbreak and of course allowing the snow to deposit on the next slope over. Average incline of the slope would be about 35 degrees, in two rather pronounced depths with a flattening out in the middle.

The guide skied and tested the slope first, was about half way down and had skied off it to the North and stood along a ridge of trees there. Three of his guests had already come down, one at a time. When the next two went out on the slope it broke and carried them a distance of about 1500 feet and 600 vertical feet down. In the process they went through a stand of wide open small trees and may even have been slightly airborne as they passed a lip in the middle of

the slope. The guide immediately got his group together, they all turned their Skadis to "receive", proceeded down the slope and spotted one victim whose head and shoulders were out. The guide attended immediately to him while the party continued on down the slope trying to pick up the signal of the second person, who was not in sight. Within about three minutes the signal was picked up and two to three minutes later the rescuers were right on top of the victim. The person whose head was out had suffered four broken ribs and one rib had punctured the lung. He was immediately flown down to the lodge and later on to Banff for hospital treatment.

The person that was completely buried had some lacerations around the mouth and some slight damage to the front teeth. One of the members in our group that week was an oral surgeon who took care of the damages right at the lodge and the person remained and skied with us for the rest of the week.

If we hadn't had the Skadis it would have been at least 20 to 30 minutes before we could have organized a proper probing and may have been at least another 10 minutes before the victim would have been found. He was buried under three feet of snow, right at the end of the deposition, only within 10 feet from the end of the avalanche itself. I am almost positive that during that time lapse this man would have completely suffocated. ..."

It might be noted that this victim was found by his companions, lodge guests and recreational skiers who obviously had been adequately instructed in the use of their Skadis. The accident, as described above, "was right out of the book." As described in the Skadi instruction manual, the search proceeded in a downward direction and the victim was found in the deposition zone, a common location. The downward search presumably also would have located the other victim first if he had been completely buried since he came to rest higher on the slope. A second accident is also described in Hans Gmoser's letter of 7 February, 1972:

"... On January 23rd, one man in a party of 10 skied out of the suggested route which resulted in his breaking off a cornice, dropping 300 vertical feet down in a rocky chute. The cornice also triggered a small loose snow avalanche which completely buried him. The guide immediately came

around the steep face, switched his Skadi to receive and immediately began picking up the signal. Since there were some big chunks sticking out of the avalanche which were part of the cornice, he headed straight for them. The signal kept increasing and when he arrived at the biggest of these chunks he was convinced that the victim was buried underneath it. Two digs with the shovel uncovered the head and within seconds the face was freed. The person was already unconscious. Two members of the party had, immediately after the accident happened, been sent to the lodge. Three of the guides got their rescue toboggan and flew with the helicopter to the scene of the accident. By that time the person had been completely dug out, was transferred to the stretcher and into the helicopter. By the time we returned to the lodge he regained consciousness and after a two hour sleep felt completely fit and stayed to ski the rest of the week.

In this case, without the Skadis this person too could have died before he was found. ..."

Finally, I will review an accident in which no one was injured and which, due to presence of mind, may have set a record for the least time used to locate a completely buried skier. This accident occurred in January, 1976 in the Bugaboos. In this case, the last skier in a group of ten triggered the avalanche when he came to an abrupt stop. Three skiers were carried about 60 m; one of them was completely buried, one chest deep and one to the neck. Mrs. Sandy Hansen, who was buried chest deep, is responsible for the speed of this rescue. Before digging herself out, she asked the other skier, who was buried to his neck, to switch his Skadi to receive and to start searching for any other buried skiers. In Mrs. Hansen's words:

"...yelled for everyone to 'head for the trees'. I didn't look up, but traversed rather quickly towards the trees. Just as I approached the trees I felt myself lifted by the snow and carried downhill. By some natural response I lifted both arms and felt as if I were body surfing. Only briefly did any snow brush over my head, and I was gently dropped about 200 feet downhill, landing in a standing position with skies and poles still on, and buried chest deep. The fall took only a matter of seconds and I was uninjured.

About ten feet uphill from me was another fellow buried to his neck. In response to a very thorough training session by our guides before our skiing began that week, we quickly put our Skadi training to practice, and both located the signal of the woman buried beside me. Within a minute or two our guide and another skier reached us and began digging. In a matter of minutes, though it appeared an eternity, the victim was recovered, and no first aid was needed as she became conscious immediately. I'm sure the sight of her being dug out will remain with me forever.

There was another skier buried further up hill who was located by two other members of our group, plus still another skier partially buried though able to dig himself out. In my opinion everyone remained calm and the situation was handled admirably. ..."

The completely buried skier, Ruta Lucas, was dug out right near the feet of Mrs. Hansen.

Aside from the fact that the rescue was very promptly carried out in all these accidents another common feature emerges. In all cases the victims lost consciousness very rapidly.

Finally, I would like to urge all of you to report any avalanche accidents or unusual experiences. It is from firsthand experience that we can best learn how to avoid accidents, and how to improve our equipment and rescue techniques. I will be more than happy to disseminate any such reports which you may send me.