AVALANCHE HAZARD EVALUATION IN HELICOPTER SKIING

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Introduction

I delivered a paper at the previous Avalanche Workshop in 1976 comparing the avalanche hazards and the problems of dealing with them in Alpine ski touring and helicopter skiing. In this paper I will review what has happened in the interim and offer some projections for the future.

Development of Hazard Evaluation Since 1976

The number of heli-skiing areas, and the number of skier days have grown substantially in recent years. In our CMH heli-skiing areas, from 1965 to 1976 we had a total of 58,000 skier days. Now in one season alone, we have over 25,000 skier days. We operate in seven different areas and on any one given day 275 skiers might make eight to ten different runs each, all in untracked snow. Because of the nature of the terrain and the unrestricted access to it, the exposure to potential avalanche hazard is enormous.

Since November 1976, some major avalanche accidents have happened in heli-skiing. In March of 1977, three skiers were killed in an avalanche in the Bugaboo Mountain Range; in February of 1979, seven skiers died in an avalanche in the Spillimacheen Range southwest of Golden, B.C.

These accidents brought great pressure on the operators to look at their operations even more critically and to develop modes of operation to substantially eliminate these hazards. Prior to the 1977 accident, the problem of minimizing the avalanche hazard while still providing exciting skiing, had already received our attention. In retrospect, the procedures developed, while useful, were not adequate. The normal, intuitive field experience of the guides and the on-the-spot instant decision-making, while certainly very valuable, were no longer enough.

Ed LaChapelle did an analysis of the avalanche accidents in the CMH areas and found that, in each case, the accident happened when a guide, in trying to find untracked snow for his group, was pushed way out to the side of one run. This study showed that the guides were perhaps too eager to always provide unbroken snow for their groups; that each guide, apart from skiing in the same general area with the other groups, operated pretty well on his own; and that there was no formal decision-making process in outlining the day's skiing program.

To bring this situation under control, we needed a formal training for our guides. We needed more information about the terrain, the snow, and the weather; and the guides had to very thoroughly examine and digest this information before the decision was made as to where and how to ski on any given day.

Further, there had to be a system of chain of command in the field. This would allow for changing a day's operating plan if it turned out that the evaluation did not accurately represent actual conditions found or if during the day weather or snow conditions changed.

Revision of Procedures Since 1976 and Present Status

Since 1976 we have introduced some changes as a result of experience over the years. Firstly, we have made liberal use of the avalanche courses offered by the British Columbia Institute of Technology and the National Research Council, and, in addition, each year we hold a course taught by Ed LaChapelle in one of our areas. These courses are mandatory for new and existing members of our guiding staff and emphasis is that scientific observation is indeed a very important part of avalanche hazard evaluation, even for a qualified and practising mountain guide.

We have also started a program in each of our areas to photograph and catalogue all the ski runs. These are normally 8" x 10" black-and-white photos mounted on cardboard, in a loose-leaf binder with up to three overlays. One overlay shows the usual skiing lines on the run; the second overlay identifies the various hazards such as cornices, slide areas or concealed drop offs; and the third overlay shows observed avalanche activity and its extent.

These photographs are useful in refreshing each guide's memory about a particular run and in giving new guides a picture of what to expect. By having all potential hazards identified, a guide will always be reminded of what the consequences can be of starting down a certain line under certain conditions. This largely eliminates a problem of the earlier days where often a guide would find himself on a run with a group where, in retrospect, under the conditions, he would have preferred not to be, but had no other choice than to try to get his group down safely.

We use the system of one base weather station in each area for snow and weather observation. These stations each have a maximum/minimum thermometer, a 12-hour snow stake, a storm and season stake. Readings from each station are taken every 12 hours. In addition, we have one high altitude station with a maximum/minimum thermometer, storm and season stakes which are read once every day, weather permitting, and we have from two to four plots with storm and season stakes in key locations throughout each area. These latter stations are read whenever our skiing activities take us in the vicinity. At these high altitude plots, we have an area fenced off where, at intervals of 10 to 14 days, we take full snow profiles. All this information, as well as all observed avalanche activity, is continually recorded on a master chart, which is displayed in the guides' room. This is the primary basis for the daily, theoretical, avalanche hazard evaluation.

Another important part in the evaluation process, but not recorded on the master chart, are the results of test pits which the guides use at their discretion at any time wherever they happen to be. Other observations by the guides, particularly their own subjective evaluations of the conditions encountered while actually skiing during the previous day, are also used.

We found such a system useful but some important information was still missing. Needing information as to the wind and temperature conditions during the past night on the slopes we were planning to ski, we then liaised with the Pacific Weather Centre and discovered that we could get a report on observed conditions at the 1,800 m, 2,700 m and 3,600 m levels, as measured in four different locations throughout British Columbia at 12-hour intervals. We also found that we could get a forecast of conditions at these

levels for the next 12 hours. Thus, in each of our areas a call is made daily to one of several weather offices, such as Castlegar, Revelstoke, Kamloops, or Prince George. With time, we hope to gain enough experience to extrapolate these data to the areas with which we are directly concerned.

In summary, we now have a history of snow data, snowfall amounts, settlement ratios, and development of the snowpack in several areas; firsthand snow observation from skiing on the slopes; current weather observation at the base; and weather observations at three different altitude levels during the past 12 hours. All this is used to determine where and how, on any given day, we will ski.

As a rule, in each of our seven areas, we have four groups skiing. The first group is with the lead guide and he directs the skiing activities. If, for example, he finds that conditions are different from what our evaluation had led us to expect, then it is up to him to move into another area, or instruct the other guides on how to conduct their groups under these conditions.

What I have described is an idealistic picture. But it must be noted that we are dealing with people, and this whole system is only as good as the commitment of the people included in it. In some of our areas it works very well because the manager and some of his key guides are fully committed to this system. But among our group of 42 guides we have, on the one hand, highly experienced people, who view all this paper work with great suspicion, feel very uncomfortable with it, and thus get very little, if anything out of it. On the other hand, we have people who chart and record snow and weather observations with admirable diligence, do the most detailed snow profiles, but have little sense of and feel for the terrain.

Future Development

The heli-skiing industry can be compared with the airline industry. Heli-skiing at present seems to be close to bush plane flying, a situation where, once the pilot is in the plane, he is on his own, where everything rests on his decisions. Essentially, this is still the situation with our guides today. Once the guide gets out of the helicopter with his group, his actions are largely determined by his judgment, by his decisions.

We may, however, be headed in the direction of today's commercial airline pilot who no longer controls the machine, but rather becomes an extension of the machine with programmed actions. While heli-skiing will be some time in reaching this point, the direction is already very clear. More and more the emphasis is shifting to scientific observation, the gathering of records, and the ensuing programmed responses. The day will come when each morning the heli-skiing guide will add the latest computer printouts to the stack of papers and manuals in his rucksack and then proceed with this group to the pre-determined run, follow the pre-determined lines to the pre-determined pick-up place and repeat this until, upon receiving a certain signal from skiing control centre, he knows it is time to head home.

Our ultimate goal, however, is a healthy blend of the practical and the scientific. This is not going to be easy and will require a great deal of effort.

Discussion

Fesler:

To what extent do you rely upon snow pits and snow pit technology--specifically shovel shear tests--in evaluating stability?

Gmoser:

At each of our high altitude stations, we do snow pits at 10- to 20-day intervals. These observations are recorded on a graph and used to follow the development of the snowpack and, hence, to form a very integral part of our stability evaluation.

Johnston:

Is relative humidity recorded at any or all of the observation stations, or is the information obtained from weather forecasting agencies, and, if so, how is it taken into account in compiling the daily assessment of avalanche hazard?

Gmoser:

While we do have hygrometers at some of our stations, humidity is not recorded nor used in our forecasting.

Schleiss:

It would appear that you do not use data from local wind stations in avalanche hazard forecasting.

Gmoser:

I did mention that we get wind conditions and wind forecasts at the 1,800 m, 2,700 m and 3,600 m levels from the Pacific Weather Centre. These we try to transpose to the areas with which we are directly concerned. Given the unreliability and cost of present telemetry equipment and the difficulty of reaching our stations regularly, we have no such equipment in use to date.

Boyd:

At present, we depend very heavily on what we call a "weather check". When conditions indicate, all the guides and the pilot will check at least part of the day's area before the clients commence skiing. This check includes observations from the air, landing to check helicopter safety, walking around the helicopter, sometimes skiing a run or runs, and occasionally using some explosive control.

Aikens:

What standards of accuracy and completeness do you demand from the personnel recording input data for your hazard forecasts and long term records? More importantly, how is your organization structured to ensure adequate supervision to maintain these standards?

Gmoser:

We use only fully qualified personnel. Our operating procedures are developed in concurrence with all our area managers. In addition, the Operations Manager and myself travel continually from area to area to check on these procedures. Nevertheless, we have not reached the stage where the individual judgment of each guide is superseded by policy, rather we try to have the guides accept policy and operating standards by convincing them of their validity.

Pendlebury:

What feedback do you have in the form of avalanche occurrence observations?

Gmoser:

Guides report avalanches when observed. We do not fly patrols for the purpose of observing occurrences, although we do fly weather patrols. We also have avalanche occurrence forms for recording reported avalanches.

Janes:

To what extent do you use explosives in making stability tests? Do you do any helicopter bombing?

Gmoser:

We do use explosives by dropping them from the helicopter. This is done on a limited basis to control some of the hazards in heavily skied areas, as well as to get additional information on stability.

Wiegele:

We share and agree with the views expressed by Hans Gmoser in regard to the complexities faced in helicopter skiing. Management has to have the flexibility to adapt rapidly to changes in conditions. For our own helicopter skiing operation, we feel we have adopted standard procedures which work well. In our forecasting we emphasize the search for changes in conditions and we feel that this is an important point.