CANADIAN AVALANCHE ASSOCIATION

AVALANCHE NEWS

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The deadline for the Winter issue is January 15, 1994. Material may be sent to the Canadian Avalanche Centre in Revelstoke in a variety of formats. Hard copy, Fax, ASCII, or WP5.1 are required for text. Diagrams, charts, & figures may be submitted as .WMF (preferred), .CGM (preferred), .WPG, .TIF, or .PIC files. Files can be sent on disk or to the PC BBS.

DUFFEY LAKE GAZ.EX

A FIRST FOR CANADIAN AVALANCHE CONTROL

by Scott Aitken

Over the summer of 1992, a GAZ.EX remote control avalanche control system was constructed by the British Columbia Ministry of Transportation and Highways. This system is located 44 km north of Pemberton above Highway #99 in Path #51.0, Duffey Lake 2. This system is the first of its kind in Canada.

The GAZ.EX system uses an explosive mixture of oxygen and propane in a 5:1 ratio detonated in a specialized three cubic metre steel exploder. This explosion occurs above the snowpack, creating a shock wave equivalent to a 20 kilogram TNT air blast which releases unstable snowpack layers. Two exploders are anchored permanently in the avalanche starting zones. Pipelines connect each exploder to separate gas supply tanks in a weatherproof shelter on Blowdown Peak. The shelter also contains the "satellite" microprocessor and communication unit which controls the electrovalves and ignition system.

The system is controlled from any line of site location on the highway using a radio link with the satellite. The avalanche crew sets up the link using a lap top IBM 386 computer connected to a base station control unit. Once the radio link is established, the satellite sends data to the base station reporting oxygen and propane pressures and present air temperature. A request for a blast from a specific exploder is made at this point with a few keystrokes on the computer. This initiates a release of gas from the dosage tanks for a timed interval followed by an ignition sequence to two "spark plugs" at the base of the exploder.

Road closure duration was reduced significantly during avalanche cycles last winter, thanks to the ability of the GAZ.EX to operate in all weather and visibility. This is a vast improvement over the traditional helicopter bombing method. Recent upgrading of the Duffey Lake portion of Highway #99 and associated increase in traffic volumes has made lengthy closures less acceptable. The system augments 83 earth mounds and a deflection dam constructed in 1990 as defense structures in adjacent avalanche paths.

The system performed well on the first winter of operation, producing a blast whenever demanded, releasing partially settled snowpack layers not necessarily involving a weak layer, and making a strong impression on anyone in the area. During a storm from January 24-26, 1993, a well buried depth hoar layer was plaguing the snowpack stability in the Coast Mountains. Throughout the avalanche cycle, frequent releases initiated by GAZ.EX kept the highway clear when natural activity would certainly have blocked the highway.

The project was not without start up problems. Several leaks in the oxygen manifold have necessitated changing the bottle leads this season. To date, 25 blasts have been initiated of which 10 were tests. Enough gas is stored on site for 35 shots (17 missions).

The GAZ.EX system, manufactured in France by Technologie Alpine de Securite, was supplied by G.M.D. Mueller Lifts of Vernon B.C. under contract.

Editors note: Scott Aitken is the Ministry of Transportation & Highways, District Avalanche Technician for Howe Sound.

CANADIAN AVALANCHE CENTRE FALL REPORT

by Alan Dennis

During the summer a Prospectus was prepared to describe the activities of the Centre. This is a ten page brochure with photographs and commentary that shows the objectives of the Public Safety Services, the Information Exchange and the Training Schools.

One of the PUBLIC SAFETY SERVICES is the Avalanche Bulletin which summarizes avalanche conditions in four mountain areas of western Canada. This information is available on the toll free number, by PC Bulletin Board and fax network. These numbers are shown on the contents page of this issue. The Avalanche Forecasts from Kananaskis Country and National Parks avalanche programs are also distributed from the Centre. This is consistent with services available in Europe and USA and last winter information from the Centre probably reached 15,000+ people.

A poster is available to publicize the Bulletin and is also used to display current information. A number of sponsors have contributed to the poster and their support is gratefully acknowledged. Copies of the poster can be ordered from the Centre.

As reported elsewhere in this issue the INFORMATION EXCHANGE has a new staff. The other major change is the availability of various AES products on a cost recovery basis. These forecasts and data will be posted on the PC Bulletin Board at the Centre. The Centre will carry special AES products for avalanche forecasters. The Kelowna Weather Office will provide support for these additional services this winter. Enquiries and comments should be directed to Torsten Geldsetzer at the Centre or Ken Little at Kelowna AES.

CANADIAN AVALANCHE ASSOCIATION TRAINING SCHOOLS have scheduled ten courses this winter. The brochure with details is available from the Centre. To maintain the high standards of the courses the manual has been revised with appendices for the three types of courses.

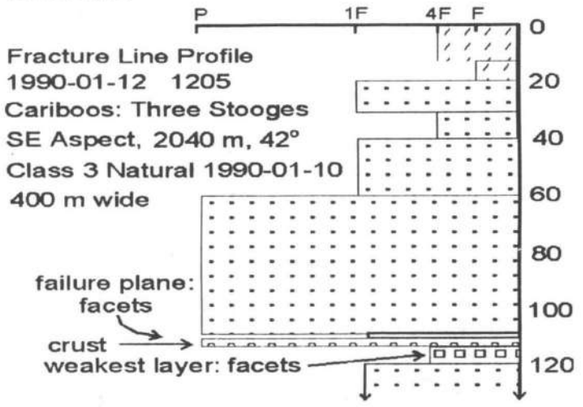
Finally, the Prospectus shows a budget for Public Safety Services (which includes editing this publication). Schools and INFOEX are very close to being financially viable, but the Bulletin needs joint venture financial support. As well as minimizing potential avalanche involvements the Bulletin can provide promotional benefits for the companies involved. Copies of the Prospectus are also available from the Centre.

Snow Slab Layers and Stability:

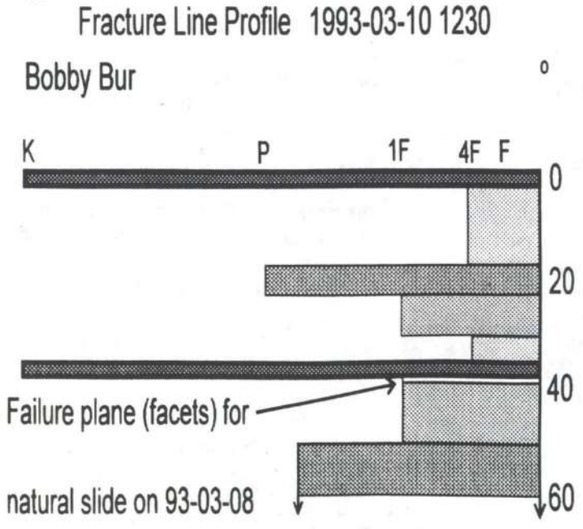
A summary of some recent research with applications

by Bruce Jamieson

While doing a fracture line profile in January 1990, Peter Schaerer and I noticed that the slab had slid, not on the weakest layer, but in a different weak layer 3 cm above the weakest layer. Peter tested the shear strength of both layers with a shear frame to be sure of the anomaly. Even if conditions had been different where the shear fracture started, why had the fracture spread along the second weakest layer?

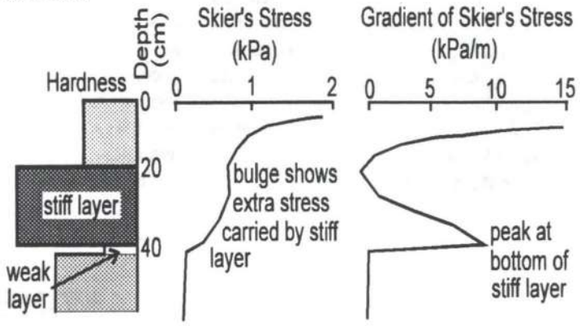


In the last four winters, I have seen other examples where slabs failed in the second weakest layer even though the weakest layer was only a few cm above or below. There seemed to be a pattern: *the second weakest layers that failed were thinner than the weakest layer and were often just below a stiff layer*. As shown in the profiles, this occurred for naturally triggered slabs and for skier triggered rutschblocks.



Stiff Snowpack Layers and Skier Triggering

At least for skier triggered slabs, the role of stiff layers was clarified at the September 1992 Symposium in Nagaoka, Japan. Jürg Schweizer of the Swiss Avalanche Research Institute reported on the shear stress caused by skiers. His calculations were based on a computer model of a snowpack with various combinations of stiff and weak layers. In a uniform snowpack, the skier's stress decreases gradually below the skis. However in a layered snowpack, stiff layers tend to carry more of the skier's stress and weak or soft layers tend to carry less. Where the bottom of a stiff layer meets a softer one, the decrease in the skier's stress changes abruptly causing a peak in the stress gradient. Of the various combinations of layers that Schweizer modelled, the one with the largest peak had a thin weak layer just below a stiff layer. This is probably why skier triggered slab avalanches and rutschblocks fail in weak layers just below stiff layers rather than in an even weaker layer a few cm above or below.

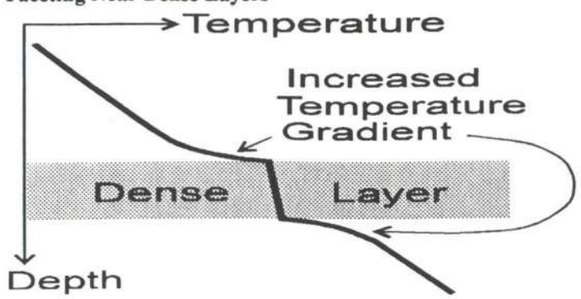


Effect of a stiff layer over a thin weak layer on shear stress due to skier (after Schweizer 1992)

Thin Snowpack Weaknesses

At the 1992 Breckenridge International Snow Science Workshop, Paul Föhn reported on weak layers and weak interfaces in the Swiss Alps. Most of the weak layers (80%) in his study consisted of surface hoar, facets or depth hoar. (In Canada, surface hoar, facets and depth hoar form the failure plane for about 76% of fatal slab avalanche accidents [Jamieson and Johnston 1992].) The thickness of these weak layers averaged 12 mm. Sixty percent of the weaknesses were classified as weak interfaces. These weak interfaces were found by a shear test such as the rutschblock; they were too thin to be found by an ordinary snow profile. Small rounds, melt freeze particles, partly decomposed grains or facets were found at most of the weak interfaces. (In Canada, 16% of the fatal slab avalanches ran on unspecified types of "old snow".) The message is clear: a profile without a shear test can miss important weak layers.

Faceting Near Dense Layers



Probable Effect of Dense Layer on Temperature Profile (after Colbeck 1991)

We expect surface hoar to form thin weak layers but can thin layers of facets form within the snowpack? One mechanism involves "near crust faceting". During most of the winter, heat flows up through the snowpack. Dense layers such as crusts conduct heat relatively quickly causing a lower than average temperature gradient within the dense layer. To achieve steady thermal conditions, the temperature gradient just above and below the dense layer must be greater than average (Colbeck 1991). Since our thermometers are usually placed 10 cm apart (and most are only accurate to ±0.5°C), we measure an average temperature gradient and miss the increased temperature gradients near crusts. Further, if the crust is relatively impermeable, additional water vapour will be deposited as ice on the grains just below crusts, contributing to crystal growth (Colbeck 1991).

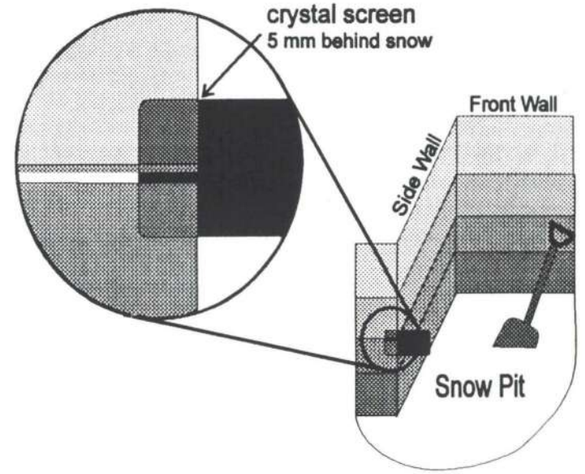
The conditions near dense layers are not always sufficient to cause faceting. However, the phenomenon has been reported from the polar snowpack (Palais 1984) to the coastal snowpack (Moore 1982). In most areas of the Columbia Mountains last winter, the January 19th surface hoar layer was just below a pencil hard dense layer. After a few weeks of metamorphism, faceted grains were more evident that the original surface hoar crystals (and the layer remained weak through early March). During early and mid winter in the Rockies, facets found just above and just below crusts are often larger than elsewhere in neighbouring layers. Given enough time this faceting can eat away at a crust until it disappears. But knowing faceted layers *sometime* form near dense layers is rarely good enough. We need to suspect faceting near crusts and dense layers, and check for thin weaknesses with profiles and field tests.

Field Tests

Given the recent evidence about stiff layers and thin weaknesses (especially surface hoar and facets), what can we do to better assess slab stability? Certainly, a rutschblock test or two will usually find the weak layer and give us an objective rating of stability for skier triggering. The compression test (Clarkson 1993) will also find and rate the weak layer, although the rating is more subjective. If we know the location of a thin weak layer, we can test it with the shovel test by placing the bottom of the shovel blade slightly above the weak layer (Schaerer 1989). However, to have confidence in the strength rating, 6 tests are recommended, and we don't know yet if the compression test is any better.

Snow Profile

Field tests such as the rutschblock and the compression test complement *but do not replace snow profiles*. On a smooth pit wall, many thin layers can be picked out visually. Brushing the wall with a glove or paint brush, will usually help thin layers stand out. The diagram shows how sliding a dark crystal screen down through the layers about 5 mm behind the pit wall can highlight thin layers.



Summary

We have known about the destabilizing effect of weak snowpack layers for decades. However recent research is warning us not to underestimate the effect of *thin* weaknesses, especially when they contain facets or surface hoar, and/or lie just below a stiff layer. Both snow profiles *and* field tests are required to locate many critical snowpack weaknesses.

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INTERNATIONAL COMMISSION FOR ALPINE RESCUE (ICAR)

Meeting of the Avalanche Committee

by Peter Schaerer

Introduction

The annual meetings of the International Commission for Alpine Rescue (ICAR) were held at Kranjska Gora in the Republic of Slovenia on 30 September - 2 October 1993. Kranjska Gora is a skiing and mountaineering resort town in the north-west corner of Slovenia (former Yugoslavia).

On the first two days, the four committees (Avalanches, Terrestrial Rescue, Air Rescue, and Mountain Emergency Medicine) conducted business in separate meetings. On the third day, the committee chairmen presented the committee activities to the assembly of all participants, then the annual general meeting of the delegates of the 23 member organizations of ICAR was held. Approximately 40 participants attended the discussions of the Avalanche Committee chaired by François Valla (France) with the assistance of Walter Good (Switzerland). The following is a summary of the significant business of the Avalanche Committee.

Avalanche Accident Statistics

Statistics on the number of fatalities in avalanches in the ICAR member countries were tabled (see enclosed table). The total of 146 deaths is close to the annual average (152) of the period 1975-1993. 86% of the accidents occurred in the five countries: Switzerland, France, Austria, Italy, and U.S.A.

As in previous years, alpine ski touring and mountain climbing contributed to about 70% of accidents. This ratio has been fairly constant over the years, but the ratio of accidents to the total number of accidents varies annually in the other activities, in relation to the amount of winter snowfall. The ICAR countries reported generally about average winter conditions in Europe in 1992-1993. The category "Miscellaneous" of the table includes snowmobilers, snowboarders, and two climbers who were swept down by an avalanche while they were bivouacking. It was decided not to stratify the category "Miscellaneous" further because it contains a relatively low number of accidents.

The annual number of fatalities in the ICAR countries had reached a peak of 224 in 1984-1985, then dropped despite an increase of winter activities in the mountains. François Valla attributed this favourable development to better education and preventive measures. In France it was noted that the skiers are now more conscientious and have actually cancelled tours when the avalanche hazard was high. Though it would be desirable to relate the number of accidents to the number of skiers and climbers, obtaining figures of their numbers was considered too difficult.

Selected Avalanche Accidents

Sievi Gliott (Switzerland) presented the case histories of two accidents which occurred within a short time in the Unter Engadin in Switzerland. In both accidents slab avalanches,that contained 50 cm to 70 cm of recently deposited snow on a layer of facets, ran on slopes with generally northerly aspect.

A group of seven skiers started an avalanche on the way down from Piz Fliana on 18 April 1993. The avalanche started on relatively gentle terrain, but then dropped over an 80 m high icefall. The only skier who was not touched by the avalanche walked down in the climbing track of the party and made a transceiver search. Of the six skiers who were caught in the avalanche, two were found injured on the avalanche surface, three were buried and dead, and one was dug out alive but died later. The burial depths were 0.6 m, 0.6 m, 0.9 m, and 1.2 m. After locating the victims, the survivor went for help to the cabin below. Probably, the concentrated load of the group, assembled close together prior to skiing the slope, triggered the avalanche.

On 21 April 1993, 24 skiers with 2 guides descended from the Fuorcla Sombrina into the Val Strippa. A large avalanche released on a steep slope and, despite the spacing between skiers, 5 persons were caught and swept into a narrow gully. Four of them were buried and found dead near the tip of the long deposit.

Helmuth Bauer described two accidents in Austria.

On 21 February 1993 a family of three persons was involved in an avalanche near Kitzb hel. One person wore a transceiver in the jacket, one carried a transceiver in the pack, and one was without a transceiver. The group rested below a col and had deposited the pack when an avalanche caught everyone. The daughter with the transceiver in her jacket and the pack with the transceiver were buried. The two other persons were still on the surface when the avalanche came to rest. Having no transceivers, the two survivors went for help. Four hours later, a rescue team located the buried victim within five minutes by transceiver. The victim was dead, but appeared to have lived for about 30 minutes under the snow.

On 12 March 1993 five persons including a guide climbed to the Querkogeljoch in the Oetztal. An old avalanche deposit led the guide to the conclusion that the slope had unloaded. The guide was high on the steep slope and his clients were well below when an avalanche released burying the two skiers. A transceiver search was made immediately, but because of a burial depth of 4 m the victims were uncovered dead about 30 minutes later. The guide had used an obsolete topographical map which erroneously indicated the chosen climb as a ski route.

On 2 August 1993 an avalanche that was released by a fall of ice caught two climbing parties at the Grand Jorasses in France. Of the 8 persons caught in the avalanche, only 3 were found. The search was difficult because of the long avalanche deposit on a rough glacier, and dogs and probing were unsuccessful in the ice. The three bodies were located from a crampon that was visible on the surface and the rope connecting them. The question was raised whether this incident should be considered an avalanche accident or a mountaineering accident.

Probability of Survival of Avalanche Victims

Othmar Buser (Switzerland) described his study of the survival probability for buried avalanche victims. He has reviewed the analysis of Brugger and Falk which was reported at the ICAR Meeting in 1992 and was subsequently described in a variety of avalanche publications (for example AVALANCHE NEWS No.39,page 7 and No.40, page 15).

Brugger and Falk determined the probability that a buried avalanche victim would be alive after a given time interval, from a sample of 332 published accidents in Switzerland. Buser used, for his analysis, 1036 cases from the files of the Swiss Snow and Avalanche Research Institute. Both samples included persons that had at least the head and upper body in the snow and excluded burials in buildings and vehicles. For each person found dead, Buser estimated the time when death probably would have occurred. For example, the survival time was assumed zero for victims with serious injuries which likely had resulted in immediate death. Other victims, that were found dead but obviously had lived for a certain time, were censored into an estimated time interval when death had probably occurred. For victims found alive, often a medical doctor estimated how long they would have lived if they were not found in time. Like Brugger and Falk, Buser analyzed the data with the rather complex statistical Turnbull Method.

Buser's survival curve differs from Brugger's curve by its starting point, but otherwise is similar in shape. According to Brugger's analysis, there were no dead victims at the time when the avalanches came to a stop, therefore the survival chance at the time zero of burial was 100%. Based on the sample of 1036 cases and his assumptions, Buser determined the following average probabilities:

- 17% of the victims were dead when the avalanche stopped;
- 50% of the victims were dead within 30 minutes;
- 90% of the victims were dead after 2 hours;
- 95% of the victims were dead after 5 hours.

It must be stressed, that these probabilities are averages and subject to much variation, particularly during the first hour of burial and depending on the assumptions of the time of death. The influence of the depth of burial could not be established clearly.

In the discussion, Herman Brugger pointed out that there is a sharp drop in the survival probability after 15 minutes of burial, and this sharp decrease was also found in studies of other accidents, for example drowning and suffocation.

As a conclusion, the chance of survival drops very rapidly within the first 30 minutes, therefore it is critical that buried victims should be found and uncovered within 15 minutes after the avalanche has run.

Avalanche Dogs

Peter Ogi (Switzerland), the chairman of the avalanche dog group, reported that contacts are maintained among dog handlers in the different countries. The dog handler chiefs of all countries will meet at the ICAR ground rescue course at Oberstdorf (Germany) on 3-6 March 1994.

As it is already done in Austria and Germany, the Swiss group has begun to examine avalanche dogs for searches in the summer. The Austrian guidelines for summer searches are available.

Report of Working Group "Prevention"

Niels Faarlund (Norway) reported on the activity of the working group "Prevention" which he had formed at the ICAR Conference 1992 at Windischgarsten. The intent of the group is to develop and promote measures for the prevention of avalanche accidents. The prevention of accidents is also one of the objectives of ICAR.

The working group had a meeting at Bormio (Italy) on 26-28 February 1993 with 26 participants. At the meeting, the following three topics of primary concern were discussed:

a) European avalanche hazard rating scale;

b) Information of the public through the media;

c) Education of young people.

The three topics were discussed again in groups at the meeting of the ICAR Avalanche Committee on 1 October 1993. The proposed European avalanche hazard rating scale is presented in this issue of AVALANCHE NEWS under a separate heading. The recommendations of the other two discussion groups were as follows:

Announcing the new hazard scale through the media is a good opportunity for drawing the attention of the public to avalanche hazards. The scale should be published every year together with comments. Avalanche bulletins should be distributed along with the weather report. It would be preferable to direct the information towards specific user groups, for example mountain climbers, ski area users, or snowboarders,

AVALANCHE ACCIDENTS IN ICAR COUNTRIES

Country	Ski Touring	Outside Skiruns	On Skiruns	Climbing	On Roads	In Buildings	Misc.	Total
Switzerland	**17**	**3**	**0**	**8**	**0**	**0**	**0**	**28**
France	*6*	*5*	*7*	*5*	*0*	*0*	*0*	*23*
Austria	**13**	**7**	**1**	**0**	**0**	**0**	**2**	**23**
Italy	*6*	*0*	*0*	*18*	*0*	*0*	*0*	*24*
Germany	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**3**
Liechtenstein	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Slovenia	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Croatia	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Spain	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**
United Kingdom	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Norway	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**
Poland	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*1*
Czech. Republic	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Slovakia	*0*	*1*	*0*	*3*	*0*	*0*	*0*	*4*
Bulgaria	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
Canada	*2*	*1*	*0*	*4*	*0*	*0*	*2*	*9*
USA	**14**	**7**	**0**	**3**	**1**	**0**	**2**	**27**
Total	60	25	8	43	1	1	8	146

but no country seems to have enough funds for issuing information stratified according to users.

A concentration of avalanche awareness education to people younger than 25 years would yield the most benefits (assuming older people have already acquired bad habits). It was recommended that avalanche education be introduced into the school curriculum (with outdoor trips), carried out in youth camps, and in the armed forces. A difficulty is that a large number of instructors would be needed and usually the money is not available to pay them. It was also suggested that members of rescue organizations could promote the cause among friends and their families.

Snowpack Tests

Walter Kellermann (Germany) describes in his avalanche information courses, then discusses, strength and stability tests of the snowpack, specifically the Rutschblock and the Norwegian tests. The avalanche courses are four days long and 75% of the time is spent in the field.

The Norwegian test involves cutting a trapeze-shaped snow block with an area 0.3 m^2 (parallel sides 0.2 and 0.8 m long with 0.6 m distance) and loading the sample by pulling with a special shovel parallel to the snow surface. Kellermann has made about 2000 Norwegian tests, and by comparing the results with the Rutschblock and the Rutschkeil he found the conclusions with respect to snow stability about equal. The advantages of the Norwegian test over the Rutschblock are the applicability on level terrain, shorter time, and requires only one person. The snow block must be cut accurately to correct size, and at right angles to the test slope. The students of Kellermann's avalanche courses and ski guides in Germany and Austria seem to prefer the Norwegian test over the Rutschblock because of its simplicity. All tests, however, must be supplemented by a snow profile.

Multilingual Vocabulary: "Snow and Avalanches"

Ruth Eigenmann of the Vanni Eigenmann Foundation distributed diskettes with the updated vocabulary. The vocabulary contains translations of snow and avalanche terms in German, Italian, French, English, Spanish, and Slovenic. The Vanni Eigenmann Foundation intends to amend the vocabulary every two years and invites comments and suggestions. The vocabulary lists the terms with the German words in alphabetical order. Ruth Eigenmann also tabled a glossary which explains, in German, the major terms.

Note: The Canadian Avalanche Centre at Revelstoke has a diskette of the vocabulary available.

Standard Flagging for Rescue Operations

At the ICAR Meeting in 1992, the French delegation presented a set of standard flags for marking avalanche rescue sites. At the 1993 meeting, the committee members were in favour of standardizing the colour of flags, but requested that there should be as few types of flags as possible. At a rescue it would be more important to concentrate on the search rather than placing correct flags. For this reason, for example, Switzerland and South Tyroi now use only two colours.

Transceivers

A new ARVA 8000 is available in France at the cost of FFr. 1200 for professionals. Modern Electronics in Switzerland continues to build the Barryvox with some improvements and at a lower cost.

European Avalanche Hazard Rating Scale

At a workshop on 21-23 April 1993 at Wildbad Kreuth in Germany, representatives of the avalanche services of the alpine countries of Europe agreed on a standard scale for avalanche hazard ratings. The rating scale is the result of a ten-year long effort by the countries that issue avalanche hazard bulletins. The scale contains five hazard classes which are a compromise that required considerable concessions on the part of participating countries. The scale of five classes is final, but the definitions for each class are still under consideration and will be modified. At this time (October 1993), the Swiss Institute of Snow and Avalanche Research is preparing revised, but temporary descriptions. In addition, each country may add guidelines on how the individual ratings affect skiers and other users of avalanche bulletins. Furthermore, the question is open whether the English term for the scale should be hazard, risk, or stability rating.

The new scale shall be published in the alpine countries of Europe with the comment that it is temporary and minor changes are possible. It will be used during the winter of 1993-1994 and the user countries are invited to comment at the end of the winter.

EUROPEAN AVALANCHE HAZARD SCALE

Draft of April 1993. Revisions of the descriptions of snowpack stability and triggering probability are in preparation.

1-LOW

Snowpack Stability: The snowpack generally is strong and stable.

Triggering Probability: Avalanche release is possible only at very few, extremely steep slopes. Natural avalanches are expected to be small.

2-MODERATE

Snowpack Stability: The snowpack has moderate strength at isolated steep slopes*, otherwise it is generally strong.

Triggering Probability: An avalanche release is possible with a high additional load, particularly at steep slopes of given exposure and altitude. large natural avalanches are not expected.**

3-CONSIDERABLE

Snowpack Stability: The snowpack has low to moderate strength at many steep slopes*.

Triggering Probability: Avalanche release is probable with a moderate additional load, particularly at steep slopes of given exposure and altitude. Isolated large natural avalanches are possible.**

4-HIGH

Snowpack Stability: The snowpack has a low strength at most steep slopes*.

Triggering Probability: Avalanche release is probable already with a low additional load at most steep slopes. In some cases, many medium size and isolated large natural avalanches must be expected.**

5-VERY HIGH

Snowpack Stability: The snowpack generally is weak and unstable.

Triggering Probability: Numerous large natural avalanches must be expected.

*** The type of hazardous terrain generally is described in the bulletin, for example altitude, exposure, shape of terrain.**

**** Additional load:**

- **high: for example a group of skiers, explosion;**
- **moderate: for example, a skier jumping, pedestrian;**
- **low: for example, a single skier.**

A MULTILINGUAL AVALANCHE BULLETIN EDITOR

The following is a translated summary of an article in the ANENA Review (Avalanche Association of France) by Robert Bolognesi.

Safety and information; information is only useful if it is understood by all. The automatic translation of forecast bulletins is a big step towards better informing those going into the mountains.

It is widely accepted that information bulletins are an effective means in the prevention of avalanche accidents. However, this tool is not used much by the public safety services of ski areas who have a unique opportunity to contact "their" skiers. It is not so easy to inform all of those skiers especially when they form such a vast and varied target audience.

The system presented here, for the automatic creation of avalanche hazard risk estimates, was designed to assist the forecaster in this difficult daily task.

PRINCIPLE

By dissecting a large number of avalanche bulletins from various agencies, it becomes apparent that information related to avalanche risks can be gathered under a relatively limited number of headings. These headings in turn are comprised of a limited number of components. It is therefore possible to picture the creation of a bulletin by a series of choices under each of those headings which could then be organized by a predetermined syntactic model. All that would then be required would be to define various models according to the grammar of another language in order to create an automatic translation.

APPLICATION

The editor displays three categories of headings: the first addresses the scope of the bulletin, the second its contents, and the third its style.

- **Scope of the bulletin:** It is determined by three headings: date (with a maximum validity of 24 hours), area, and geographic location.
- **Content of the bulletin:** It is defined by choosing from six headings: risk of a release, type of instability, type of possible avalanche, probable size of those avalanches, probable cause of release, most unstable areas.
- **Style of the bulletin:** It depends on the alarm factor raised. The editor therefore proposes for a given date and location over 100,000 coherent possibilities (the control of the coherence of the information is by the editor which prohibits approximately 50,000 illogical combinations).

CONCLUSION

Such a system would free the local forecaster with some of the work involved in creating an avalanche bulletin and allow him more time to concentrate on the real problems of snowpack analysis and hazard evaluation. Furthermore, this tool allows standardizing data and therefore promises better communication of information. Finally, it offers a viable solution to a current problem in Europe, multilingual information dissemination.

Translators Notes

The translated article describes and experimental software package for daily creation of an avalanche bulletin. The translation is provided for information only. At this point, it appears that this multilingual editor is very limited. The multilingual editor only has set basic phrases available and does not allow any "free form" from the forecaster. It also only allows a limited amount of technical content. The bulletin is intended to serve a clientele in Europe where a number of different languages are spoken and understanding of some languages is limited. It is intended for ski area use. Here in Canada, bilingual requirements are usually based on political requirements rather than user requirements. For this reason, in the Parks Service, it is felt that providing a detailed forecast in English is more important than having a simple message which is easily translated. People requesting information in French are referred to staff who can provide it.

submitted by: Marc Ledwidge

The Latest Update in Crystal Classification

written by: Susan Hairsine
contributed by: Peter Clarkson

Once upon a time in the Rocky Mountains lived a family of snow crystals called the Stellars. They were pure, clean living folk, content to idly lie by on the surface slopes, occasionally bonding when skiers or animals came by.

The Stellars had the penthouse suite of the snow layer. They weathered the high pressure, segregating themselves from the other crystals that shared the snowpack.

"You start being friendly with those graupels or plates that live down below and right away, they try to malform you," said Mr. Stellar.

"Yes dear, there's just no rime or reason to it", Mrs. Stellar agreed.

Days passed, and as usual, sunny skies and cold temperatures continued to reign over the Rockies. One morning at breakfast Mr. Stellar said, " I think our children are changing."

"Oh, they're just growing up dear," Mrs. Stellar replied.

"No my little snow cone, just last night I saw our Henry looking quite round."

"Oh, you've been needling him too much," Mrs. Stellar answered. But as the days passed she had to agree - their children were changing.

Mr. and Mrs. Stellar couldn't dwell on this matter too long though. There was trouble in the neighbourhood. A group of the worst crystals of all, Depth Hoars had moved into the low rent basement suite of the snowpack. Mr. Stellar was certain he had seen his sons venture down through the layers to pay those fallen female crystals a visit.

"Those women just have to go!" said Mr. Stellar.

"I don't know how ladies, as pure as the driven snow, could sink so low to become Depth Hoars," Mrs. Stelllar replied. "And why did they have to move into our slope? It was such a stable environment before they showed up."

"Yes my ice maiden, and if they had their way we would all sink to their level. As it is, our sons are being quite spineless and will soon become faceted if they aren't careful!" roared Mr. Stellar.

"Oh snowheart, it doesn't really matter

what happens to the children. We still have each other. The shear stress and tension you're under - it's surprising you haven't fractured," Mrs. Stellar observed.

"Ram it dear! I'm just feeling a little unstable these days," Mr. Stellar answered.

Time passed with cold, clear nights and warm clear days. A wispy wind started whispering rumours to the Stellar's snowpack. The anti-stratigraphy league had been busy on avalanche paths throughout the land, trying to halt decadence and ruin. The surface hoars were quickly discovered and to avoid facing arrest, had run out to other slopes. It wasn't long before they made their way to the Stellar's snowpack.

"Hoars above us - hoars below us!" screamed Mr. Stellar, "That'll be the day when I let you live with such snow scum. Come on honey we're out of here!"

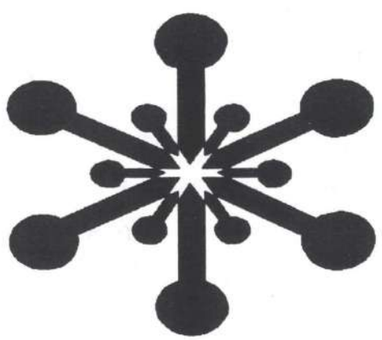
And with that Mr. Stellar cracked. The entire slope began to shake and soon everything was moving. The graupels and plates sensed trouble and quickly slid down the slope. When the depth and surface hoars collided they began to mud wrestle and the slope slid right to ground. Mr. and Mrs. Stellar clung together in the wave of snow and landed unscathed at the base of the mountain.

"Oh, my snow white, you're alright, said Mr. Stellar. "I would have melted if anything had happened to you."

"I have a suggestion dear," Mrs. Stellar said. When the next flurry comes let's move to a different snow slope."

"Yes," agreed Mr. Stellar. "We'll stop before the Rocky Mountain Rainshadow next time and settle on the Columbia Mountains. There aren't any hoars there to destroy our neighbourhood."

And with that thought they put on their best snow suits, got into their snowmobile and headed west.



Handcharges in Pre-priming and Avalanche Control: Sensitivity Testing

Background

Most Avalanche News readers will be aware that in 1991 the (Workers Compensation Board of British Columbia (WCB of BC) informed the industry that pre-priming of handcharges would no longer be allowed under current Industrial Health & Safety regulations. Their concern was that a premature detonation could occur in a skiing fall, or if a worker was carried down in an avalanche. Since that time the approved practice has been control point arming (i.e., priming charges as they are required out on the avalanche control route).

At the 1991 Annual General Meeting of the CAA, the Members asked the Directors to:

Make application to the WCB of BC to establish new regulations which better reflected the safety concerns of the industry (to allow pre priming).

Work on common language for variance applications to allow pre priming under existing regulation.

The CAA position in support of pre-priming was based on long established avalanche control practices in North America, allowance of the practice in jurisdictions outside B.C., and the opinions of various industry experts.

Since that time the CAA has corresponded with, and made a presentation to, the WCB of BC Board of Governors in regards to the current process of regulation review, which is being applied to several areas of WCB jurisdiction. At the same time we have corresponded with Occupational Safety & Health division in regards to variances under existing regulation.

Sensitivity Testing of Handcharges in Avalanche Control by CANMET

Previously, no hard data have been available to address the concerns of the WCB, in regards to the sensitivity of pre primed charges. Similarly, many workers have asked what, in fact, is the risk of premature detonation?

During the summer of 1993 the CAA asked Energy Mines & Resources Canada's CANMET Laboratories to undertake testing to assess the risk of premature detonation of pre primed handcharges. The report *Sensitivity Testing of Handcharges in Avalanche Control* summarizes the findings of this work.

In the CANMET tests pre primed handcharges, explosives and cap fuse assemblies were tested for sensitivity. The explosive products tested included dynamite (Dynamite L), cast primers (Sno-Det) and emulsion explosives (Sno-Frac).

Impact tests, using a drop weight tester with a maximum attainable speed of 7.6 m/s, were used to evaluate low-speed impacts, such as may occur in a skiing fall. Projectile impact tests were used to evaluate high speed impacts, such as those that may occur in an avalanche. The maximum probable speed of an avalanche in which a handcharge team member could be caught was identified as 50 m/s, however, tests were undertaken in the range of 60 to 500 m/s in order to establish a data set with both detonation and non-detonation events.

The conclusions of the study can be summarized as follows:

•**The hazard of low speed impacts, such as may occur in a skiing fall, is significant only for unprotected or loose detonators.** In addition, the drop weight tests suggest that the explosive, whether it be a cast booster, emulsion or dynamite, protects the detonator from impact, which would otherwise cause it to detonate.

•**From the viewpoint of impact at both low and high velocities, pre priming cartridges does not increase the hazard with respect to impact** (provided that the charges are prepared so that the safety fuse assembly is securely inserted into the explosive charge). A statistical approach was used to estimate the probability of detonation (primed or unprimed) at the maximum velocity of concern (50m/s): Dynamite L, approximately 10^{-10}%, Sno-Det and Sno-Frac, both < 10^{-15}%.

Current Submissions to the WCB of BC

We have forwarded the CANMET report to both the WCB Board of Governor's (in regards to regulation review currently underway) and to the Occupational Safety & Health Division (in regards to existing regulation). With the report we have included our detailed reasoning for support of pre priming from a risk management perspective and our recommendation that the practice be recognized under WCB regulations.

We have also forwarded the report and our risk management perspective to ICI and ETI (explosives companies). It is clear that their support will be important for the CAA to be successful in its presentations to the WCB.

It is very important to recognize that standard practice in the general blasting industry has been to separate detonators and explosives until the last practicable moment before use, and that moment is usually when the shot is about to be fired. Regardless of the results of the CANMET study, this precedent from the general blasting industry will weigh heavily on the minds of both regulatory agencies and explosives manufacturers. For this reason a clear explanation of our risk management concerns has been presented along with the results of the CANMET study.

The CAA reasoning from the risk management perspective includes the elements of: •standard industry practice; •allowance of pre priming in other jurisdictions; •minimum exposure time to terrain, avalanches & weather; •quality control of the charges; •team safety (protection of the safety backup); •avoidance of unnecessary handling of fuse assemblies; •minimum closure time to the public; and finally •the basic principle of simplicity in mountaineering.

It is also worthy of note that the WCB has indicated that variances probably are not applicable to pre-priming under existing regulations. A variance is required where a specific regulation cannot be met in procedure, such as the common variance for blasting signals in avalanche control. The practice of pre-priming is not allowed under interpretation of existing regulation and it is possible this interpretation could be changed by the WCB in response to new data. As the current Industrial Health & Safety Regulations were originally introduced in 1978, presumably pre-priming was allowed in the past, based on interpretation.

Future Submissions to the WCB of BC

As soon as replies are received from the explosives companies, the CAA will forward them to the WCB. Until that time it is unlikely any new interpretations of existing regulation will be forthcoming from the WCB.

The Chairman of the Board of Governors of the WCB has acknowledged receipt of the CANMET report and our letter regarding risk management. He assures us that the information will be brought to the attention of the blasting sub-committee in the process of regulation review. We will continue to pursue an approval of pre priming in avalanche control under the new WCB regulations.

The CAA will continue to work with the WCB and explosives manufacturers to improve worker safety. We strongly recommend that the risk management perspective be emphasized in any operators discussions with the WCB. We also encourage operators to invite their local WCB personnel to attend actual field operations in avalanche control, so that they can better understand the unique needs of our industry.

Submitted by: Chris Stethem
Chairman, Handcharge Policy Committee, Canadian Avalanche Association

NOTICES:

ISSW 94
Call for Papers

The International Snow Science Workshop (ISSW94) will be held in Snowbird, Utah from October 30 to November 3, 1994. The theme will again be "A merging of theory and practice." All persons interested in making a presentation are invited to send an abstract of 500 words or less by March 1, 1994 to:

Dr. Rand Decker
Civil Engineering
3220 - MCB U
University of Utah
Salt Lake City, Utah, USA
84112

Canadian Avalanche Rescue Dog Association (CARDA)

This year's courses for avalanche rescue dogs will be held in:

•Blue River: Nov. 27 to Dec. 4, 1993
•Whistler: Jan. 8-15, 1994

For more information contact Jan Tindle, ph. (604) 932-5196 or Anton Horvath, ph. (604) 932-1110

Introductory Avalanche Awareness Course

Recognizing and avoiding avalanche hazard is the focus of this course (follows the outline of the Canadian Avalanche Association). On Saturday, lectures, slides, and movies present information on avalanche terrain, formation and safety measures. On Sunday, participants will practice using transceivers, ski touring into alpine terrain, learning safe travel techniques and route-finding, use observation and snowpack tests to recognize hazard, and perform a rescue practice. The return trip involves skiing unpacked slopes and is not suitable for novice skiers.

Cost includes: instruction, transceiver rental, snow kit rental, and course manual. Transportation is not included; carpools are arranged on Saturday.

•Course #W940AVA101: Feb. 5-6, 1994
•Course #W940AVA102: Mar. 12-13, 1994
Cost: $75/members; $82/public.

For more information contact: Steve Chambers, ph (403) 220-7021, University of Calgary, Outdoor Program Centre.

cont'd next page

Avalanche Control Incident Reports
In the past few years the Canadian and American Avalanche Control communities have expressed concern over the lack of cross-border transfer and dissemination.

This is primarily in regard to incidents where avalanche control circumstances may cause a safety hazard. Examples are: a particular procedure which has created a safety hazard; or material flaws in a control device, like material disintegration due to extreme cold or unacceptably poor propellant ignition.

In an effort to ensure safety in the operation of North American avalanche control programs, the Canadian Avalanche Association and the American Association of Avalanche Professionals have set up a procedure for distributing information when a safety hazard has been identified. If you experience or become aware of an avalanche control situation which is a safety hazard, please forward the information to the Canadian Avalanche Centre at (604) 837-2435. Information will be forwarded to the American avalanche community.

PUBLICATIONS

•Avalanche Handbook, McClung & Schaerer 2nd edition. Technical reference. 256pp, $26.95

•Avalanche Safety for Skiers & Climbers, Daffern 2nd edition. Resource for recreationists. 192pp, $14.95.

•Backcountry Avalanche Awareness, Jamieson 4th edition. Student manual. 47pp, $5.00 retail. (Wholesale price available for course instructors.)

The publications listed above are all available from the Canadian Avalanche Centre. Prices quoted are Canadian dollars and do not include shipping.

•The Crystal Ball, new publication of the New Zealand Mountain Safety Council. Newsletter format. Enquiries for copies to the editor: Dave Morgan, NZMSC, Box 6027, Wellington Te Aro, New Zealand.

VIDEO

A 25 minute video on the Rutschblock, Spring table and shear frame tests, is available from the Dept. of Civil Engineering, University of Calgary, Calgary, Alberta, T2N 1N4. Phone (403) 220-5821. The cost is $25 plus $5 S&H plus GST.

PRODUCTS

RUTSCHBLOCK SAW: A two piece rutschblock saw, 125 cm assembled, 1.7 kg., $150 plus GST and shipping. Order from C.D. Johnston, Dept of Civil Engineering, Uof C, Calgary, Alberta, T2N 1N4. Phone (403) 220-6599, fax 282-7026.
CAA T-SHIRTS: A reminder that CAA T-shirts, which serve as fund-raiser for the Association, are still available for $21 plus GST & PST. Send your orders to the Canadian Avalanche Centre, P.O. Box 2759, Revelstoke, B.C. V0E 2S0.

PERSONAL NEWS

Daniel Nixon-formerly of SRAWS and UBC Civil Engineering Dept is now working for BC Hydro as an Operational Hydrology Engineer. His job will include forecasting watershed streamflows and managing the province wide network of meteorological telemetry stations. He will continue as Associate Editor of the Avalanche News.

Chris Whalley-has left work at the Canadian Avalanche Centre where he set up the PC based computer system which runs the Infomation Exchange and the Avalanche Bulletin. He is working in Revelstoke for forestry consultants.

Lisa Normandeau-who worked on the INFOEX for two winters is now working at Mt Mackenzie, a Revelstoke ski area.

Torsten Geldsetzer-has taken over the work done by Chris Whalley. His training as a climatologist and recent work as a system analyst will build on the solid foundation laid down by Chris Whalley.

EDITORIAL NOTE

The intention of *AVALANCHE NEWS* is to assist communication among persons and organizations engaged in snow avalanche work in Canada. Short articles cover accidents, upcoming and past events, new techniques and equipment, publications, personal news, activities of organizations concerned with avalanche safety, education and research.

The editor welcomes and expects contributions; all reasonable comments and discussions will be printed. The articles in *AVALANCHE NEWS* reflect the views of the authors; only when it is specifically stated do they represent the opinion of the Canadian Avalanche Association. No paid advertisements are carried. Suppliers who wish to draw attention to their products should send information to the editor who will publish a note when equipment has value in avalanche work and safety.

***AVALANCHE NEWS* is published three times per year. There is no subscription fee. Requests for copies and changes of address should be sent to the publisher.**

AVALANCHE RESOURCE AGENCIES

INFORMATION IN THIS RESOURCE LIST IS UPDATED ANNUALLY. NEW OR REVISED INFORMATION MUST BE RECEIVED BY 15 SEPTEMBER, 1994. PLEASE SEE LAST PAGE.

AVALANCHE CONDITIONS, SEARCH AND RESCUE

The following agencies and individuals maintain continuous observations of the snow stability and avalanche hazards in their areas. They are also equipped for search and rescue work.

PARKS CANADA

Banff	Telephone	Fax
Taped message:	403-762-1460	
Calgary (Western Region):	403-292-6600	762-4404
Banff Warden's Office:	403-762-4506	762-3240
Lake Louise Warden Office:	403-522-3866	522-3577
Avalanche control offices at:		
Sunshine Village-Banff:	403-762-2693	
Lake Louise Temple Research		
Mt. Norquay-Banff		
Emergency (24hr):	403-762-4506	762-3240

The Chief Warden
Banff National Park
P.O. Box 900
Banff, Alberta, T0L 0C0

Jasper	Telephone	Fax
Chief Warden (office hours):	403-852-6155	852-4775
Switchboard (24 hrs.):	403-852-6161/6156/6157	
Outlying office:	403-852-2356	
Sunwapta Warden's Office:	403-852-5383	

The Chief Warden
Jasper National Park
P.O. Box 10
Jasper, Alberta, T0E 1E0

Mt. Revelsoke & Glacier	Telephone	Fax
The Superintendent:	604-837-5155/7500	837-7536
Information concerning avalanche conditions:		
Taped message-Revelstoke:	604-837-6867	
Information-Rogers Pass:	604-837-6274	

Search and Rescue:
Chief Warden: 604-837-5155/7500
Warden Office, Rogers Pass: 604-837-6274

The Superintendent
Mount Revelstoke and Glacier National Parks
P.O. Box 350
Revelstoke, BC, V0E 2S0

Yoho	Telephone	Fax
Chief Park Warden	604-343-6324	343-6330
Box 99		
Field, BC, V0A 1G0		

Kootenay	Telephone	Fax
Chief Park Warden:	604-347-9361	347-9050
Box 220		
Radium Hot Springs, BC, V0A 1M0		

Waterton Lakes	Telephone	Fax
Information concerning avalanche conditions:		
Warden Office (off. hours):	403-859-5110	859-2279
Taped Message:	403-859-5105	
Emergency (24 hours):	403-859-2636	

Kluane	Telephone	Fax
Warden Office:	403-634-2251	634-2338
Main Office:		634-2686

The Chief Park Warden
P.O. Box 5495
Haines Junction, Yukon, Y0B 1L0

BC MINISTRY OF HIGHWAYS

Jack Bennetto, Manager
Gordon Bonwick, Mike Boissoneault
Snow Avalanche Program
4C 940 Blanshard Street
Victoria, BC, V8W 3E6
Tel: 604-387-6931 Fax: 356-8143

Avalanche Technicians:
Scott Aitken
Howe Sound District Avalanche Program
Box 260
Pemberton, BC, V0N 2L0
604-894-5495

Ed Campbell
Box 579
Hope, BC, V0X 1L0
604-869-2401

Bill Golley
Bag 4500
Merritt, BC, V0K 2B0
Tel: 604-378-9359 Fax: 378-9364
Coldwater Site: 604-378-4648 Summit Site: 604-378-6449

John Tweedy
Compartment 1
Lakeside Drive Group Box
Nelson, BC, V1L 6B9
Summer: 604-354-6724 Winter Tel: 604-354-1351 Fax: 354-1298

Bruce Allen
Box 710
Revelstoke, BC, V0E 2S0
Tel: 604-837-7685 Fax: 837-9407

Tony Moore
Box 127
Stewart, BC, V0T 1W0
Tel: 604-636-2625

Nic Seaton
Snow Avalanche Programs
4C 940 Blanshard Street
Victoria, BC, V8W 3E6
Tel: 604-987-9311/387-6361

Dave Smith
Kootenays Region
310 Ward Street
Nelson, BC, V1L 5S4
Tel: 604-354-6455 Fax: 354-6723

Al Evenchick
North West Region
400 - 4546 Park Avenue
Terrace, BC, V8G 1V4
Tel: 604-638-3334 Fax: 638-3587

BC MINISTRY OF PARKS

East Kootenay District
Box 118
Wasa, BC, V0B 2K0
Tel: 604-422-3212 Fax: 422-3326

West Kootenay District
R.R. #3 4750 Hwy. 3A
Nelson, BC, V1L 5P6
Tel: 604-825-4421 For info only: 825-9509

Garibaldi/Sunshine District
Box 220
Brackendale, BC, V0N 1H0
Tel: 604-898-3678 Fax: 898-4171

ALBERTA RECREATION AND PARKS

Kananaskis Country Region
Box 280
Canmore, AB, T0L 0M0
Emergency: 403-678-5508 Fax: 678-5505

Lloyd Gallagher-Alpine Specialist, Public Safety Co-ordinator
George Field-Alpine Specialist
Larry Stanier-Snow Study Observer

Peter Lougheed Provincial Park: 403-591-6300
Emergency (0800-1630): 403-591-7444
Bow Valley Provincial Park (0800 - 1630): 403-673-3663
Elbow District (Mon-Fri, 0800 - 1630): 403-949-3754

Ribbon Creek Emergency Center (all areas, 7 days, 24hrs):
403-591-7767

SKI AREAS

Brian Leighton
Whistler Mountain Ski Corp.
Box 67
Whistler, BC, VON IBO
Tel: 604-932-3434 Fax: 932-6374

Skat Peterson
Red Mountain Ski Area
Box 670
Rossland, BC, VOG 1Y0
Tel: 604-362-7384

Dave Aikens
Fernie Snow Valley Ski Ltd.
Ski Area Road
Fernie, BC, V0B 1M1
Tel: 604-423-4655

Niko Weis
Mt. Washington Ski Resort Ltd.
P.O. Box 3069
Courtenay, BC, V9N 5N3
Tel: 604-338-1386 Fax: 338-7295

Doug Yarwood
Whitewater Ski Resort Ltd.
Box 60
Nelson, BC V1L 5P7
Tel: 604-354-4944 Fax: 354-4988

Wayne Flann
Blackcomb Mountain
P.O. Box 98
Whistler, BC, V0N 1B0
Tel: 604-932-3141

Peter Amann, Avalanche Forecaster
Ed Robert, Assistant Avalanche Forecaster
Marmot Basin Ski Lifts Ltd.
Box 1300
Jasper, AB, T0E 1E0
Tel: 403-852-3816

HELICOPTER & SNOWCAT SKI OPERATORS

Canadian Mountain Holidays (CMH) Inc.
Box 1660
BANFF, AB T0L 0C0
Tel: 403-762-7100 Fax: 762-5879 Emergency: 403-762-7198

Colani Bezzola
CMH Snow Safety Co-ordinator
Tel: 604-348-2370 Fax: 348-2551

Franz Fux, CMH Adamants
Tel/Fax: 604-837-4245

Rob Rohn, CMH Bobbie Burns
Tel/Fax: 604-348-2226

Jocelyn Lang, CMH Bugaboos
Tel/Fax: 604-346-3391

Ernst Buehler (Dave Cochrane), CMH Cariboos
Tel/Fax: 604-566-9888

Bernhard Ehmann, CMH Galena
Tel/Fax: 604-369-2235

Ian Campbell, CMH Gothics
Tel: 604-837-4204 Fax: 604-837-3363

Dominic Neuhaus, CMH Monashees (Seasonal)
Tel: 604-834-7223 Fax: 834-7330

Buck Corrigan, CMH Revelstoke
Tel: 604-837-9344 Fax: 837-3644
or Regent Hotel: 604-837-2107 Fax: 837-9669

Stefan Eder, CMH Valemount (Seasonal)
Tel: 604-566-4487 Fax: 566-4111
or Alpine Motel: 604-566-4471 Fax: 566-4767

R-K Heli Ski Panorama BC
P.O. Box 695
Invermere, BC, V0A 1K0
Tel: 604-342-3889 Fax: 342-3466

Rudi Gertsch
Purcell Helicopter Skiing
Box 1530
Golden, BC, V0A 1H0
Tel: 604-344-5410 Fax: 344-6076

Peter Schlunegger
Selkirk-Tangiers Heli-skiing
c/o Box 59
Revelstoke, BC, V0E 2S0
Tel: 604-837-6161 Fax: 604-837-5460

Helicopter and Snowcat Ski Operators, continued

Allan Drury
Selkirk Wilderness Skiing
Meadow Creek, BC, V0G 1N0
Tel: 604-366-4424 Fax: 366-4419

Mike Wiegele Helicopter Skiing
Box 159
Blue River, BC, V0E 1J0
Tel: 604-673-8381 Fax: 673-8464

Tyax Heliski
Box 849
Whistler, BC, V0N 1B0
Tel: 604-932-7007 Fax: 932-2500

Herb Bleuer, Tyax Lodge Heliskiing
Tyaughton Lake Rd.
Gold River, BC, V0K 1P0
Tel/Fax: 04-238-2446

Whistler Heliski
Box 368
Whistler, BC, VON 1B0
Tel: 604-932-4105/1-800-661-9226 Fax: 938-1225

Kootenay Helicopter Skiing
Box 717
Nakusp, BC, V0G 1R0
Tel: 604-265-3121 Fax: 265-4447

MINING COMPANIES

Line Creek Resources
Line Creek Mine (Upper Elk Valley)
Box 2003
Sparwood, BC, V0G 2B0
Tel (24 hrs) : 604-425-2555 Fax: 425-7144

CANADIAN AVALANCHE CENTRE

Alan Dennis
Canadian Avalanche Centre
Box 2759
Revelstoke, BC, VOE 2S0
Tel: 604-837-2435 Fax: 837-4624

Public Avalanche Information Bulletin:
Recorded messages by selectable regions: **1-800-667-1105 (toll free).**

The Canadian Avalanche Centre supplies avalanche information and operates an Industry Information Exchange.

The Centre is not equipped for search and rescue work.

DOGS FOR AVALANCHE SEARCH

PARKS CANADA

Gordon Peyto
Glacier National Park
Revelstoke, BC, V0E 2S0
Bus/Fax: 604-837-6274 Res: 604-344-5041

Scott Ward
Banff National Park
Banff, AB, T0L 0C0
Bus (24hr): 403-762-4506 Fax: 762-3240 Res: 403-678-5554

ROYAL CANADIAN MOUNTED POLICE

The following dogmasters and their dogs have received special avalanche training:

Nelson Detachment, Cpl. T. M. Barter (Terry)
Tel: 604-354-5160/5184 Fax: 354-4841

Cranbrook Detachment, Cpl. Bill Henderson
Tel: 604-489-3471 Fax: 604-426-5240

Fort St. John Detachment, Cst. A. G. Soneff (Al)
Tel: 604-785-6617 Fax: 785-7138

Port Alberni Sub/Division, Cpl. Bruce McLellan
Tel: 604-723-2428/2424 Fax: 604-329-5061

Squamish Detachment, Cpl. C. H. Brandt (Cec)
Tel: 604-898-6911 Fax: 898-4712

Terrace Detachment, Cpl. L. Bretfeld (Lothar)
Tel: 604-638-0333 Fax: 635-7248

Vernon Detachment, Cpl. R. T. Boal (Tim)
Tel: 604-545-7171 Fax: 545-7961

Calgary Detachment, Cpl. Bill Hamilton
Tel: 403-291-6236 Fax: 403-230-5415

The following pass calls on to the Alberta Provincial Parks:
RCMP, Kananaskis, 403-591-7707

RCMP, Canmore, 403-678-5516

RCMP, Banff 403-762-2226

RCMP, Cochrane, 403-932-2211

CANADIAN AVALANCHE RESCUE DOG ASSN.

The following teams have BC PEP validation.
Russ Hendry, Invermere, BC.
Bus: 604-342-4200 Res: 604-347-6575

Wayne Bertrand, Kelowna, BC.
Bus: 604-765-3101 Res: 604-765-2359

Bruce Brink, Vancouver, BC.
Pager: 1-979-4050 Res: 604-657-3975

Kathy Calvert, Jasper, AB.
Bus: 403-852-6155 Res: 403-852-5071

Duncan Daniels, Calgary, AB.
Res: 403-242-5702

Steve Kuijt, West Fernie, BC.
Res: 604-423-6739

Rene Long, Whistler, BC.
Bus: 604-932-3141 Res: 604-932-4406

Robin Siggers, West Fernie, BC.
Bus: 604-423-4656 Res: 604-423-4892

Kirstie Simpson, Whitehorse, YT.
Res: 403-668-7302

Jan Tindle, Whistler, BC.
Bus: 604-932-3434 Res: 604-932-5196

Canadian Avalanche Rescue Dog Association
Rod Pendlebury, Secretary-Treasurer
25123-124th Avenue
Maple Ridge, BC, V2X 4K6
Pager: 604-979-6628 Res: 604-423-7932

Pat Coulter, Whistler, BC.
Res: 604-932-3434

PROVINCIAL EMERGENCY PROGRAM (P.E.P)
(Ministry of Solicitor General)

The British Columbia Provincial Emergency Program co-ordinates most local search and rescue groups in the Province. Enquiries can be directed to:

Provincial Government Emergency Operations Centre
Tel: 1-800-663-3456 Fax: 604-387-2957

Dave Brewer
Provincial Co-ordinator (Volunteers)
Search and Rescue
Provincial Emergency Program
1257 Lucking Place
North Vancouver, BC, V7J 3L5
Tel: 604-984-4915 Fax: 984-1745

Geoff Amy
Manager of Land/Inland Waters
Ministry of Attorney General
Provincial Emergency Program
3287 Oak Street
Victoria, BC, VX8 1P8
Tel: 604-387-5956 Fax: 387-9900

Scott Patch (AIR)
1917 Tenth Road
Kelowna, BC, V1Y 7S6
Tel: 604-861-7328 Fax: 861-7585

24hr Toll Free Emergency Number
Provincial Government Emergency Operations Centre
Emergency Co-ordination Centre (PEP-ECC)
Tel: 1-800-663-3456 Fax: 604-387-2957

PEP Zone Managers are located at:
Vancouver Zone
Robin Gardner
207 - 815 Hornby Street
Vancouver, BC, V6Z 2E6
Tel: 604-660-3723/3725 Fax: 660-2808

Chilliwack Zone
Mr. P. Harkness (Pat)
403 - 9200 Mary Street
Chilliwack, BC, V2P 4H6
Tel: 604-795-6408 Fax: 795-8427

Kelowna Zone
S. Patch
1917 Tenth Road
Kelowna, BC, V1Y 7S6
Tel: 604-861-7328 Fax: 861-7585

Kamloops Zone
Mr. M.E. Dyer (Murray)
102 - 310 Nicola Street
Kamloops, BC, V2C 2P5
Tel: 604-828-4357/372-3213 Fax: 828-4971

Nelson Zone
G. Hartley
310 Ward Street
Nelson, BC, V1L 5S4
Tel: 604-354-6399 Fax: 354-6561

Prince George Zone
Mr. B. Kelly (Bob)
505 - 280 Victoria Street
Prince George, BC,
Tel: 604-565-6115/6395 Fax: 565-6886

Terrace Zone
Mr. R. Salem (Rod)
203 - 3219 Eby Street
Terrace, BC, V8G 4R3
Tel: 604-638-3514 Fax: 638-3498

Vancouver Island Region
Mr. B. Akehurst (Barry)
368B 11th St.
Courtenay, BC, V9N 8H5
Tel: 604-334-2778 Fax: 334-1430

Note: All zone offices are call-forwarded to PEP-ECC when the offices are not staffed.

EDUCATION

TECHNICAL COURSES
Canadian Avalanche Association Training Schools
Box 2759
Revelstoke, BC, V0E 2S0
Tel: 604-837-2435 Fax: 837-4624

Courses for Professional Personnel
Inge Anhorn - Registration

AWARENESS COURSES
Federation of Mountain Clubs of British Columbia
336 - 1367 W. Broadway
Vancouver, BC, V6H 4A9
Tel: 604-737-3053 Fax: 604-738-7175

Canadian Ski Patrol System
T. Simper, National Avalanche Training Officer
RR2, Box 1117
Okotoks, AB, T0L 1T0
Bus: 403-938-2101 Fax: 938-6020 Res: 403-938-2131

Bear Enterprises Ltd.
Box 4222
Smithers, BC, V0J 2N0
Bus: 604-847-2854 Fax: 847-4533 Res: 604-847-3351

Ptarmigan Tours
Box 11
Kimberley, BC
Tel: 604-422-3270 Fax: 422-3566

Michael Zylicz Consulting
1385 11th Avenue
Williams Lake, BC, V2G 2N1
Tel/Fax: 604-392-7016

Columbia Mountain Recreation
Box 990
Golden, BC, V0A 1H0
Tel/Fax: 604-344-6322

Cirrus Mountaineering
RR #1 1034 Highway 3A
Nelson, BC, V1L 5P4
Tel: 604-354-3820

Stellar Consulting Services Ltd.
Box 450
Rossland, BC, V0G 1Y0
Tel: 604-362-5314
or Box 1193
Revelstoke, BC, V0E 2S0
Tel: 604-837-5022

Snowline Technical Services
7943 48th Ave NW
Calgary, AB, T3R 2A7
Tel: 403-288-7541

AVALANCHE FILMS & VIDEOS

Avalanche - 50 minutes
Ministry of Health
Audio-Visual Library
1515 Blanshard Street
Victoria, BC, V8W 3C8
604-387-6468

The Snow War - 25 minutes
National Film Board Library
100 - 1045 Howe Street
Vancouver, BC, V6X 2B1
604-666-0716
1-800-661-9867

Avalanche - 12 minutes (Video)
Kananaskis Country
Recreation and Parks
Box 280
Canmore, AB, T0L 0M0
403-678-5508

Avalanche Terrain - 9 minutes (Video)
Snow Profile Observation - 8 minutes (Video)
Alan Dennis
Canadian Avalanche Centre
Box 2759
Revelstoke, BC, V0E 2S0
604-837-2435

Avalanche Dynamics: order # 719176 $90. US (Video VHS NTSC)
Snow Metamorphism: order # 719907 $90. US
University of Washington
Box 50096
Seattle, WA, USA, 98145
206-543-4050

In the Mountain's Shadow - 8 minutes (Video)
The Eyes Multimedia Productions
BC Ministry of Transportation and Highways
Snow Avalanche Programs
4C - 940 Blanshard Street
Victoria, BC, V8W 3E6

WEATHER OFFICES

Atmospheric Environment Service

P. Pender
Regional Director General
1200 West 73rd Avenue
Vancouver, BC, V6P 6H9
604-664-9190

G. E. Wells
Pacific Weather Centre
1200 West 73rd Avenue
Vancouver, BC, V6P 6H9
604-664-9000

E. Coatta
Climate Information
700-1200 West 73rd Avenue
Vancouver, BC, V6P 6H9
604-664-9156

The Regional Director
Atmospheric Environment Service
Rm. #240, 4999-98th Avenue
Edmonton, AB, T6B 2X3
403-495-3143

Weather Offices in British Columbia
(area code 604)

Location	Office	Public Forecast Tape	Mountain Forecast Tape	Open Hours (local time)
Castlegar	**—**	**365~3131**	**—**	**0630~1600**
Fort Nelson	*774~2302*	*774~6461*	---	*0200~1700*
Fort St John	**785~4304 Fax: 6332**	**—**	**—**	**0700~1500**
Kamloops	*376~2160*	*376~3044*	---	*0630~1700*
Kelowna	**491~1511/1525**	**765~4027**	**765~1500 (Seasonal)**	**0445~0015**
Pacific Weather Centre	*664~9053*	---	---	*24hrs*
Port Hardy	**949~6559**	**—**	**—**	**0715~1715**
Prince George	*963~7710/7552*	*963~9330*	---	*0215~0515/0515~2115*
Terrace	**635~3224**	**—**	**—**	**0710~1710**
Vancouver	*664~9032/9031*	*664~9010*	*664~9021*	*24hrs*
Victoria	**363~6629/6630**	**656~3978**	**—**	**24hrs**

WEATHER OFFICES IN ALBERTA AND YUKON
(area code 403)

Location	Office	Public Forecast Tape	Mountain Forecast Tape	Open Hours (local time)
Banff	**762-4707**	**762~2088**	**762~3091**	**0600~1700**
Whitehorse	*667~8454*	*668~6061*	---	*24hrs*
Alberta Weather Centre	**468~7925/7927**	**468~4640**	**—**	**24hrs**
Calgary	---	*275~3300*	---	---

Changes, additions or deletions to the Avalanche Resource List can be made by filling in the form below and mailing it to:
Canadian Avalanche Association, Box 2759, Revelstoke, BC, V0E 2S0
604-837-2435

NAME: _____

ADDRESS: _____

PHONE: _____ **FAX:** _____ **BULLETIN BOARD:** _____ **eMAIL:** _____