CANADIAN AVALANCHE ASSOCIATION

AVALANCHE NEWS

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Avalanche News
Number 47
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CANADIAN AVALANCHE ASSOCIATION

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Tel: (604) 837-2435 Fax: (604) 837-4624

January 9, 1996

To:

Canadian Avalanche Association Members:

Re: CAA Executive Meeting Brief

The Executive of the Canadian Avalanche Association met on September 18th, 1995. This memo is being forwarded to all CAA members to keep you informed of the Association's business. The following items were discussed.

Search and Rescue Video

- A short version of the Search and Rescue video being made for the Canadian Avalanche Association will be submitted to the Banff film festival. Marc Ledwidge pursued this further with Karl Klassen -- it was subsequently decided that we would submit the completed video for next year's film festival and keep the short version for other promotional opportunities.
- The film contractor, Karl Klassen, will be asked to supply a projection of the finished costs of the project, and an outline of how this projection will be achieved.

Professionalism in the CAA

- Charity status for the CAA has been pursued by Alan Dennis to help with funding initiatives -- especially for the public information bulletin. However, our applications for charity status have been turned down because we are registered as a non profit *professional* society.
- Professionalism within the Association was discussed at length. A number of issues were covered, including the CAA's discussions with APEGBC. It was decided that the Executive should strive to maintain and to improve the level of professionalism in our Association. It was decided that some improvements could be made through better information dissemination by:
    - mailing out briefs of the meetings of the Executive (this memo);
    - committees preparing reports prior to each Executive meeting, and making them available for publication in the *Avalanche News*.
- CAA business issues regarding committee responsibilities (e.g., explosives and recoilless rifles) are often directed to the CAC. It was decided that these issues should be forwarded to the respective committee.
- Membership criteria were discussed, it was decided to leave the membership qualifications as they are.

.../2

BC Snowmobile Association

- Phil Hein discussed his attendance and interaction at the B.C. Snowmobile Association Executive meeting. He found it interesting. The CAA will continue to promote positive relations with the Snowmobile Association.

Canadian Ski Patrol System

- CSPS requested CAA to provide recommendations regarding CSPS avalanche training courses. A decision was made to provide assistance for CSPS avalanche training courses by having the education committee review their training materials, instructor qualifications and make recommendations where appropriate.

Financial Statements

- Reviewed.

CAA Committee Reports

- Reviewed.
- Committee reports and significant correspondence should be forwarded to Alan Dennis for filing. A copy should also be forwarded to the Secretary Treasurer.

Avalanche Safety Workshop

- Coordination and management of this workshop were discussed.
- The workshop was held at the University of Calgary, November 25 and 26. Karl Klassen managed the workshop agenda and coordinated speakers. Bruce Jamieson and Karl Klassen developed the theme for the workshop. Mike Mortimer and Brendan Clark managed the promotion and commercial aspects. Tony Daffern and Mike Mortimer chaired the sessions. Alf Skrastins managed site coordination at the University. All speakers volunteered their time.
- The workshop was a success, both financially and in promoting avalanche safety.
  To all who worked on this workshop - Thanks!

Next Directors Meeting

- Blue River, March 29, 1996.

Bruce Allen
Secretary Treasurer

In This Issue:

AVALANCHE NEWS is published three times per year by the: Canadian Avalanche Centre Box 2759, Revelstoke, BC, Canada, V0E 2S0 604-837-2435

Winter avalanche information is available from DECEMBER TO APRIL from the Canadian Avalanche Association.

PHONE:

- **In Alberta and BC call: 800-667-1105**
- **In Calgary, call the Calgary Herald Talkies: 403-243-7253 then dial SNOW (7669)**
- **In Vancouver call: 604-290-9333**

ELECTRONIC INFORMATION

- **Canadian Avalanche Association BBS: 604-837-4893 (8N1 to 9600baud)**
- **http://www.csac.org**

FAX

- **Call for information: 604-837-2435**

The deadline for the next issue is February 15, 1995. Material may be sent to the Canadian Avalanche Centre. Submit typewritten hardcopy or a PC diskette in Word, WordPerfect, or ASCII format. Illustrations should be submitted as hardcopy or in electronic form (.TIF, .WMF, .CGM are preferred). In all cases, send a printed copy of your submission in addition to electronic formats. Please contact the Avalanche Centre for more information.

Canadian Avalanche Centre update

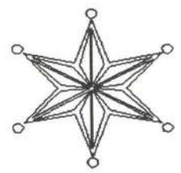
The most noteworthy change at the Canadian Avalanche Centre this summer is that Inge Anhorn has left and is now pursuing other activities in Revelstoke, including the completion of condominiums that she built this summer. Inge worked at the Avalanche Centre since it opened in 1990 and saw the development of the schools from seven courses per year to sixteen. The Information Exchange and Public Safety activities of the Centre were ideas when she started at the Centre and she made an important contribution to their growth. We wish her the best with all the new endeavours she has undertaken.

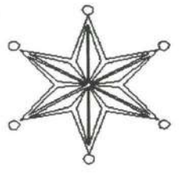
During the summer Mark Moore of the North West Avalanche Centre did heroic work on establishing an Avalanche Danger Scale that would be acceptable and workable for all of North America. This was an exercise that truly tested the democratic committee process of decision making. Over the next year it looks as though all avalanche forecast centres will be using a similar scale and set of descriptors for avalanche conditions. The Danger Scale shown on the following page is to be used in Canada this winter. There are some minor revisions required next year to make this scale compatible with the scale agreed on in the late fall at the AAAP meeting. This was after Canadian Danger Scale cards were printed for the winter.

Torsten Geldsetzer is running the Information Exchange (InfoEx) this winter with assistance from Laura Howatt. He keeps talking about missing the Rockies but really knows the best touring is much closer to Revelstoke. The Information Exchange is attracting more subscribers which is a credit to its success. It is hard to remember that there was a day when there was no InfoEx. Remember also there was a day when there were no pull wire igniters and people lit charges with a cigar. No one does that anymore. The Information Exchange has a slightly different format and the data is based on the new Observation Guidelines and Recording Standards for Weather Snowpack and Avalanches.

The instructors of the Canadian Avalanche Association Training Schools had their annual training meeting in November. Peter Schaerer who was the Education Committee chairman for many years wants to retire. Already this year we have found that it takes three people to do the work he did. Phil Hein, Jim Bay, and Scott Flavelle are trying to fill the gap. The new Observation Guidelines and Recording Standards for Weather Snowpack and Avalanches, referred to as the "white book", and other new course material developed during the summer by the Education Committee and Janice Johnson were introduced at the fall meeting in Revelstoke. Torsten Geldsetzer who did a significant portion of the work on the "white book" introduced the session to a quiz on the book. This was a self-marked test with no results officially kept. Judging from the shocked responses when the answers were given it is just as well no record was kept. There is a lot of work to be done by the instructors to be sure they know the new book. This year 16 courses are scheduled compared with eight in the winter of 1991-92. A first of its kind will be a Level 1 course for Snowmobile Operations, please call the CAC for details.

The first Avalanche Bulletin of the season was prepared on the 7th of November. Already a number of people have been caught by avalanches and one complete burial in the Yukon. The 'lucky' person was found by his friend who was beating a ski he found against the surface and uncovered his friends hand. He was dug out unconscious but recovered.





Avalanche Danger Scale

Avalanche Safety Basics

Always practice safe route finding. Remember that all avalanches may be lethal and even very small slides may be dangerous if they carry an unwary back country traveller into or over terrain traps like cliffs, rocks, trees, or creeks. However, please note that no matter what the hazard, there are avalanche safe areas in the mountains. Contact local authorities for current information. Remember: any geographic, aspect, and elevation distinctions listed are approximate and transition zones exist.

Danger Level *Colour* —WHAT—	Avalanche Probability *Trigger Size* —WHY—	Recommended Action —WHAT TO DO—
LOW GREEN	Natural slab avalanches highly unlikely; human triggered releases unlikely; sluffs possible.	Travel is generally safe; normal caution advised.
MODERATE YELLOW	Natural slab avalanches unlikely; loose or human triggered slab avalanches possible.	Use caution in steeper terrain on certain aspects.
CONSIDERABLE ORANGE	Natural or loose avalanches possible; human triggered slabs probable.	Use increasing caution. Be aware of potentially dangerous areas.
HIGH RED	Natural and human triggered slab or loose avalanches likely.	Travel in avalanche terrain not recommended; safest travel on windward ridges or lower angle slopes without steeper terrain above.
EXTREME RED with BLACK BORDER	Numerous natural avalanches certain and slabs easily triggered by humans.	Travel in and near avalanche terrain should be avoided; travel only in low angle terrain well away from avalanche path runouts.

Notices

ISSW 96

The International Snow Science Workshop (ISSW96) will be held at the Banff Centre in Banff, Alberta from October 6 to 10, 1996 The theme will again be "A merging of theory and practice".

Workshop Format

Following an opening presentation and mixer on Sunday evening, there will be four days of meetings, poster displays, commercial exhibits, slide and video presentations, and a banquet. An optional overnight field trip to the avalanche control program at Rogers Pass will leave after the afternoon session on October 10th.

Topics

- Mountain Weather and Snowpack
- Avalanche Education and Warning Programs
- Avalanche Initiation and Forecasting
- Backcountry Avalanche Operations
- Boundary Issues in Avalanche Operations
- Remote Sensing of the Snowpack
- Data Management for Weather, Snowpack, and Avalanches
- Avalanche Hazard Management and Mapping
- Avalanche Dynamics and Defence Structures
- Avalanche Control
- Avalanche Rescue

All persons interested in making a presentation are invited to send an abstract of 200-500 words or less by April 15, 1996 to:

C.D. Johnston
ISSW 96 Papers Committee
Dept. of Civil Engineering
University of Calgary,
2500 University Dr. NW
Calgary, Alberta, T2N 1N4
Canada
Fax: (403) 282-7026
Phone: (403) 220-6599
e-mail:
ISSWpapers@enci.ucalgary.ca

Papers and posters may be sent on disk or by e-mail in Word, WordPerfect, or text formats. Guidelines for effective use of the Banff Centre a/v equipment will be sent to all presenters. For papers to be included in the proceedings they should be received by Sept. 15, 1996.

Registration

Form below.
Before March 1, 1996 $Cdn110 $US80
After March 1, 1996 $Cdn125 $US90
Payment may be made payable to the Banff Centre for Conferences.

ISSW 96 Registration Form

Name:_____ Affiliation:_____
Address:_____
Tel:_____ Fax:_____ Email:_____
Amount Enclosed:_____ ☐ $US ☐ $Cdn
☐ Will Attend Conference
☐ Interested in Bus Trip to Rogers Pass (fee not included)
☐ Plan to submit paper. Title:_____
☐ Plan to submit poster. Title:_____
☐ Commercial exhibit. Description:_____
☐ Film/Video/Slide Set. Desc./Length:_____
Submit to: Banff Centre for Conferences
Box 1020, Station 15
Banff, AB
T0L 0C0

Visiting Avalanche Researcher

This winter Juerg Schweizer will be working in Canada and turning on the power in the cold lab at Rogers Pass for the first time in over five years.

Juerg is a research associate (with a Ph.D. in glaciology) from the Swiss Federal Institute for Snow and Avalanche research at Weissfluhjoch/Davos, Switzerland. His one year visit to Canada is within the framework of the Swiss National Science Foundation and the National Science and Engineering Research Council (NSERC) exchange program. His principal affiliation is with the University of Calgary (C.D Johnston and B. Jamieson). Other cooperators in this joint Swiss-Canadian research project are Dave McClung of the University of B.C. and Dave Skjonsberg of Parks Canada.

During the winter he will reside in Revelstoke to work primarily at the Rogers Pass cold lab, where he will study the temperature dependence of the snow strength using a direct simple shear apparatus, and follow the evolution of the strength of weak layers in the field. There is a long history of young European scientists coming to Canada to improve their knowledge and experience in avalanche research on an international level. We are lucky for that.

Juerg is interested in everything going on in the avalanche community; he can be reached at the CAC in Revelstoke or by e-mail:

jschweiz@enci.ucalgary.ca.

CSPS Brochure

The Canadian Ski Patrol System (CSPS) has produced a new Awareness brochure. Copies are available from the CAC in Revelstoke.

Notices

Personal News

We are pleased to announce that Dr. Bruce Jamieson has received his PhD. for his thesis work in "Avalanche Prediction for Persistent Snow Slabs". Bruce has made a significant contribution to the identification and testing of hazardous avalanche conditions in the field. His work with the Rutschblock test has lead to its adoption as one of the preferred field tests by the CAA Congratulations Bruce!! Bruce is continuing on a project in collaboration with Colin Johnston and the B.C. Helicopter and Snowcat Skiing Operators Association studying persistent instabilities and triggering phenomena.

International Symposium on Snow and Avalanches

First Circular October 1995

The International Glaciological Society will hold an international symposium on snow and avalanches in at the Salle des Congrès Majestic, Chamonix Mont-Blanc, France from May 25 to 30, 1997. The theme is the properties of snow in mountain and polar regions and the processes taking place within the snowcover.

Topics

- Snow properties, mechanical, electro magnetic, and radiative
- Modelling snow & ice chemistry processes
- Snow cover distribution, stability, evolution, & modelling
- Snow structure
- Snow drifting / blowing snow
- Avalanches
- Avalanche Dynamics
- Risk assessment
- Model verification
- Slush flows

Sessions

Oral presentations will be held on four full days and one half day with ample time for poster displays.

Publication

The Proceedings of the symposium will be published by the Society in the *Annals of Glaciology*.

Accommodation

Details will follow in the second circular. A full range of hotel accommodation will be available.

Excursions

There will be a mid-week excursion to the Aiguille du Midi (3800 m a.s.l) or Mer de Glace and a post-symposium tour to Nice.

Further Information

If you wish to attend the symposium or submit a paper return the form (below) as soon as possible to receive the second circular.

"APATIT" JSC Glacaiological Association

First Circular October 1995

In 1996 the Centre of Avalanche Safety of "Apatit" will be sixty. The avalanche work in Russia started in the Centre in 1936. This the first international conference on avalanches to be held in Russia. The objective is to provide a forum for the exchange of ideas and information between the world avalanche community and Russian avalanche community. The conference will be held from September 2 to 6, 1996 in Kirovsk, Murmansk Region, Russia. The theme is "The contribution of theory and practice to avalanche safety".

Topics:

- Snow cover stability
- Avalanche Dynamics
- Time and spatial avalanche forecasting
- Geography of avalanches
- History of studies and the struggle against avalanches
- Avalanche control techniques
- Avalanche protection
- Avalanche awareness, education, and public warning systems
- Avalanche search and rescue
- Properties of snow and snow cover evolution
- Snow drift
- Instrumentation
- Other related topics

International Glaciological Society
Symposium on Snow and Avalanches

Last Name:_____ First Name:_____

Address:_____

Tel:_____ Fax:_____ Email:_____

☐ I hope to participate in the Symposium in May 1997

☐ I expect to submit an abstract.

My abstract will most closely relate to the following topic(s):

_____

☐ I hope to join the post-symposium tour.

☐ I am interested in an accompanying persons program.

Submit to: Secretary General
International Glaciolocical Society
Lensfield Road
Cambridge, CB2 1ER, U.K.

Notices

Abstracts

Abstracts of 500 word or less should be sent to the paper committee (same address as the registration). Abstracts should be single spaced , typed in English on A4 white paper. All abstracts must include:

1) a title in capitals centred on top of the first page.
2) name of the author, with affiliation, address, telephone, and fax centred below the title. If selected a camera ready copy is required at the conference.

Sessions

Oral presentations should be 20 minutes in length with a 10 minute discussion period.

Publication

The papers will be published in the proceedings of the conference.

Fees

The conference fees are in rubles equivalent to 75$US payable on arrival at the conference.

Accommodation

Details will follow in the second circular.

Further Information

All persons interested in making a presentation are invited to send an abstract of 500 words or less by April 1, 1996 to:

Centre of Avalanche Safety
33"a", 50 years of October st.
Kirvosk, Murmansk region
184230 Russia.
Fax: +4778914124
Phone: +78152196230
e-mail: master@apatit.murmansk.su

Return the form below as soon as possible to receive the second circular.

APATIT Glaciological Association
Registration Form

Name:_____ Affiliation:_____

Address:_____

Tel:_____ Fax:_____ Email:_____

Amount Enclosed _____ US$ ☐ CDN$ ☐

☐ Will Attend Conference

☐ Plan to submit paper. Title:_____

☐ Plan to submit poster. Title:_____

☐ Commercial exhibit. Description:_____

☐ Film/Video/Slide Set. Desc./Length:_____

Submit to: Banff Centre for Conferences
Box 1020, Station 15
Banff, AB
T0L 0C0

Avalanche Transcievers

The Canadian Avalanche Centre has used avalanche transceivers for sale. These units are one year old and have been used only on courses. Cost is $210. Please contact the CAC if interested.

IMASURVIVOR

A Survival Kit Sealed in a Can

IMASURVIVOR is a locally manufactured product for emergency rescue and survival. The sealed container contains:

- a weatherproof shelter
- 50 hours of fuel and stove
- spoon, knife, pot, and soup mixes
- mirror, whistle, and Morse code
- tourniquet, gauze pads
- firestarters, waterproof matches
- survival hints and instructions
- water purification still
- 19 ft. of cord

To order, send $24.95 + GST to:
A.J.M. Enterprises
#101 1710 Kosinina Rd.
Kelowna, B.C. V1T 8T2
ph (604)545-0800/fax (604)545-0866

Avalanche Marker Bag

The Avalanche Marker Bag was developed with the Gendarmerie squad for high mountain rescue in Chamonix, France. During a rescue with several teams, it is difficult to accurately convey all information (zones already probed, dog markings, equipment found, etc.) to a new team. A system of colour codes with flags and markers to indicate the state of a search is available in a single 13kg weather resistant canvas backpack 70cm x 40cm x 20cm. The bag contains:

- 10 orange flags for avalanche dog
- 10 yellow flags for transceiver
- 10 blue flags for victim material
- 50 black and yellow flags for transceiver
- 100 red flags to delimit probed areas
- 50 green flags to mark safe zones
- 1 plastic mesh sign 50cm x 70cm reading <<DEPOSIT OF MATERIAL>>
- 1 sign marked <<A>> to identify leader
- 500 grams red colouring with high diffusion in snow
- plastic covered clip board, pen, and forms
- whistle with security cord for the watchperson

For the cost and more details contact:
Paul Chassagne
L.B. TUTOR SEÇURITE
81 Avenue du Progrés
69680 CHASSIEU, FRANCE

Weather monitoring systems for avalanche forecasting.

Milford Road, New Zealand.

Peter Weir, P. Geo. and Wayne Carran.
Works Civil Construction Ltd,
Milford Road, New Zealand

Geography and Climate

The Milford Road traverses Fiordland National Park in the south west of the South Island of New Zealand (around 45oS latitude; similar to Northern Oregon). The road climbs to an elevation of 945 m where it traverses under the Homer Saddle between Mt. MacPherson (1935 m) and Mt. Moir (1962 m) in a 1.2 km long tunnel before descending 18 km to sea level at Milford Sound on the west coast. It is the only public road in N.Z. that is affected by avalanches and has the country's only avalanche programme.

The terrain features deep U shaped valleys left behind following the retreat of large glaciers around 14,000 years ago. Large avalanche start zones (up to 60 ha in area) exist above the steep valley walls that are typically around 50° to 65° declination (Fitzharris and Owens, 1980).

Fig 1. Milford Sound located in SW of South Island, New Zealand.

The climate is generally a mid latitude maritime, that features very high precipitation (maximum daily rates have exceeded 400 mm with monthly totals exceeding 1000m and annual totals in excess of 7000 mm). Orographic precipitation is common with maximum precipitation rates occurring during strong winds from the westerly quarter. Convective activity is also common. Frontal passages often feature tremendous displays of thunder and lightning.

The area can experience highly variable freezing levels during storms but on rare winters the freezing level can remain below the base of the mountains for weeks bringing large accumulations of snow to the valley floors (as was the case in 1995) .

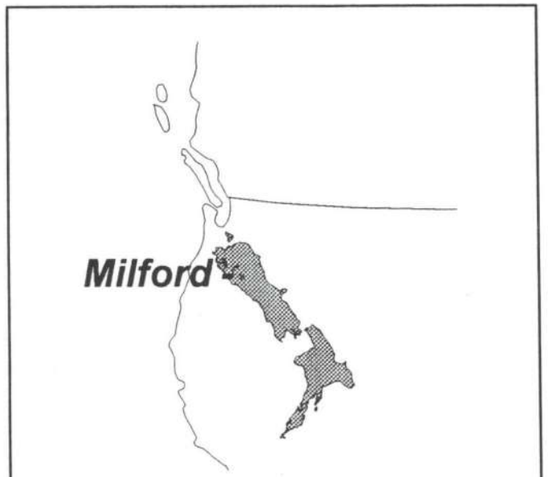


Fig 2. Relative latitude of NZ to continental North America

Avalanche environment

The Milford Road is a direct action avalanche environment, with avalanche activity often occurring in direct response to storm events. The avalanche start zones are difficult to access, and a helicopter is required for field work. Avalanche forecasting relies largely on Class 1 data (avalanche observations and control results) and class 3 data (meteorological information recorded by automatic weather stations and precise Meso Scale weather forecasts). Snowpack measurements are difficult, and often impossible, to obtain because of severe weather and difficult access to the start zones.

The avalanche programme for the Milford Road was established in 1984 by the now defunct Ministry of Works and Development (MWD) following the death of the road foreman in an avalanche during maintenance operations. In 1988 the MWD was disbanded and its engineering services privatized. A state owned enterprise called Works Civil Construction Ltd was subsequently formed.

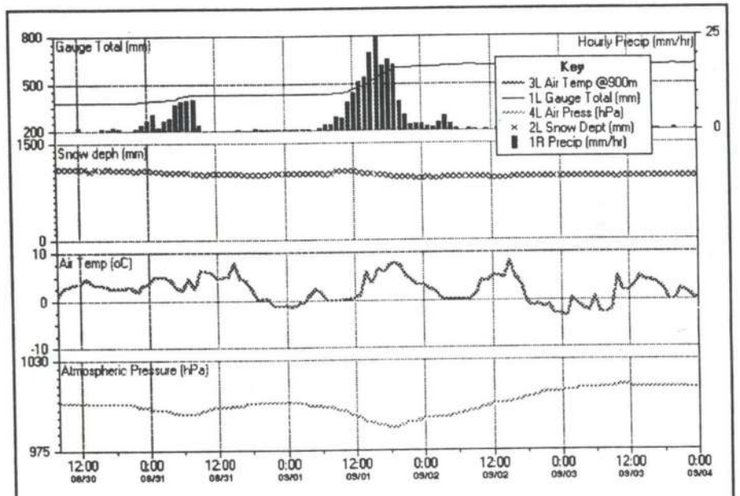
In 1990 road maintenance was privatized in New Zealand in accord with changing Government policy. Since that time, Works Civil Construction Ltd, a corporate member of the Canadian Avalanche Association, has operated under contract to New Zealand's road authority, Transit N.Z., to undertake road maintenance and provide an avalanche hazard reduction and control programme on the Milford Road. The provision of a VHF radio communication system and servicing of automatic weather stations remains a part of the contract which is tendered every three years.

Search and rescue training is done in conjunction with local police, fire fighters, and National Parks staff. Close liaison is maintained with tour operators, local fishermen who operate out of Milford Sound, and other road users.

Weather data acquisition systems

Transit N.Z. have funded a network of four automatic weather stations based on Campbell Scientific data logging equipment. The stations adopted sensor configurations developed by the British Columbia Ministry of Transportation and Highways (BC MoTH) Snow Avalanche Program.

Weather information is telemetered 75 km back to Works Civil Construction's depot in Te Anau by high power VHF radio. Data can also be interrogated via a Laptop PC in the avalanche programme vehicles and graphed in real time using a program named "Visualog". The ability to monitor variations in precipitation intensity and freezing level is particularly useful when storms are developing.



Time series weather plot as displayed on a PC in an avalanche patrol vehicle.

Station name	Consolation Peak	Mt. Belle	East Homertunnel	West Homertunnel
Elevation (m)	1800	1600	900	800
Air temperature	✓	✓	✓	✓
Precipitation			✓	✓
Snow depth		✓	✓	
Wind speed & gust	✓	✓		
Wind direction	✓	✓		
Atmospheric pressure			✓	
Snowpack temperatures		✓		

The table shows the parameters that are measured at the automatic stations.

Relative humidity and solar radiation have been measured in the past but these parameters were discontinued in recent years. Relative humidity is not considered an important parameter in this environment.

The BC MoTH standpipe precipitation gauges have proven particularly successful at Milford. The gauges use a 0 to 2 psi (0 to 14 kPa) pressure transducer to give a capacity of 1200 mm with a resolution of no better than 3 mm. This coarse resolution is not a constraint because of the region's high precipitation regime.

Considerable effort and expense have gone into lightning protection systems at the ridge top stations. Broad flat (60 x 4 mm) copper straps extend from well above the highest point on each station down to well below the ridge lines. All cable shields are bonded to the lightning dissipation system and electronic protection systems are fitted where ever practicable. The radio antenna cable receives special attention.

In the mid 1980s Works developed an innovative anemometer de-riming system for its high level weather stations. A high pressure pump was used to spray isopropyl alcohol over the anemometer. This system was later adopted by the BC Ministry of Transportation and Highways Avalanche Program for de-riming of their wind sensors

In early summer any high level station in need of maintenance can be unbolted from its foundation on the mountain and flown by helicopter as one complete unit to a maintenance yard. This enables electronics technicians to work on the station in an sheltered warm and easy accessible environment.

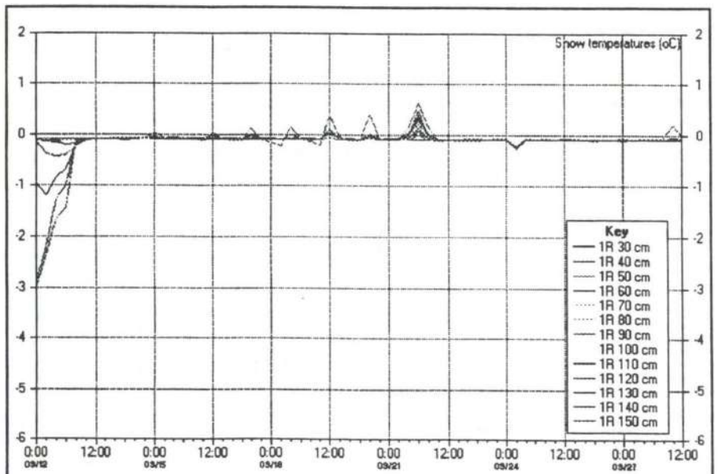
The BC Ministry of Transportation and Highways Avalanche Program has employed snow temperature poles for several years to monitor the temperature regime in the snowpack (Weick and Campbell, 1992). A mechanical multiplexer is used to apply an excitation voltage to YSI resistive thermistor beads and the resultant voltage linearised by a fifth order polynomial expression in the datalogger to produce a snowpack temperature. The thermistor beads are mounted in a drilled out alloy grease fittings which are mounted at 20 cm intervals in a 76 mm diameter custom made fibreglass tube. The tube is filled with styrofoam beads to minimise convective temperature transfers.

Gaza and Turner (1989) describe a thermocouple based snowpack temperature monitoring device constructed from a single fine constantan wire (30 awg) suspended vertically through the snowpack with 17 chromel wires joining it at 10 cm intervals. Their design offers the benefit that there is no sensor supporting device (eg a hollow tube) to absorb radiation and thus cause cavitation in the snow. The fine wire thermocouples minimise temperature conduction in the system. However this design was considered too light for the Milford environment which can feature heavy rime ice accretion and significant snow creep.

Works Civil Construction Ltd has refined the BC MoTH technology by employing small diameter (0.5 mm) low cost thermocouples (pairs of dis-similar alloy wires twisted and fused together to form a temperatures sensitive junction) in preference to the more expensive thermistors. A new generation of low power solid state multiplexer was employed to feed the signal from 25 thermocouples into a single datalogger channel.

Temperate sensors were mounted through holes drilled in 6 mm diameter nylon bolts spaced at 10 cm intervals up to 1.5m and every 20 cm thereafter on a white painted 4 m high tapered fibreglass tube (a wind surfer mast). The use of readily available components makes this monitoring device easy to construct. A snow pack temperature pole represents a simple upgrade for any existing automatic weather station system.

The snowpack temperature measurement system allows staff to monitor the penetration of warm rain into the snowpack, the cooling that occurs through outgoing long wave radiation on clear nights, and the seasonal change in snowpack from cold dry winter to spring conditions when the pack becomes isothermal at zero degrees (as shown on the extreme left of following graph).



A simple snowpack temperature monitoring system.

Acknowledgment:
Transit New Zealand encouraged the development and innovation that contributes to increased road safety on the Milford Road.
The work of Stewart Hall, Works' radio communication technician, is acknowledged.

References:

Fitzharris, B.B. and Owens, I.F., 1980. Avalanche atlas of the Milford Road and an assessment of the hazard to traffic. New Zealand Mountain Safety Council, Wellington. Report No. 4, ISSN 0110-9499, 79p.

Gaza, B and Tanner, B. 1989. Remote measurement of Snow Depth and Temperature. The Tripod; news and notes about automated weather station applications. Institute of Agriculture and Natural Resources University of Nebraska-Lincoln. p 3-4.

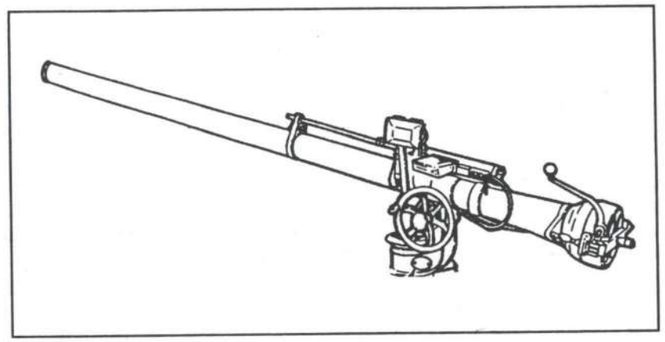
Weick, E.J. and Campbell, E., 1992: Weather stations of the Ministry of Transportation and Highways. Province of British Columbia, Unpublished report. 65p.

Alpine Meadows accident investigation - update

Mike Boissonneault

It is just over a year now since the fatal incident during target registration with a 106mm recoilless rifle at Alpine Meadows Ski Resort in California. US Forest Service Snow Ranger, Roger Evans, suffered a fatal injury as a result of an in-bore detonation of the third projectile used during that particular mission. Although there were five others on the gun deck at the time, it is simply amazing that no one else suffered any physical injuries.

The immediate action of the US Forest Service (USFS) was to suspend any further use of 106mm recoilless rifles for avalanche control. Subsequent action taken by the B.C. Ministry of Transportation and Highways was to suspend use of 105mm HEP-T ammunition as the fuse used in those rounds were identical to the one involved in the incident. Parks Canada also suspended use of their newly acquired 106mm recoilless rifles (intended to replace the 105mm Pack Howitzer program). Shortly after the incident the USFS permitted use of the 106mm recoilless rifle, providing it was fired under precaution. This allowed selected areas to provide safety in their avalanche programs as well as safety to personnel who operated the rifle. Using the rifle under "precaution" involves a safe and reliable method to remotely fire the weapon while personnel are protected behind a metal barrier.



An investigation to determine the cause of the accident was immediately launched by the US Forest Service under the direction of Doug Abromeit (Director of the National Avalanche Center). Artillery accident investigators from Picatinny Arsenals in New Jersey were called to the scene on the day following the accident. Despite the emotional trauma of individuals involved and the media circus, the USFS and Picatinny accident investigators began to collect information and perform interviews in an attempt to determine how and why the accident occurred.

At a meeting of the Avalanche Artillery Users of North America Committee (AAUNAC) in Alpine Meadows on August 23, 1995, chief accident investigators from both the US Forest Service and Picatinny Arsenals presented information regarding the status of the investigation, as follows:

- the 106 rifle was tested for metal defects just before the incident and was found in good shape. The number of rounds through the tube and breech were well within acceptable levels. Tests performed on the rifle and rifle fragments confirmed that the rifle did not contribute to the in-bore detonation. Approximately 50cm was blown off the end of the tube;

- the M91A1 fuse did not function, and the projectile detonation was "low order". This was confirmed by the amount of Comp A3 explosive material found around the gun platform (approximately 1 kg). If the fuse had functioned there would not be any explosive material found and the projectile would have functioned "high order";

- numerous fragments were found. The majority of fragments were recovered just in front and to the right side of the gun platform. The farthest distance traveled by a fragment was 215 meters. Most fragments were from the rifle and not the projectile. Some fragments impacted projectiles on the gun deck surface;

- Picatinny Arsenals investigation of 114 of the M91A1 fuses discovered that approximately 20% of the fuses were in "very poor" condition. They were covered with rust. Their ability to function in the field was considered "suspect". Many other fuses had some rust but were in better condition. None were considered "perfect". Due to these findings, a separate report is being prepared by Picatinny to determine the condition of fuses on 106m HEP-T projectiles;

- there is a high correlation between defective tracer elements and fuse functionality. Ammunition lots with projectiles known to have defective tracers are also known to have high dud rates;

- the reason considered for the rusty fuses is moisture introduced at the time of assembly. Most 106mm recoilless rifle

rounds were manufactured in the mid 1970's in the southern states where humidity levels are high. Moisture conditions during storage may also be a contributing factor towards rusty fuse conditions, but not as much as moisture introduced at time of assembly;

• the following 106mm recoilless rifle ammunition lots are known to have dud rates in excess of 10% - MA 43-11, MA 55-11 and MA 55-18A;

• a metal defect was discovered during four way X-ray tests of 180 rounds. An air pocket was discovered in the metal casing around the explosive filler just below the pre-engraved rotating band in a projectile from the same lot as the round responsible for the Alpine Meadows incident (MA 55-7). There is speculation by Picatinny accident investigators that a similar metal defect resulted in the fatal incident.

At the present time, Picatinny Arsenals is working to create projectiles with air pockets in the metal casing. These projectiles will be remotely fired to see how they perform. It is expected that rounds with metal defects, as the one discovered, will not perform as intended. This test is one of the final steps towards the completion of the Alpine Meadows Accident Investigation Report and which is expected to be released by January 1996.

The AAUNAC decided, at the meeting in Alpine Meadows, that any programs who propose to use the 106mm recoilless rifle will continue to do so under precaution. Alpine Meadows has taken the initiative to investigate the design of a protective shield on the gun deck to avoid movement by the gun crew up and down ladders when using the rifle.

Avalanche programs who have used or are proposing to use 106mm recoilless rifles are anxiously awaiting the Picatinny Arsenals report. It is expected that this report will reveal the cause of the accident and will make recommendations on how 106mm recoilless rifles and HEP-T ammunition can be used safely for North American avalanche control programs.

"Making Decisions in Avalanche Terrain"

Avalanche Safety Workshop, 1995
November 25 - 26, 1995
Calgary, Alberta

The first avalanche workshop for recreational activities was organised by Tony Daffern and held in 1979. We think the date is right but memories are fading; even Tony isn't sure. Since then, over the years, Alf Skrastins and Jack de Bruyn organised several similar workshops. For the past three years the Canadian Avalanche Association has worked with Tony, Alf, and Mike Mortimer in Calgary and with the Federation of Mountain Clubs of British Columbia, Scott Flavelle, and other CAA members in Vancouver to continue this work.

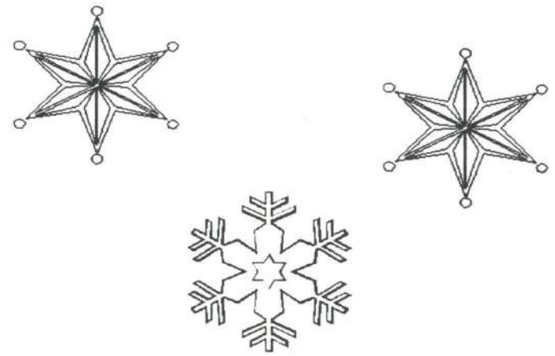
The objective of the workshop is to get together early in the winter and, with a variety of lecturers and discussions, promote avalanche safety to the public. This year, nearly 170 people attended the Calgary workshop.

Money raised from ticket sales goes towards providing the Avalanche Bulletin and other public safety services of the CAA. In the past three years, several thousand dollars has been raised each year. All speakers donate their time and most organising is done by volunteers.

This year the theme "Making decisions in avalanche terrain" was the idea of Karl Klassen and Bruce Jamieson. Karl developed the speakers agenda as well as presenting "Recognising Transition." Bruce was the keynote speaker and delivered the keynote address: "Stability Assessment and Decision Making."

Other speakers included Murray Toft, Chris Stethem, Alan Dennis, George Field, Brad White, Gerald Edwards, and Marc Ledwidge. A wide range of topics from "Identifying Avalanche Terrain" to "Human Factors Affecting Decision making" to "Successful SelfRescue" were covered. First person accounts by Julia Dundass and Doug Kashuba made a strong impression on everyone.

The success of the workshops seems to be shown by people who come back to learn new skills, techniques, and refresh the basics. Each year , more snow-boarders and snowmobilers have taken part in the workshop so there is an opportunity for everyone to reduce the risk for all activities in avalanche terrain.



Helicopter mounted rescue beacons:

A high speed, low exposure avalanche search procedure.

Wayne Carran and Peter Weir, P. Geo.
Works Civil Construction Ltd, Milford Road, New Zealand

New Zealand's Milford Road carries tourist traffic year round to Milford Sound, a previously glaciated fiord, in the south west of the South Island in Fiordland National Park, a world heritage park. The hard granite rock that forms the Darran Mountains surrounding the road attracts rock and ice climbers during the shoulders of the avalanche season. The terrain at Milford is particularly dangerous because avalanches plunge from high cirques down over near vertical cliff bands to the road up to 1500m below. In 1979, the distinguished American snow scientist, Professor Ed LaChapelle noted in a report commissioned by the New Zealand Mountain Safety Council "that the avalanche situation here is as dangerous here as any mountain highway in the World". Since that date a comprehensive avalanche programme has been put in place on the Milford Road.

Large avalanche deposits are common along the road corridor which follows the floor of the Hollyford and Cleddau valleys. Up to half a million cubic metres of snow have been recorded from individual avalanche events. Many of the avalanche paths overlap in the runout zone and many have multiple start zones. However, there are few safe stopping areas along the road.

Avalanche rescue techniques are regularly practiced both for the contingency of a buried vehicle or machine, or for a buried climber or recreationist. It is well recognised that on large deposits individual searchers using transceivers or people involved in a formal probe line would have great difficulty escaping to a safe place should a second avalanche occur during a search. There are few safe places to shelter.

The massive size of some deposits makes searching a very slow process. Many deposits have large blocks on the surface making them very difficult to traverse on foot or on skis A fast helicopter based search technique was developed over the past two winters and vastly speeds the search process reducing the number of people exposed to further avalanches.

A 457 kHz transceiver is taped to the front of a helicopter skid and set to medium sensitivity. The pilot wears the earphone. By covering the terrain in low level flight the pilot can quickly detect and focus on transmissions from buried transceivers. A crew of rescuers equipped with shovels, probes and transceivers set to near minimum receive is carried on board. In the case of multiple burials a single searcher is dropped off over each buried transceiver.

The searcher pin points the strongest signal position, marks the point with a flagged wand then commences probing and digging. All searchers are in radio contact with the pilot. An avalanche guard is stationed at a safe place on the look out for further avalanches. If an alarm is given, the pilot can pick up each searcher in a very short time using a hover entry technique.

With practice an experienced pilot can locate five buried transceivers in the space of five minutes in a 20 hectare deposit area (200 m x 1000m), including the time that it takes to tape the transceiver to a skid. (In our case the pilots had experience with radio tracking devices used for wild life studies and for recovering tranquilliser darts used in commercial helicopter deer recovery).

The search technique has the distinct benefit of exposing only a small number of people for a very short period of time to the hazard of further avalanches. It also allows a much larger area to be covered rapidly thus minimising the search time.

In late June of 1995 a climber was caught and buried by an avalanche at the head of the Gertrude Valley in the upper Hollyford river catchment, just 3 km from an avalanche rescue cache on the Milford Road. Poor weather and unstable snow made it too dangerous to expose searchers to the area; search controllers recognised a substantial risk of further avalanche (the probable burial site was obliterated by a size 4 avalanche four days later). Four search dogs were used in the area without success. The climber's body reminded buried by debris in October, four months later

Had the climber been wearing an avalanche rescue beacon then this helicopter search technique could have lead to a very prompt recovery.

Avalanche Resource Agencies

Information in this resource list is updated annually. New or revised information must be received at the Canadian Avalanche Centre by September 15, 1995.

The Canadian Avalanche Association

Canadian Avalanche Centre

Box 2759
Revelstoke, BC
Canada, V0E 2S0

Alan Dennis, Manager: Tel: 604-837-2435 Fax: 837-4624
Traci Neale, Course Administrator: Tel: 604-837-2435
Torsten Geldsetzer, INFOEX Manager: Tel: 604-837-4425

Public Avalanche Information Bulletin:
Calgary and area: 403-243-7253 +[7669]
Vancouver and area: 604-290-9333
Toll free in Canada: 1-800-667-1105
Computer Bulletin Board: 604-837-4893

The Canadian Avalanche Centre supplies avalanche information, runs training schools, and operates an Industry Information Exchange.

The Centre is not equipped for search and rescue work.

Government Agencies

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

Parks Canada

	Telephone	Fax
Banff National Park		
Taped message:	403-762-1460	
Calgary (Western Region):	403-292-4401	
Banff Warden's Office:	403-762-1470	762-3240
Emergency (24hr):	403-762-4506	
Bob Haney	403-762-1481	
The Chief Warden		
Banff National Park		
P.O. Box 900		
Banff, AB, T0L 0C0		
Jasper National Park		
Taped Message	403-852-6177	
Chief Warden (office hours):	403-852-6155	852-4775
Switchboard (24 hrs.):	403-852-6161	
Avalanche Hut:	403-852-2356	
Sunwapta Warden's Office:	403-852-5383	
Paul Galbraith	403-852-6105	
The Chief Warden		
Jasper National Park		
P.O. Box 10		
Jasper, AB, T0E 1E0		
Mt. Revelsoke & Glacier National Park		
Taped message:	604-837-6867 (MTNS)	
Information - Rogers Pass:	604-837-6274	
Search and Rescue:		
Chief Warden - Bill Brown:	604-837-5155/7500	837-7536
Warden Office, Rogers Pass:	604-837-6274	837-6274
Roger Beardmore	604-837-5155/7514	
The Superintendent		837-7536
Mount Revelstoke and Glacier National Parks		
P.O. Box 350		
Revelstoke, BC, V0E 2S0		

	Telephone	Fax
Yoho National Park		
Ian Church	604-343-6324	343-6758
Chief Park Warden		
Box 99		
Field, BC, V0A 1G0		
Kootenay National Park		
Perry Jacobsen	604-347-9361	347-9050
Chief Park Warden:		
Box 220		
Radium Hot Springs, BC, V0A 1M0		
Waterton Lakes National Park		
Warden Office (off. hours):	403-859-2224	859-2279
Taped Message:	403-859-5105	
Emergency (24 hours):	403-859-2636	
Kluane National Park		
Warden Office:	403-634-2251	634-2338
Main Office:	403-634-2686	
The Chief Park Warden		
P.O. Box 5495		
Haines Junction, YK, Y0B 1L0		

Alberta Environmental Protection

	Telephone	Fax
Lloyd Gallagher-Alpine Specialist, Public Safety Co-ordinator		
George Field-Alpine Specialist		
Kananaskis Country	403-678-5508	678-5505
Box 280		
Canmore, AB, T0L 0M0		
Peter Lougheed Provincial Park:		
	403-591-6300	591-7379
Emergency:	403-591-7444	

	Telephone	Fax
Bow Valley Provincial Park:	403-673-3663	
Ribbon Creek Emergency Center:	403-591-7767	
Elbow District:	403-949-3754	
Emergency:	403-591-7767	

BC Ministry of Highways

	Telephone	Fax
Main Office:	604-387-6931	356-8143
Jack Bennetto, Manager:	604-387-7523	
Gordon Bonwick, Sr. Avalanche Officer:	604-387-7516	
Mike Boissoneault, Sr. Avalanche Officer:	604-387-7514	

Snow Avalanche Program
4C 940 Blanshard Street
Victoria, BC, V8W 3E6

District Avalanche Technicians:

Scott Aitken 604-894-5495
Howe Sound District Avalanche Program
Box 206
Pemberton, BC, V0N 2L0

Ed Campbell 604-869-7328 869-2961
45474 Luckakuckway
Sardis, BC, V2R 3S9

Simon Walker 604-378-9359 378-9364
Bag 4500
Merritt, BC, V0K 2B0
Coldwater Site: 604-378-4648
Summit Site: 604-378-6449

	Telephone	Fax
John Tweedy		
Compartment 1		
Lakeside Drive Group Box		
Nelson, BC, V1L 6B9		
Summer:	604-354-6724	
Winter:	604-354-1351	354-1298
Bruce Allen	604-837-7685	837-9407
Box 710		
Revelstoke, BC, V0E 2S0		
Tony Moore	604-636-2625	636-2333
Box 127		
Stewart, BC, V0T 1W0		
Tel: 604-636-2625		

Snow Avalanche Technicians:

Nic Seaton	604-987-9311	
Snow Avalanche Programs	604-387-6361	660-1200
4C 940 Blanshard Street	604-329-9526 (Cellular)	
Victoria, BC, V8W 3E6		
Dave Smith	604-354-6455	354-6723
Kootenays Region		
310 Ward Street		
Nelson, BC, V1L 5S4		
Al Evenchick	604-638-3334	638-3587
North West Region		
4825 Kieth Ave.		
Terrace, BC, V8G 1K7		

BC Ministry of Environment, Lands, and Parks

	Telephone	Fax
East Kootenay District	604-422-3212	422-3326
Box 118		
Wasa, BC, V0B 2K0		
West Kootenay District	604-825-4421	825-9509
R.R. #3 4750 Hwy. 3A		
Nelson, BC, V1L 5P6		
Garibaldi/Sunshine Coast	604-898-3678	898-4171
Box 220		
Brackendale, BC, V0N 1H0		

	Telephone	Fax
Mount Robson	604-566-4325	566-9777
Box 579		
Valemount, BC, V0E 2Z0		
Strathcona	604-337-5121	337-5695
1815 Miracle Beach Drive		
Black Creek, BC, V9J 1K1		

BC Ministry of Solicitor General

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

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

	Telephone	Fax
Geoff Amy	604-387-5956	387-9900
Manager of Land/Inland Waters		
Ministry of Attorney General		
Provincial Emergency Program		
455 Boleskin Road		
Victoria, BC, V8Z 1E7		

Provincial Emergency Program
Emergency Toll Free
Provincial Government Emergency Operations Centre
Emergency Coordination Centre 24 Hour operation

Telephone: 1-800-663-3456 Fax: 604-387-2957

Avalanche Films and Videos

- *Avalanche* - 50 minutes (Film)
- *Avalanche Terrain* - 9 minutes (Video)
- *Control* - 15 minutes (Video)
- *Snow War* - 25 minutes (Video)
- *Avalanche* - 12 minutes (Video)
- *Snow Profile Observation* - 8 minutes (Video)
- *Metamorphism* - 16 minutes (Video)

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

Commercial Operations

Ski Areas

	Telephone	Fax
Steve Portman Apex Alpine Resort Box 1060 Penticton, BC, V2A 7N7	604-492-2880	292-8622
Wayne Bertrand Ski Patrol Supervisor Big White Ski Resort Ltd Box 2039 Kelowna, BC, V1X 4K5	604-765-3101	765-8200
Matt Coutoure, Safety Coordinator Blackcomb Mountain 4545 Blackcomb Way Whistler, BC, V0N 1B0	604-938-7289	938-7532
Dave Aiken, Propatrol Fernie Snow Valley Ski Ltd. Ski Area Road Fernie, BC, V0B 1M1	604-423-4655	423-6644
Jay Pugh Fortress Mountain Skiing Inc. 307-1111 11th Ave. SW Calgary, AB, T2R 0G5	403-264-5825	
Niko Weis Mt. Washington Ski Resort Ltd. P.O. Box 3069 Courtenay, BC, V9N 5N3	604-338-1386	338-7295
John Thornton Mystic Ridge & Norquay Box 1258 Banff, AB, T0L 0C0	403-762-4421	762-8133
Tim Mellon Nakiska Box 1988 Kananaskis, AB, T0L 2H0	403-591-7777	591-7780
Hank Cuttle, Manager Red Mountain Ski Area Box 670 Rossland, BC, VOG 1Y0	604-362-7384	362-5833
Peter Fern Silver Star Mt. Resorts Ltd. Box 2 Silver Star Mt., BC, V0E 1G0	604-542-0224	542-1236
Mark Klassen Skiing Louise Box 5 Lake Louise, AB, T0L 1E0	403-522-3555	522-2095
Peter Amann, Avalanche Forecaster Greg McAuley, Assistant Avalanche Forecaster Marmot Basin Ski Lifts Ltd. Box 1300 Jasper, AB, T0E 1E0	403-852-3816	852-3533
Tom Riley Sunshine Village Box 1510 Banff, AB, T0L 0C0	403-762-6500	762-6513
Brian Leighton, Safety Manager Whistler Mountain Ski Corp. Box 67 Whistler, BC, VON IBO	604-932-3434	932-6374
Mark Austin Whitewater Ski Resort Ltd. Box 60 Nelson, BC V1L 5P7	604-354-4944	354-4988

Helicopter, Snowcat, & Wilderness Ski Operators

	Telephone	Fax
Jim Stanton Amiskwi Lodge (Golden BC) c/o Box 1747 Canmore, AB, T0L 0M0	403-678-4039	678-5437
Russ Younger ABC Wilderness Adventures Box 811 Golden, BC, V0A 1H0	604-344-2639	344-5520
Clyde Newsome CAT Powder Skiing Inc. Box 1479 Revelstoke, BC, V0E 2S0	604-837-5151	837-5111
Canadian Mountain Holidays Inc. (CMH) Box 1660 Banff, AB, T0L 0C0 (Emergency):	403-762-7100 403-762-7198	762-5879
CMH Snow Safety Co-ordinator Colani Bezzola	604-348-2370	348-2551
CMH Adamants Erich Unterberger	604-837-4245	837-4245
CMH Bobbie Burns Rob Rohn (Bruce Howatt)	604-348-2226	348-2226
CMH Bugaboos Jocelyn Lang (Peter Harvey)	604-346-3391	346-3391
CMH Cariboos Ernst Buehler (Dave Cochrane)	604-566-9888	566-9888
CMH Galena Bernhard Ehmann (Peter Arbic)	604-369-2235	329-2235
CMH Gothics Ian Campbell (Bryan Keefer)	604-837-4204	837-3363
CMH Monashees (Seasonal) Dominic Neuhaus (Roger Laurilla)	604-834-7223	834-7330
CMH Revelstoke or Regent Hotel Buck Corrigan	604-837-9344 604-837-2107	837-3644 837-9669
CMH Valemount (Seasonal) or Alpine Motel Danny Stoffel	604-566-4487 604-566-4471	566-4111 566-4767
Battle Abbey (via CMH Bobbie Burns)		
Mark Aubrey Crescent Spur Heli-Skiing General Delivery Crescent Spur, BC, V0J 3E0	604-569-2730	569-3276
Alison Dakin Golden Alpine Holidays Box 1050 Golden, BC, V0A 1H0	604-344-7273	344-7273
Wayne Bingham Great Canadian Heliskiing Box 175 Golden, BC, V0A 1H0	604-344-2326	344-2316
Brent McCorquodale Great Northern Snow-Cat Skiing Box 220, Station G Calgary, AB, T3A 2G2	403-287-2267	
Dan McDonald Island Lake Mountain Tours Cedar Valley Road Fernie, BC, V0B 1M1	604-423-3700	423-3700
Tad Derbyshire Kootenay Helicopter Skiing Box 717 Nakusp, BC, V0G 1R0	604-265-3121	265-4447
Mike Wiegele Helicopter Skiing Box 159 Blue River, BC, V0E 1J0 (Banff Office):	604-673-8381 403-762-5548	673-8464 762-5846
Ron Blaue Mistaya Alpine Tours Box 809 Golden, BC, V0A 1H0	604-344-6689	344-2229
Sepp Renner Mount Assiniboine Lodge Canmore, AB, T0L 0M0	403-678-2883	
John Luttrell - Ski Guide Mountain Heli-Sports Inc. Box 460 Whistler, BC, V0N 1B0	604-932-2070	938-1852
Jim Bay Mountain Light tours Box 1789 Revelstoke, BC, V0E 2S0	604-837-6655	837-6655

Helicopter, Snowcat, & Wilderness Skiing Operators, cont'd

	Telephone	Fax
Rudi Gertsch Purcell Helicopter Skiing Box 1530 Golden, BC, V0A 1H0	604-344-5410	344-6076
Dan Griffith R-K Heli Ski Panorama BC P.O. Box 695 Invermere, BC, V0A 1K0	604-342-3889 1-800-661-6060	342-3466
Bernard Faure, Ski Guide Robson HeliMagic Inc. Box 18 Valemount, BC, V0E 2Z0	604-566-4700	566-4333
Rudi Beglinger Selkirk Mountain Experience Box 2998 Revelstoke, BC, V0E 2S0	604-837-2381	837-4685
Peter Schlunegger Selkirk-Tangiers Heli-skiing c/o Box 59 Revelstoke, BC, V0E 2S0 (Best Western) (Golden)	604-837-5378 604-837-6161 604-344-5016	837-5766 837-5460 344-7102
Allan Drury Selkirk Wilderness Skiing Meadow Creek, BC, V0G 1N0	604-366-4424 1-800-799-3499	366-4419
Neal Bedell Sno-Much-Fun Catskiing Inc. 63 Wattsville Road Cranbrook, BC, V1C 2A1	604-426-5303	426-5567
Mike Jacobsson Tyax Heliski Box 849 Whistler, BC, V0N 1B0	604-932-7007	932-2500
Herb Bleuer Tyax Lodge Heliskiing Tyaughton Lake Rd. Gold Bridge, BC, V0K 1P0	604-238-2446	238-2446
Ken Hardy Whistler Heliski Box 368 Whistler, BC, VON 1B0	604-932-4105	938-1225

Mining Companies

	Telephone	Fax
Line Creek Resources Line Creek Mine (Upper Elk Valley) Box 2003 Sparwood, BC, V0G 2B0	604-425-3145	425-7144
Brian Spreadbury Elkview Coal RR 1, Hwy 3 Sparwood, BC, V0G 2B0	604-425-8746	425-8700
Ken Clark Fording Coal - Greenhills Box 5000 Elkford, BC, V0B 1H0	604-865-3248	865-3250

Dog Teams

Canadian Avalanche Rescue Dog Association

Whistler Region

When paging the Whistler and Blackcomb teams: Do not enter voice messages when asked to enter numeric or voice messages. Enter the number you want the doghandler to call then 9999 to indicate it is an avalanche emergency. Brink, Horath, Tindle, and Thornton are available on pager 24 hrs a day and will initiate a "fan-out" call of additional resources (dog teams, a/c, etc.) as required.

Whistler Teams

Whistler Dispatch:	604-938-3210 local 300
Anton Horvath (Pager):	604-979-7995
(Home):	604-932-1110
(Work):	604-932-3210 local 300
Call also for Missing Person Search	
Yvonne Thornton (Pager):	604-979-7995
(Home):	604-894-5565
(Work):	604-932-3210 local 300
Call also for Missing Person Search	
Jan Tindle (Pager):	604-979-7993
(Home):	604-932-5196
(Work):	604-932-3210 local 300

Blackcomb Teams

Blackcomb Dispatch:	604-938-6700
Bruce Brink (Pager):	604-979-4050
(Home):	604-932-6771
(Work):	604-879-4515
(Cell):	604-957-3975
(Port Cell):	604-657-8437
Call also for Missing Person Search	

Whistler Region, cont'd

Rene Long (Pager):	604-979-7991
(Home):	604-938-9188
(Work):	604-938-7600
Craig Ross (Pager):	604-979-7990
(Home):	604-932-4406
(Work WVFD Pager):	604-932-2020
Bruce Watt (Pager):	604-979-8352
(Home):	604-979-6269
(Work):	604-932-2300
(Cell):	604-932-7674
Richard Wyne (Home):	604-938-1795
(Work):	604-938-7600
Pat Coulter:	604-366-4424

Invermere

Russ Hendry (Pager):	604-979-9015
(Business):	604-342-4200
(Residence):	604-347-6575

Fernie

Robin Siggers (Business):	604-423-4656
(Residence):	604-423-4892

Wardner

Sue Boyd (Residence):	604-429-3958

Jasper

RJ Kingston	403-852-3816

Whitehorse

Kirstie Simpson	403-667-3862
(Residence):	403-633-2199

Accommodation Reservation

The Banff Centre

The Banff Centre
Attention: Reservations
Box 1020, Station 15
Banff, Alberta, Canada
T0L 0C0

place stamp here

The Banff Centre

Accommodation Reservation

Conference Name: **International Snow Science Workshop**

Conference Dates: **October 6 - 11, 1996**

Reserve your accommodation at The Banff Centre by:

Tel: Call conference reservations toll-free at 1-800-884-7574 (Canada), or (403)762-6308.

Fax: Complete this form and fax to: Reservations at (403)762-7502.

Mail: Complete this form and return to: The Banff Centre
Attention: Reservations, Box 1020, Station 15
Banff, Alberta, Canada T0L 0C0

Please print:

1. Please reserve accommodation for:

   Affiliation/Company: _____

   Name: _____

   Address: _____

   _____

   City: _____

   Province/State: _____

   Postal/Zip Code: _____

   Telephone (day): _____

2. Please send confirmation to above address:
   ❑ Yes ❑ No

3. Please provide your credit card information to guarantee reservation.
   Rooms that are not guaranteed will be released at 6 pm.
   No shows or reservations cancelled less than 48 hours prior to arrival will be subject to a charge equivalent to one night's stay.

   ❑ American Express ❑ EnRoute/DinersClub
   ❑ Visa ❑ MasterCard

   Name on card: _____

   Account number: _____

   Expiry date: _____

   Signature: _____

4. Please indicate desired room category and occupancy: If rate and category requested are not available, nearest will be assigned. Rates are in Canadian dollars and are subject to applicable taxes.
   ❑ **Non-Smoking** ❑ **Smoking** (limited availability)

   Single*: (one delegate/one bed)
   ❑ Standard $105.00 ❑ Superior $135.00 ❑ Suite $N/A

   Twin: (two delegates/two beds)
   ❑ Standard $65.00 ❑ Superior $80.00 ❑ Suite $N/A

   Sharing with: _____

   The above special rates have been negotiated to include:
   Accommodation, daily buffet breakfast and buffet lunch, conference gratuities and delegate use of the Sally Borden Recreation Facility.

   ***Companion Package:**
   ❑ $ 41.00
   A companion sharing a room with a conference delegate stays in the room at no additional nightly charge, but may choose to purchase the Companion Package which includes three full meals and access to the Sally Borden Recreation Facility.

5. Arrival date: _____ Arrival Time: _____
   Departure date: _____
   Name of airline (if applicable): _____
   (Check-in is available after 2:30 pm., check-out is 12:00 noon)
   If you wish to extend your stay before or after the conference dates as specified above, please indicate at time of reservation.

6. Reservations received after **September 6, 1996** will be on a space available basis.

7. Comments/Special Requests: (eg. bed-type preference)

   _____

   _____

   _____

   _____

   _____

   _____

Thank you for requesting reservations at The Banff Centre. Our entire staff would like to take this opportunity to extend a warm welcome to you during your upcoming conference.

MOISTEN CAREFULLY – PRESS DOWN FIRMLY

An Evening of Film, Video and Slide Presentations: Tuesday October 8.

Banquet: Wednesday October 9.
Tickets will be sold at the registration desk.

Workshop Location

Banff is an internationally known resort town in the Canadian Rocky Mountains, 1½ hours drive west of Calgary. Workshop activities will be at the Banff Centre on the side of Tunnel Mountain, a 10 minute walk from Banff's commercial area.

Accommodation

Accommodation will be available at the Banff Centre (form enclosed) and elsewhere in Banff. Accommodation for those on a tight budget, including camping, will also be arranged. Details of accommodation options will be included with the second announcement scheduled for January 1996.

Registration

Before March 1, 1996 US $80, Cdn $110

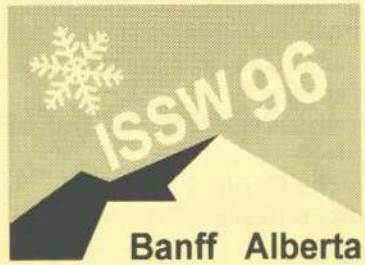
After March 1, 1996 US $90, Cdn $125

Payment may be made by money order, approved credit card or cheque payable to The Banff Centre for Conferences.

First Announcement,
October 1995

INTERNATIONAL SNOW SCIENCE WORKSHOP 1996

October 6-10, 1996
Banff, Alberta
Canada



A merging of theory and practice

The Banff Centre for Conferences
403-762-6308, fax 403-762-7502
P.O. Box 1020, Stn. 15
Banff, Alberta T0L 0C0
Canada

The Banff Centre for Conferences
403-762-6308, fax 403-762-7502
P.O. Box 1020, Stn 15
Banff, Alberta T0L 0C0
Canada

ISSW 96
REGISTRATION FORM

(Please detach and return)

Name: _____

Affiliation: _____

Address: _____

_____

Telephone: ( ) _____

Fax: _____

Email: _____

Amount enclosed: _____ US$ ❑ Cdn$ ❑

Cheque ❑ Money Order ❑

Visa ❑ American Express ❑

Mastercard ❑ Diners Enroute ❑

Credit Card # _____ Expiry _____

Money orders or credit card payments can be in US or Canadian funds. US cheques must be in US funds. Canadian cheques must be in Canadian funds. Sorry, we cannot accept cheques from other countries.

Will attend conference ❑

Interested in bus trip to Rogers Pass.
(for an additional fee) ❑

Plan to Submit:

Paper ❑

Proposed title: _____

_____

Poster ❑

Proposed title: _____

_____

Commercial Exhibit ❑

Description: _____

_____

Film, Video, or Slide Set ❑

Description and length: _____

_____

Objectives

The workshop provides an opportunity for the exchange of ideas between those who work with snow in hazard management, research and recreation. Twenty years after the Avalanche Workshop in Banff, ISSW 96 will follow the tradition established by workshops at Banff 1976, Vancouver 1980, Bozeman 1982, Aspen 1984, Lake Tahoe 1986, Whistler 1988, Bigfork 1990, Breckenridge 1992 and Snowbird 1994.

Topics

- Mountain Weather and Snowpack
- Avalanche Education and Warning Programs
- Avalanche Initiation and Forecasting
- Backcountry Avalanche Operations
- Boundary Issues in Avalanche Operations
- Remote Sensing of the Snowpack
- Data Management for Weather, Snowpack and Avalanches
- Avalanche Hazard Management and Mapping
- Avalanche Dynamics and Defence Structures
- Avalanche Control
- Avalanche Rescue

Presentations

We welcome presentations of field methods, research and case studies. We encourage presentations by field workers, researchers, etc. Persons interested in making an oral or poster presentation should submit a 200-500 word abstract by April 15, 1996 to:

C.D. Johnston,
ISSW 96 Papers Committee,
Dept. of Civil Engineering,
University of Calgary,
2500 University Dr. NW,
Calgary, Alberta, T2N 1N4,
Canada.
Fax: (403) 282-7026
Phone: (403) 220-6599
e-mail ISSWpapers@enci.ucalgary.ca

An IBM disk or e-mail message in Word, Wordperfect or text format is preferred. Guidelines for effective use of the Banff Centre's audiovisual equipment will be sent to all presenters. A booklet of accepted abstracts will be available to registrants at the workshop.

Papers from oral and poster presenters are encouraged but abstracts will be included in the Proceedings in lieu of submitted papers. To be included in the Proceedings, papers should be submitted to the Papers Chair by September 15, 1996 in Word or WordPerfect format on a 3½" IBM or Mac disk along with the hardcopy.

Workshop Format

Following an opening presentation and mixer on Sunday evening, there will be four days of meetings, poster displays, commercial exhibits, slide and video presentations and a banquet. An optional overnight field trip to the avalanche control program at Rogers Pass will leave after the afternoon session on October 10.

Oral presentations

Each half day session will have a topic. Each session will start with an invited paper, to be followed by submitted presentations and finished with an open discussion on the session topic.

Posters

Twenty-five poster presentations are planned. Each will be provided with a wall panel and a table. AC power available on request.

Commercial Exhibits

Space will be available for companies or organizations interested in selling or displaying equipment or information related to snow. A fee of $250 will be charged. Exhibitors should indicate the nature of their exhibit on the registration form.

Dog Teams, cont'd

Parks Canada

	Telephone	Fax
Will Devlin	403-852-6625/6155	
Jasper National Park		852-4775
Box 10		
Jasper, AB, T0E 1E0		
(Residence):	403-852-4234	
Gordon Peyto	604-837-6274	837-6274
Glacier National Park		
Revelstoke, BC, V0E 2S0		
(Residence):	604-344-5041	

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

Royal Canadian Mounted Police

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

	Telephone	Fax
Nelson Detachment	604-354-5160/5184	
Cpl. T. M. Barter (Terry)		354-4841
NCO i/c Nelson Sub/Division PDS		
1010 Second Street		
Nelson, BC, V1L 6B6		
24 hr. Emergency:	604-352-2156	
Port Alberni Sub/Division	604-723-2428/2424	
Cpl. Bruce McLellan		329-5061
i/c Port Alberni PDS		
4110 - 6th Avenue		
Port Alberni, BC, V9Y 4M9		
Squamish Detachment	604-898-9611	898-4712
Cpl. C. H. Brandt (Cec)		
NCO i/c Squamish PDS		
40439 Tintalus Road,		
Box 1880, Squamish, BC		
Pager:	604-978-1053	
Terrace Detachment	604-638-0333	635-7248
Cpl. L. Bretfeld (Lothar)		
NCO i/c Terrace PDS		
3205 Eby Street		
Terrace, BC, V8G 2X7		

	Telephone	Fax
Vernon Detachment	604-260-7126	260-7190
Cpl. R. T. Boal (Tim)		
NCO i/c Vernon PDS		
3402 - 30th Street		
Vernon, BC, V1T 5E5		
Residence:	604-542-1864	
Calgary Detachment	403-291-6236	
Cpl. Bill Hamilton		
NCO i/c Calgary Sub/Division PDS		
920 - 16th Ave NE		
Calgary, AB, T2E 1K9		
Kamloops Detachment	604-828-3099	828-3210
Cpl. Al Sonneff		
NCO i/c Kamloops S/D PDS		
1280 Trans Canada Hwy N		
Kamloops, BC, V2C 5Y5		
Chilliwack Detachment	604-792-2711 (Emergency)	
Cpl. Bud Mercer		
NCO i/c Chilliwack S/D PDS		
2, 45924 Airport Road		
Chilliwack, BC, V2P 1A2		
(Pager):	604-792-5227	
(Residence):	604-793-9197	

Education

Academic Courses

	Telephone	Fax
Dave McClung	604-822-2674	822-6150
Department of Geography and Civil Engineering		
University of British Columbia		
2324 Main Mall		
Vancouver, BC, V6T 1Z4		

- Geography 408 - Snow and Ice Processes
- Civil Engineering 450 - Natural Hazards Engineering

Technical Courses

	Telephone	Fax
Canadian Avalanche Association Training Schools		
Box 2759		
Revelstoke, BC, V0E 2S0		
Courses for Professional Personnel		
Traci Neale - Registration	604-837-2435	837-4624

Awareness Courses

	Telephone	Fax
Federation of Mountain Clubs of British Columbia 336 - 1367 W. Broadway Vancouver, BC, V6H 4A9	604-738-7175	737-3053
Canadian Ski Patrol System T. Simper, National Avalanche Training Officer RR2, Box 1117 Okotoks, AB, T0L 1T0 (Residence):	403-938-2101 403-938-2131	938-6020
Island Sauvage 131 Beech Street Campbell River, BC, V9W 5G4	604-286-0205 1-800-667-4354	287-8840
Bear Enterprises Ltd. Box 4222 Smithers, BC, V0J 2N0 (Residence):	604-847-2854 604-847-3351	847-4533
Art Twomey Ptarmigan Tours Box 11 Kimberley, BC, V1A 2I5	604-422-3270	422-3566
Phil Hein Columbia Mountain Recreation Box 990 Golden, BC, V0A 1H0	604-344-6322	344-6322
Cirrus Mountaineering RR #1 1034 Highway 3A Nelson, BC, V1L 5P4	604-354-3820	

	Telephone	Fax
Stellar Consulting Services Ltd. Box 450 Rossland, BC, V0G 1Y0 or Box 1193 Revelstoke, BC, V0E 2S0	604-362-5314 604-837-5022	
Weather Tech Services Rod Gee Box 992 Terrace, BC, V8G 4V1	604-638-6640	638-8577
Snow Safe Greg McCauley Box 2891 Canmore, AB, T0L 0M0	403-678-6830	
Snowline Technical Services Bruce Jamieson 7943 48th Ave NW Calgary, AB, T3R 2A7 Compuserve: 73122,1110	403-288-7541	
Mountain Light Tours Jim Bay Box 1789 Revelstoke, BC, V0E 2S0	604-837-6655	837-6655
Kevin Christakos Box 1224 Jasper, AB, T0E 1E0	403-852-4073	
Ascent Box 1624 Canmore, AB, T0L 0M0 Compuserve: 74227,337 Internet: 74227.337@compuserve.com	403-678-2815	288-3072

Weather Services

Environment Canada

	Telephone	Fax
E. Anthony Regional Director General Environment Canada, Pacific and Yukon Region 700 - 1200 West 73rd Avenue Vancouver, BC, V6P 6H9	604-644-9111	
G. E. Wells Director, Environmental Services Branch Pacific Weather Centre Environment Canada, Pacific and Yukon Region 700 - 1200 West 73rd Avenue Vancouver, BC, V6P 6H9	604-664-9000	

	Telephone	Fax
A Wallace Manager, Mountain Weather Services Office Environment Canada 3140 College Way Kelowna, BC, V1V 1V9	604-491-1510	

Weather Offices in British Columbia (area code 604)

Location	Direct Consultation	24 hr Recording	Fax
Castlegar	365~3132	365~3131	3653134
Fort Nelson	774~2302	774~6461	774~3742
Fort St. John	785~4304	785~7669	785~7669
Kamloops	376~2160	376~3661	376~0727
Kelowna	491~1511	491~1500	491~1509
Revelstoke	837~9244	837~4164	837~6004
Dease Lake	771~4351		771~4352
Vancouver	664~9032	664~9010	664~9005
Victoria	363~6632		363~6674
Port Hardy	949~6559	949~7174	949~5933
Prince George	963~7552	963~9330	963~8480
Terrace	635~3224	635~4192	635~4192

Weather Offices in Alberta and Yukon (area code 403)

Location	Direct Consultation	24 hr Recording	Fax
Banff	762~4707	762~2088	762~8430
Calgary	299~7814	299~7878	299~3594
Edmonton	468~7077	468~4940	951~8762
Jasper	852~3260	852~3185	852~5355
Whitehorse	667~8463	668~6061	668~3591

Private Weather Services

	Telephone	Fax
The Weather Network	514-597-1700	
World Weather Watch 401 Bently Street - Unit 4 Markham ON, L3R 9T2	905-477-4120	477-0824

Snowmobile

	Telephone	Fax
Alberta Snowmobile Association Percy Page Centre 11759 Groat Road Edmonton, AB, T5M 3K6	403-453-8668	453-8553
British Columbia Snowmobile Federation Louise Sheridan, Executive Director Debbie Paynton, President Box 59 Silverton, BC, V0E 2Z0	604-358-7105	358-7105

Changes, additions, or deletions to the Resource List can be made by filling in the form below and mailing it to:
Canadian Avalanche Association, Box 2759, Revelstoke, BC, V0E 2S0
Telephone: 604-837-2435 Fax: 604-837-4624

Name: _____

Address: _____

Phone: _____ **Fax:** _____ **Bulletin Board:** _____ **Email:** _____

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 valué 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.**

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Iron Creek Snowmobile Club
Mountain Equipment Co-Op
Revelstoke Snowmobile Club
Golden Snowmobile Club

BC Parks

Alberta Snowmobile Association
Carleton Recreational Equipment
B.C. Environment Lands & Parks
Alberta Recreation Parks & Wildlife
B.C. Forest Service
Elkview Coal
Wilson Sports
ICI Explosives
Sno Much Fun Cat Skiing
Alpine Club of Canada
Mountain Magic Equipment
B.C. Snowmobile Federation
Abbot Pass Trading Company
Bighorn Printing & Design
Federation of Mountain Clubs of B.C.
Avalanche Safety Workshop in Calgary
National Search & Rescue Secretariat
Dunvegan Snowmobile Club
Wintering Hills Snowmobile Club

Anonymous

YAMAHA

BOMBARDIER ski-doo

POLARIS Believe it