# DEVELOPMENT OF AVALANCHE SAFETY AND CONTROL PROGRAMS IN THE CANADIAN ROCKY MOUNTAIN NATIONAL PARKS

## AN HISTORICAL PERSPECTIVE

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## ABSTRACT

The Parks Canada Warden Service has the responsibility for avalanche safety and control programs within the Canadian Rocky Mountains National Parks. The avalanche program has developed over the years in response to avalanche accidents, changing visitor use patterns and technological advances.

Ski touring as a recreation began in the parks in the late 1920's and several avalanche accidents occurred in the early 1930's that the wardens responded to as rescuers. With the advent of lift serviced skiing after the second world war, it was recognized that the Wardens needed training in both skiing skills and avalanche snowcraft in order to adequately protect the public and respond to accidents. Noel Gardner instituted the first skiing and avalanche awareness schools for Wardens in the early 1950's. In 1955 a group of three select wardens traveled to Alta, Utah to study avalanche practices under Monty Atwater. Also in 1955 the Parks hired a Swiss mountain guide at the chief park warden level to administer the mountain rescue and travel training in the National Parks. During the 1960's considerable growth occurred in the ski areas in the parks, and the Wardens performed ski patrol and avalanche duties at the ski hills and began to experiment with explosive control methods to protect ski terrain and Park's roadways. The first avalanche danger bulletins and public information dissemination began. Record snowfalls and avalanches that created considerable property damage in the early 1970's prompted further improvements in forecasting and control techniques. Remote weather telemetry was installed and a number of innovative remote control methods for roadways were tested. A radio controlled remote bomb detonating system (ACES) was developed. Recoilless rifles for both road and ski area control were also instituted. The late 70's and early 1980's saw great growth in ski touring and associated avalanche accidents in the National Parks and during this period greater emphasis was placed on accident prevention and education including widespread dissemination of daily avalanche bulletins. As the ski hills developed the Warden avalanche control programs at the ski areas grew into large operations. During the late 1980's the ski hill concession operators began to take control of their own avalanche safety programs and park wardens were no longer doing daily avalanche control at the ski hills. Park wardens continue to perform avalanche forecasting and control for Park's roadways and provide avalanche awareness programs including daily avalanche bulletins for the public. Future improvements to the park road control system include the possibility of replacing remote radio bombs with Gazex detonators.

## INTRODUCTION: EARLY AVALANCHE RESPONSE

Since the inception of the Warden Service in Canada's National Parks, the Park Warden Service has had the responsibility for overseeing visitor safety. As skiing began to gain popularity as a winter recreation in the late 1920's avalanche accidents began to occur that required the response of warden teams. In 1933 two separate avalanche incidents near Lake Louise outlined the need for improved control of backcountry skiing by the Park's service. The Daem brothers of Banff disappeared on a backcountry ski trip in Yoho National Park and a large search involving wardens and local skiers determined that they had perished in an avalanche in Duschenay basin. Their bodies were not recovered until spring. The death of renowned mathematician Kit Paley while skiing alone from newly opened Skoki Ski Lodge prompted an inquest that recommended that the National Park Service institute guidelines for park visitors skiing in avalanche terrain. In Jasper National Park in 1938, Donald "Curly" Phillips, famed for his near first ascent of Mt. Robson with Reverend Kinney, triggered an avalanche that buried and killed him and one of two young school boys that he had brought along on a search for new ski terrain. The resulting search and recovery operation lasted several days and required a large team of wardens, RCMP and volunteers. This incident shook the local community and highlighted the need for winter rescue and avalanche response in the warden service, but at this point wardens were still mainly travelling in the valley bottoms on snowshoes and had little skiing ability.

## THE POST WAR ERA

Although skiing development in the National Parks continued during the period of the Second World War, the post war era saw rapid growth in skiing as a popular winter pastime. Ski Lodges in the Rockies at Mt. Norquay, Sunshine, Temple (Lake Louise) and Marmot Basin were encouraged by Parks management to improve their access and facilities. Roads were constructed and ski lifts installed. At the same time visitation at backcountry lodges such as Shangrila, Skoki and Assiniboine increased and ski touring and mountaineering throughout the parks became more widespread. As a result of the increase in the numbers of people traveling in potentially dangerous terrain in winter, visitor safety became a real concern and the Park's Service began to respond to the need by tasking the Warden Service with ski patrol and rescue duties.

## NOEL GARDNER

Noel Gardner was the father of avalanche recording and forecasting in Canada. In 1948 he took a job as a Warden in Rogers Pass and began observing and carefully noting weather patterns and recording avalanche occurrences. Gardner was a keen skier, and at his instigation and with the recognition by management of the need for park wardens to obtain winter travel and avalanche skills, Noel started the first Warden ski school in 1951. Five Banff wardens spent ten days in Glacier National Park with Noel. The curriculum included not only ski lessons, but also classroom and practical sessions on how to recognize and deal with avalanche dangers. Gardner impressed on management the need for more and longer ski schools in the future arguing that wardens often *"feel a sense of inferiority when confronted by some of these ski teachers and guides when in all actuality he should be the man looked up to by these people."* He went on to stress the need for capable rescue response stating:

> *" Should the need for a rescue party arise at any time the warden of that district should be capable of leading the party efficiently, making the decisions and at all times be in command of the situation. To be able to do this the warden must be trained in this work."*

*Noel Gardner at Rogers Pass Photo by Bruno Engler*

Gardner's suggestions met with some enthusiasm from the Park managers including National Parks' Director J. Smart in Ottawa who agreed that "the growth of recreational skiing in the mountain parks meant that the Warden Service would have to develop more expertise to maintain its traditional authority". The endorsement of Gardner's suggestions paved the way for the development of a comprehensive winter training program for wardens in the mountain parks that included introductory and advanced courses in skiing, winter mountaineering, winter rescue and "terrain analysis for snow avalanche recognition". A form of these winter schools continues to this day, making the winter ski school the longest continuously held mountain rescue school in the National Park's service.

Gardner also recognized the need for training of local skiers. In April of 1954 he held a mountain rescue school for local enthusiasts of the "Banff Mountain Rescue Group" giving them "practical demonstrations in mountain and avalanche rescue" in order to give them skills for "ski patrol and mountain rescue so that they could be called upon to meet emergencies". This training was held at an old forestry camp near Cuthead warden cabin and was the first of many warden training schools at what would become known as " Cuthead College".

Gardner's efforts to transform the warden service from backcountry horsemen and snowshoers did not occur without some resistance. Chief Warden Bryant noted that "there are a number of elderly wardens who would not 'go' for the ski and who will finish on snowshoes." To opponents who called his courses "glorified ski holidays", Gardner replied: "This misconception I hasten to correct…I should like to have a Chief Park Warden of any park concerned along for an entire course. Both for his benefit and my own."

Noel had developed contacts with Monty Atwater and others in the avalanche field in the United States, and in late 1954 the US National Park's Service invited Canada to send some candidates down to attend an Advanced Snow and Avalanche Training School to be held in January 1955 at Alta, Utah. As graduates of Noel's advanced winter school and the most accomplished skiers, wardens Jim Sime, Bert Pittaway and Tom Ross were sent to the course complete with a brand new "special skiing uniform" of peaked cap, ski pants and parka.

At the end of 1954, Noel retired from the warden service and took on an avalanche research job with the National Research Council in Rogers Pass in preparation for the highway construction project. Once there, he built the Fidelity Research Station and began the nucleus of what is today the largest road avalanche control program in the world.

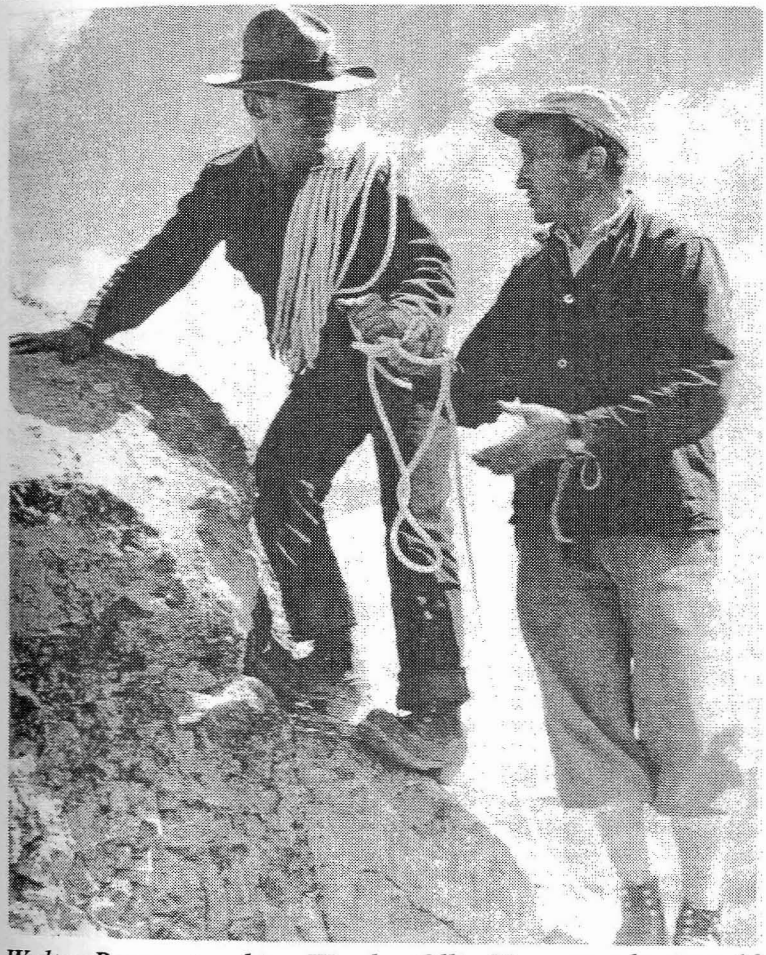
## SWISS GUIDE'S INFLUENCE

In addition to large numbers of visitors coming to the Parks in winter, the Parks were seeing a great increase in parties undertaking mountaineering in the summer months. Several events in 1954 coincided to create what is considered to be the beginning of the organized mountain rescue program in Park's Canada.

From the late 1800's until 1954 the Canadian Pacific Railway (CPR) had hired professional mountain guides from Europe to take their customers safely into the mountains. These guides had the expertise to lead the wardens and volunteers required for occasional infrequent mountain search and rescue responses. This kind of cooperation was typified in the remarkable rescue in 1921 of Mrs. Stone who spent seven days stranded on a ledge on Mt. Eon after her husband had fallen to her death from the summit. Warden Bill Peyto and Mountain Guide Rudolph Aemmer responded by horse from Banff and the two of them managed to locate Mrs. Stone alive on the south slopes of the mountain. Bill belayed Rudolph down to Mrs. Stone and Rudolph then carried her down the technical terrain on his back to the pass where she was transferred to Peyto's horses. The Swiss Guide's expertise in rescue again came in to play in the summer of 1954, when a tragic accident on Mount Victoria took the lives of four climbers. Three female members of the Mexican Alpine Club and their Mexican guide tumbled to their deaths after a slip by one of the rope team resulted in an unstoppable fall. Swiss guide Ernest Feuz stationed at the Chateau Lake Louise effected the rescue of the three remaining women of the party who were left stranded on the face, and he oversaw the safety of the warden and volunteer crew that carried out the body recoveries. Shortly after this accident, a climber was killed on Mt. Rundle and in another instance, a young woman was stranded on a ledge in Yoho National Park. Both incidents required technical rescue response by the warden service.

However, even with the increase in mountaineering and associated accidents the demand for licensed guides at the CP Hotels was dropping off and after the 1954 season the CPR decided it would no longer renew the Swiss Guide's contracts. With the loss of expertise available from experienced mountain guides and the ever increasing demand for rescue response, it was becoming obvious that the Park Service would have to develop it's own in-house rescue capabilities. In February 1955 the superintendents of Banff, Jasper and Yoho agreed to hire a mountain guide to develop a training program for summer mountain rescue and to continue with the winter program that Noel Gardner had begun.

WALTER PERREN



*Walter Perren teaching Warden Ollie Hermanrude circa 1955 Photo: Bruno Engler*

Walter Perren was a mountain guide from Zermatt who had climbed the Matterhorn 140 times before coming to Canada in the late 1940's to guide for the CPR. His expertise already known to Parks, as Noel Gardner had unsuccessfully attempted to hire him to assist with one of his early ski mountaineering schools. With his contract with the CP expired, Walter was in a perfect position to step in and become the first technical alpine specialist in the Canadian Parks Service. Hired at the Chief Park Warden level, Walter's task was to create winter and summer training programs to teach mountaineering and rescue skills to wardens.

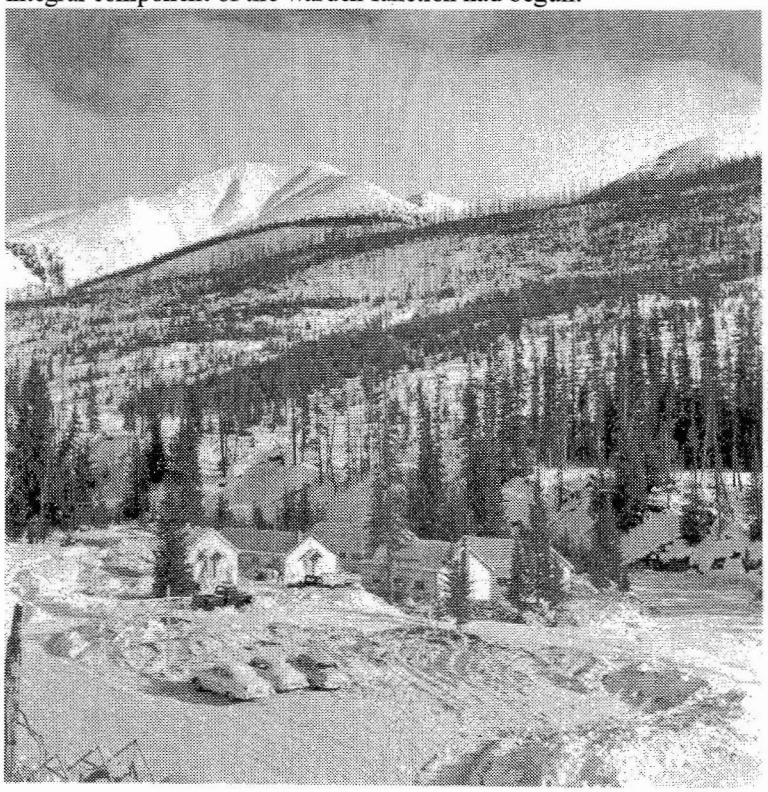
> *" Perren seemed an excellent choice to develop a professional mountain rescue capability within the Warden Service of the Mountain Parks, and he more than fulfilled these expectations. Under his firm but understanding guidance, the small crew learning to mountain ski in 1951 became, in very short time, the nucleus of a world class search and rescue organization."*

Walter's greatest skills were in summer mountaineering and rock climbing, but he was also a very capable ski mountaineer. In 1955 he hired another very capable young Austrian, Hans Gmoser, to assist with the winter training programs. Hans and Warden Tom Ross taught Jasper wardens ski and glacier travel skills as well as avalanche and crevasse rescue during ten days at the Columbia Icefields during which time the temperatures had dropped to –48 degrees Fahrenheit. Hans went on to become one of the founding members of the Association of Canadian Mountain Guides and is best known for pioneering the sport of helicopter skiing in the Bugaboos and starting up the company Canadian Mountain Holidays.

It was not long before the need for Walter's training became manifest. In early July of 1955 an avalanche accident occurred which made international headlines. Early in the afternoon of July 11th, eleven teenage boys from the Wilderness Camp of Philadelphia were swept off the south face Mt. Temple by a wet avalanche and by the time the warden rescue team under the direction of Perren had effected the recovery of the victims, seven of the eleven were dead.

The boys were all from well to do eastern families, and the resulting public outcry and coroner's inquest recommendations prompted the Park's Service to enforce more stringent regulations restricting climbing and ski mountaineering. Henceforth, all park visitors heading into the mountains to climb a mountain or to camp overnight were required to register out with the warden service before departing and to return the registration upon their return. This mandatory registration in the mountain parks included backcountry ski touring, and continued until the mid seventies at which time the sheer numbers of registrations and the resulting number of false overdue investigations prompted a change to optional self-registration.

Perren used the old forestry and internment camp facilities at "Cuthead College" for his early training schools, and after the summer 1955 there was considerable pressure to get wardens in the mountain parks up to speed with mountain rescue training. The training school held that fall had forty-eight participants including several Chief Park Wardens and RCMP from the local detachments. Mountain rescue as an integral component of the warden function had begun.



*Cuthead College, Banff National Park , circa 1956 Photo: Bruno Engler*

Winter rescue and avalanche training for wardens continued to be important as the warden service became more involved in ski and avalanche programs at the ski hills. (See SKI AREAS below) Early in the 1960's Walter and the Canadian Army experimented with different methods of avalanche control for ski terrain. Recoilless rifles and mortar launchers were used with limited success. One of the major drawbacks was that the army brigade had to be called in from Saskatchewan with considerable delay. The system was used only sporadically through the mid-sixties. Even though records indicate that on February 4th, 1965, the Mt. Bosworth slide path in Yoho blocked the highway and railway with 325 yards of debris and 180 year old timber, there is no record of any attempts to control the Rocky Mountain Park's highways using the military in these early years.

Walter Perren ran the mountain rescue training and the avalanche control programs in the mountain National Parks until his untimely death from leukemia in 1967. He pioneered the use of the helicopter as an aid for transport in rescues and instituted the technical rope and cable systems that form the basis of today's systems. His biggest legacy is that of fostering a sense of professionalism and dedication to mountain rescue within the warden service that continues to this day.

SKI AREAS

As the ski hills in the National Parks developed and gained popularity, the need for competent ski patrol and accident response became evident. In the early 1950's Park managers were considering this problem. The view of the Banff superintendent at the time was that the new ski lodge concessionaires should be responsible for rescue and first aid within their own areas of operation. However, not everyone agreed with this view and by 1951 Parks had established the Banff Ski Patrol at Mt. Norquay under the direction of the Warden Service with the costs to be shared between the Parks and the Banff Chairlift Corporation. This initial compromise set the stage for a further forty years of warden service involvement in the day to day operation of visitor safety programs at the established ski resorts within the Parks.

With regards to avalanche safety within the ski hills, again it was Noel Gardner who suggested that the Wardens were the organization who should be tasked for the job:

> *With the great increase in the popularity of recreational skiing, National Parks with ski areas within their boundaries are faced with an entirely new type of problem. The problem is mainly concerned with the well being and safety of the recreational skier and it is thought that the Warden Service must handle the job. One only has to go to Sunshine Ski Lodge, Mt. Temple Chalet or Marmot Basin to observe the most flagrant disregard of all safety procedures...if snow and avalanche hazard continues to be disregarded it will only be a matter of time until lives are lost. It is my hope that ski and snowcraft training will go ahead and that the Warden Service will initiate regulations governing ski areas."*

Gardner's words proved prophetic when the first fatality within a "designated" skiing area in the National Parks occurred at Marmot Basin in March 1956. Park wardens were employed at Marmot on ski patrol with duties that included opening and closing of potential avalanche terrain and maintaining rescue equipment for injury or avalanche response. Two wardens accompanied groups of skiers into the basin and directed them where it was safe to ski based upon their snowpack evaluation and ski cutting. On the day of the accident Charles Dupre skied into terrain that he had been told to avoid and triggered an avalanche that buried him under nine feet of snow. The accident was witnessed by Wardens C. Wilkins and Steve Kun (later superintendent) who quickly organized a rescue response and sent to Jasper for additional rescuers. Unfortunately the victim was deeply buried and was not found until four hours later by probing. The incident prompted this endorsement of the ski patrol by Banff Superintendent, G. Dempster:

> *" I cannot speak too highly of the manner in which the ski patrol took command of the situation...The training which these men have undertaken proved to be exactly what was required...Under the skilled guidance of the ski patrol members the skiers made a successful search party...it has proven the worth of the training which the Warden Service has received."*

This incident reinforced management's support of the Warden Ski Patrol and highlighted the need for further efforts to educate skiers in avalanche safety. By 1958 the Wardens had developed the following generic avalanche warning signs for skiers. The wording gives a good indication of the state of understanding of avalanche phenomenon at the time: (circa 1957)

National Parks of Canada
AVALANCHE WARNING

| | |
|---|---|
| DON'T | ski on slopes of 22 degrees or more for at least three days after a fresh snowfall. |
| DON'T | ignore a sudden rise in temperature. It may be the first hint of wet snow avalanches during rain or in warm weather. During a thaw avalanches may occur more frequently in the afternoon than in the morning. |
| DON'T | ski on slopes facing away from the direction of the wind immediately after a fresh fall of snow. (Soft and Powdery) |
| DON'T | be misled by a false sense of security. Slopes hardened by the wind will present a slab like condition which may cause a fatal avalanche accident. |
| DON'T | traverse a dangerous slope horizontally if it is essential, remove your skis and cross high up. |
| DON'T | cross a dangerous slope wearing skis. The chance of surviving an avalanche is greater when you are on foot and is less likely to cause a slide. |
| DON'T | travel within one hundred yards of your nearest companion when crossing a suspected slope. |
| DON'T | cross a slope directly beneath a cornice. Should it break, an avalanche might result. |
| DON'T | forget that the tip of an avalanche may travel over moderate slopes and even over flat ground. |
| DON'T | take chances and don't let your skiing companion take chances. |

GENERAL WARNING

Unless you are on a frequently traveled trail do not ski in the mountains alone. Do not set out for one of the commercially operated high country ski lodges without making arrangements with the management. Always register out at National Parks Offices or with the nearest Warden when undertaking a trip other than on the main route to a regularly operated ski lodge. On return, register in. In your own interests, and those of other skiers in the Rockies observe these rules carefully.

THE MINISTER OF MINES AND RESOURCES

This warning was in place at Bow Summit ski hill on November 28, 1958, when Wardens on ski patrol once again witnessed a skier-triggered avalanche. Two skiers had strayed close to the closure warning flags that the Wardens had placed on the upper slope when the avalanche occurred. Even though the Wardens Jack Woledge and Harold Shepperd responded immediately and located one partially buried victim within a relatively short time, both skiers died of suffocation. The line of flags that marked the edge of the supposed safe zone was wiped out by the avalanche.

It is interesting to note the recommendations of Alpine Specialist Walter Perren after this event. In his report detailing the specifics of the avalanche and rescue response he concludes:

> *" In my opinion marking avalanche areas away from lift facilities in alpine country is not practical, the conditions change very rapidly and the hazard cannot be tested and controlled. The same applies to Sunshine and Temple Lodge ski touring areas. In lift areas the constant use of ski runs by skiers prevents the build up of avalanche conditions as each snowfall is rapidly stabilized. Should, however, a hazard build up overnight on an ordinary ski run the run will be closed until the hazard is removed."*

He goes on to indicate that:

> *"When avalanche accidents happen...it is usually due to either inexperience, ignorance or failure to ascertain the condition of the area. It is the responsibility of all those who undertake to ski on alpine slopes to be sufficiently educated in ski lore to understand all hazards involved."*

Interest in skiing continued to grow, and a period of rapid development of all the Park ski areas occurred through the 1960's. During this time great number of lifts and facilities were constructed and ever increasing numbers of skiers came to sample the famed Rocky Mountain slopes. With these numbers came a corresponding increase in injury accidents and the question of responsibility for ski patrol was revisited. In this period the operators took on the financial responsibility for treating ski injuries and the professional and volunteer ski patrols took over the task. The Warden Service continued to have responsibility for avalanche safety and control and worked together with the ski patrol members to train for avalanche rescue response.

*Avalanche Rescue with Wardens and Ski Patrol near Temple Ski Lodge, 1963 Photo: Bruno Engler*

Wardens continued to perform avalanche control duties at the ski resorts into the early 1990's. As the areas expanded into new ski terrain and more demand was put on the teams to get terrain open quicker the avalanche control programs grew into large entities with correspondingly large budgets. By the late 1980's the avalanche control team at Lake Louise consisted of over a dozen wardens and professional ski patrol operating out a new two-story log office. Control equipment included four avalalaunchers and a snow cat and over 1000 kg. of explosives were used yearly. Eventually park managers had to take a good look at why so much money was being spent on avalanche safety programs inside privately operated resorts. In addition, there was pressure from the operators themselves to operate their own avalanche safety programs as they were confident that they could do the task more cheaply and efficiently with their own staff and they wanted direct control of the programs. Parks management agreed, and by 1992 all of the ski area operators had begun a transition period to take over responsibility for their own avalanche control.

DOGMASTERS

As early as 1957 there had been suggestions that the Park Service should obtain and train dogs for search and rescue response. Superintendent at Banff, George Dempster, argued in 1958 against the idea stating that the duty and responsibility of training a dog would take too much time away from the traditional duties of a warden. However, the value of dogs to an avalanche rescue team was clearly understood and the idea of obtaining in-house search dogs was one that would come up again.

After Walter Perren's untimely death in 1967, the Park Service responded to the increased need for Warden rescue training by hiring two Alpine Specialists to fill Walter's position. Peter Fuhrman, a young Canadian certified mountain guide originally from Germany, took the Banff position while Willi Pfisterer an Austrian ski instructor and mountain guide was hired in Jasper. The two specialists looked after mountain rescue training and response in their respective Parks, and shared the responsibility for the other Parks in the system. Each of the specialists had their own approach and areas of expertise, and the two shared a friendly rivalry throughout their careers.

In Jasper, Willi was a strong advocate of dogs for search and rescue and with his encouragement the first Park's rescue dog was obtained in the early 1970's. Warden Alf Burstrom and his dog Ginger were trained at the RCMP training kennels in Innisfail under a reciprocal arrangement whereby Parks would provide mountain rescue and avalanche training for RCMP. Of course, once Jasper had a dogmaster it was not long before Banff obtained a dog for its own Public Safety program. Warden Jack Woledge stationed in Lake Louise became Banff Park's first dog handler and he drafted the first guidelines for dog's use. Shortly afterward Warden Earl Skjonsberg became a dogmaster in Banff. Unfortunately Earl's dog Ruff was killed on the highway after only two winters in use and for financial reasons management did not replace it.

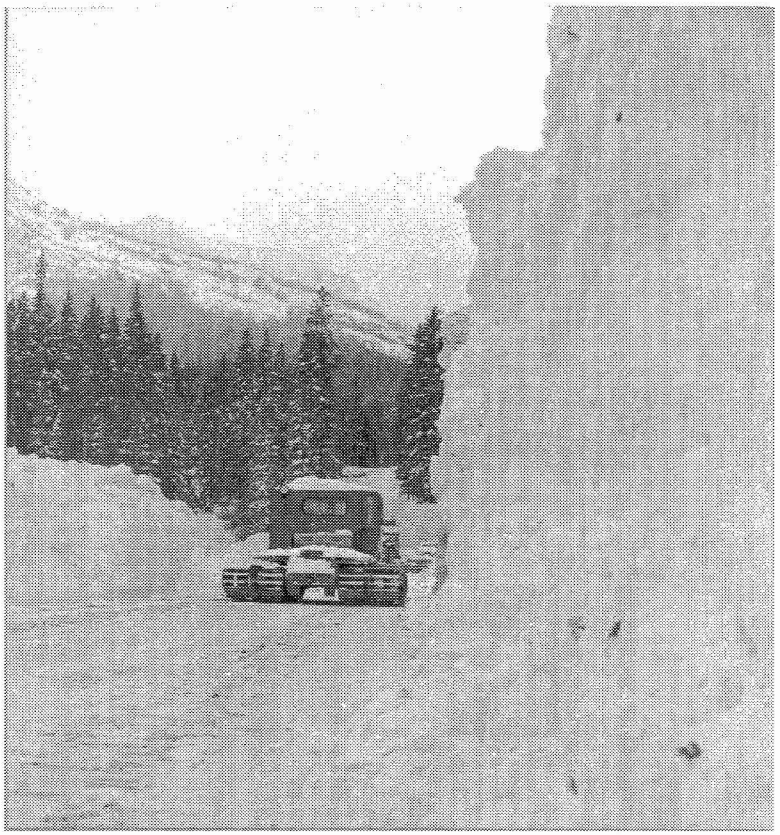
During the same period, Glacier National Park trained Gord Peyto as a dogmaster. Gord was no stranger to avalanche rescue as he was a third generation of the famous Peyto family and had grown up skiing in Banff. While still a teenager he was skiing on Norquay with Herman Fuhrer where he was nearly caught when the two of them triggered a large avalanche. The slide fractured just below Peyto's skis and carried Herman to the bottom where he was buried and killed.

Parks maintained an avalanche dog in Glacier until Peyto's retirement in the mid-1990's. At that time it was decided due to budget constraints not to re-staff the position. The dogmaster positions in Banff and Jasper remain and the dogs are an integral part of the avalanche rescue program. Although the Park's dogs have yet to locate a live victim, the dogs are invaluable in searches where victims are not wearing transceivers and for determining that there are no burials in un-witnessed avalanches where there is a potential for human involvement. The dogs have saved countless man hours in probing. The demand for the dog's services continues to grow in proportion to the numbers of recreationalists venturing into the backcountry in search of powder snow. During the winter season of 2001-2002, Banff dog handler Mike Henderson and his dog Attila responded to 22 avalanche calls.

HIGHWAY AVALANCHE CONTROL

The Warden Service is responsible for avalanche protection on all public roadways in the National Parks. Up until the mid 1960's very little active road control work was undertaken. During the big snow winter of 1965 several large natural avalanches blocked the highways and the need for active control work on the roads became evident. After the Granduc mining disaster in the same year, the technique of helicopter bombing was developed and in the late 1960's Alpine Specialist Peter Fuhrman and local helicopter pilot Jim Davies began to experiment with the helicopter for road control in the Parks. The helicopter proved to be an effective tool and by the end of the decade most of the major avalanche paths effecting roadways were being controlled on a sporadic basis.

The winter of 1971 was the *Year of the Avalanche* in the Rocky Mountains, and the events of this winter shaped the future of avalanche control in the Parks. By the end of January, over 550cm of snow had fallen in the mountains and a two meter slab was resting on a base of depth hoar. Fuhrman returned from a holiday in Mexico and realized that control work was urgently required. He began bombing on the Sunshine road paths and the resulting avalanches buried 32 cars and several buses and destroyed a building in the parking lot. The access road was buried under up to ten metres of snow in nine places and several new slide paths existed where previously there had been mature timber. Power and telephone lines were ripped out.



*Avalanche Across Sunshine Access Road, 1971 Photo by Bruno Engler*

Meanwhile, in Yoho National Park, a natural avalanche on Mt. Bosworth came down and covered the road and there was the potential that there was a car involved. Wardens spent the evening probing underneath the slide path at considerable risk and the following day the slope was controlled by heli-bombing. When the bomb hit the upper slope, it triggered a massive avalanche even before it detonated. Peter had a bird's eye view of the resulting devastation from the helicopter and described it:

> *"It was the only time I had ever seen a slide turn from white into complete black. The reason was that the slide was ripping out major timber and the soil with it. The timber and soil were mixing with the snow to create a black cloud. Massive spears of timber were flying in all directions. When the slide hit the highway it took out everything. It went right across the highway across Sink Lake and across the valley to the old 1A highway. All the telecommunications to the west were wiped out and the impact was so great that it moved the bed of the railway."*

Avalanche control on Highway 93 south in Kootenay Park and north in Jasper during the same cycle created avalanches that blocked the highways for nearly two weeks.

As could be expected, there followed intense questioning by management of the reasoning and methods used to cause such a large amount of property damage and the virtual shut down of the mountain parks. How could such events be avoided in the future? The end result was that the road control programs in the Parks were considerably enhanced. Funding for new avalanche control initiatives was made available and control plans and avalanche forecasting and control teams were set up to ensure constant ongoing hazard reduction. Avalaunchers and 105mm reccoiless rifles were purchased as an adjunct to helicopter bombing. In several locations run-out mitigation features were constructed. In the late 1990's the use of artillery was discontinued due to lack of reliable ammunition and today teams of forecasters based at Sunwapta, Banff and Lake Louise do daily analysis and use a combination of heli-bombing, avalunchers, pre-placed explosives and closures for road control methods in the mountain parks.

RESEARCH

After the winter of 1971,the need for better forecasting and observation techniques was recognized and a snow research laboratory was set up at Sunshine in 1974 to garner better understanding of local snow conditions. Dr.Ron Perla of the Glaciology Division of Environment Canada was in charge of the laboratory and directed research into shear strengths and slab properties of the Rocky Mountain snowpack. At the same time initiatives were taken to create a technique to remotely trigger avalanches at any time. A joint project with the Parks Service and the Defense Research Establishment was undertaken to develop methods for remotely detonating explosives. Two methods were developed: One involved pre-placed explosives on the slope with radio controlled detonation and the other was a radio-activated mortar launcher that was placed above the slide path. The mortar launcher was tested on the Bourgeau slide paths in the winter of 1975 and there were great hopes that it would prove more successful than the pre-placed explosive system that had been first tried the previous year. In the initial tests the launcher worked very well, but after exposure to the weather the charges froze onto the launcher and eventually the idea was shelved. Work continued on the pre-placed explosive system and a third generation of the Avalanche Control Electronic System (ACES) is still in use today.

The need for accurate weather information from near the starting zones was also identified and by 1974 cooperative arrangements were made with Environment Canada to place protoype weather telemetry stations in trial locations at Sunshine, Norquay and Bourgeau. The value of the initial telemetry equipment was quickly evident, and today Parks maintains a network of over a dozen Campbell Scientific stations for avalanche forecasting.

*Testing of Mortar Launcher, Mt. Bourgeau,1975 Photo by Bruno Engler*

EDUCATION AND PREVENTION

From the earliest ski and avalanche schools it had been recognized that education of the public was a key to accident prevention.( See 1957 WARNING, above) Throughout the years ski hill avalanche wardens continued to place a great emphasis on prevention programs. Avalanche awareness talks were given to local interest groups and a daily summary of the avalanche conditions was posted on each avalanche control hut at the ski areas. The 1974 avalanche control summary for the Sunshine program stated that: "An intensive program of public information was begun (and) this has resulted in a gratifying reduction in the rescue statistics."

Over the years there continued to be improvements to the education programs. Parks was a founding member of the Canadian Avalanche Association and wardens such as Clair Israelson were instrumental in the development of the Canadian Avalanche Schools.

As the popularity of skiing continued to grow so too did the number of avalanche involvements. In February of 1981 a series of fatal avalanche accidents in a short period of time prompted a review by the local forecasters of the existing information dissemination techniques. The result of this review was the development of the daily "Avalanche Forecast Bulletin". The warden forecast teams from the three ski hills would pool their observations at the end of the day, and a forecast for the following day's avalanche danger was prepared. The forecast was faxed to the media and posted at ski areas and at local establishments. It was also available on a telephone recording. The bulletin proved to be an effective and popular item and it continues today to be a valuable tool for backcountry travelers. Most users now access it from the webpage and the capabilities of computer technology are allowing for additional information to be presented. Future contemplated improvements include access to archived previous bulletins, drop-down glossaries and links to graphic snow profiles.

MIKE WYNN

In the fifty years since Noel Gardner began the first avalanche training for wardens there had been a number of close calls, avalanche involvements, and injuries to wardens but no fatal avalanche accidents. One of the nearest misses occurred on a Warden training climb of Mt. Logan when Tim Auger and Peter Perren fell and triggered an avalanche on the east ridge. They fell approximately 2000 ft off the ridge and when they came to rest Peter was partially buried with a badly broken leg and Tim was completely buried. Peter was able to locate Tim and dig him out with his hands and get him breathing again. The two were evacuated by helicopter shortly before the weather closed the mountain off for nearly two weeks. Unfortunately, in early 2002 the odds and the number of hours spent in avalanche terrain caught up with the Warden Service. Warden Mike Wynn was killed in an avalanche while performing snowpack observations near Parker's Ridge on the Banff Jasper Highway. The death shook the National Park Service and Mike's memorial was likely the largest gathering of National Park Wardens in one location in the history of the service.

CONCLUSION

The Public Safety function of the Warden Service continues to keep responsibility for visitor safety in the Parks. In the Rocky Mountain National Parks there are six fully certified Mountain Guides and several in training who carry on the role of the original Alpine Specialist. Year-round duties include summer and winter mountain travel and rescue training for wardens, accident prevention and response programs and avalanche control and forecasting. Future improvements in avalanche control include the prospect of improving the remote control capabilities on certain paths with the installation of Gazex exploders. The popularity of ice climbing, snow boarding and other winter based recreation has expanded exponentially, and the number of visitors coming into the National Parks in winter has kept pace. The demand for expertise in avalanche safety and control programs in National Parks is a great as it has ever been. It has been the history of the Warden Service to adapt to meet changing needs of the visitor and the future will continue to challenge the wardens to keep at the forefront of avalanche knowledge.

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