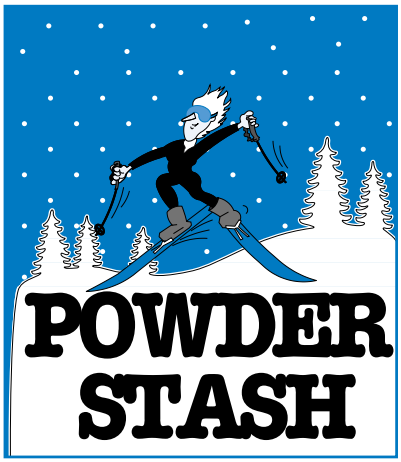
COLORADO DEPARTMENT OF NATURAL RESOURCES

A Newsletter for Friends of the CAIC

Spring 2002 ❄ Volume 6 Number 3

THE Beacon

It seems difficult to believe that the Friends of the CAIC program is finishing its sixth season this spring. I was looking back on my cache of past issues of *The Beacon* the other day, which brought a few smiles as I remembered some of the fun we've had putting this program together. In all honesty it is the donations from our Friends program that really help us keep our backcountry-forecasting program afloat. Knowing that we have the support of a strong core of people who believe in what this program does makes it a lot easier to come to work in the pre-dawn darkness. Not only have your dollars and moral support helped keep us around, but also your comments have improved our daily operations. Our morning reports have become clearer with better information, and our spelling has improved dramatically. Some of the original subscribers can verify that, I am sure.



by Scott Toepfer

An offshoot of the Friends program is our backcountry observers program. In this program we have nine hardcore people from some of the hot spots around the state who frequently report what they are seeing in the backcountry snowpack. This program has brought us invaluable and timely information, which has made our reports more accurate. Certainly I have to consider myself pretty lucky to be in charge of the Backcountry Observers Program (BOP). I am forced to venture around Colorado to work with our observers for training and learning their areas. In the process I've been able to ski some amazing snow, even this season, and have gotten a better idea of just how dangerous our snowpack really was in 2001–2002. Art Judson, the man who started avalanche forecasting in Colorado, believes this was the most dangerous snowpack he had seen in 42 years. He has sent us a few e-mails mentioning some of the large spring avalanche cycles he's witnessed over the years. It has been said that winters with exceptional depth hoar on the ground may lead to large spring avalanche cycles. We suspect that will be the case this spring.

There is no question that this winter has been dangerous: we have seen eight avalanche fatalities (six is average) as well as some remarkably close calls. Avalanche season will still be around when you get this issue, so the odds unfortunately favor another fatality before we close the books on the 2001–2002 season. This is a sad reality of what we do. Mountains are not forgiving of our mistakes.

Once again we have a full issue. Cory Brettman, a professional ski patroller at Aspen leads off with a wild event that will provide years of tall tales for people as far away as France. It's a true story that happened last spring. Knox Williams will once again tackle a couple of questions that we received during the winter in our Q&A section. These were some tough questions that brought on quite a bit of discussion among our staff. Our last article is an interview with John Hereford. John is the inventor of the Tracker DTS beacon. John happily rode his bike to our office in Boulder during a snowstorm to do this interview. In hindsight, as bad as the roads were, it was probably the safest form of travel that day.

One last item: I must make my first retraction in the six-year history of *The Beacon*. In the last issue I stated that the Eldora Ski Patrol alerted Alpine Search & Rescue to the avalanche accident at Yankee Doodle Lake near Rollins Pass on November 28th. In fact it was the Rocky Mountain Rescue Group that was alerted and responded first to that accident. My sincere apologies. Of course I am disappointed that I made this gaff, but on the other hand I am happy to see that people are reading our newsletter. We put quite a bit of energy into this newsletter and we hope you find it informative and entertaining.

We hope to see everyone back again next year, and we really need more folks to sign-up. Our enrollment was down 5 percent this year. I want to believe some of that is due to the economy or the events of September 11. In order for this program to continue, we need more Friends, so please help us spread the word. ❄

Waking a Sleeping Bear

by Cory Brettmann

Cory Brettmann has been a professional ski patroller at Aspen for 12 seasons. During the spring of 2001, Cory and three other patrollers were doing control work near the Spar Gulch Run during a wet avalanche cycle on Aspen Mountain. What happened next was reported to the CAIC and Cory was kind enough to write this short story for **The Beacon**.

The charge explodes and I uncover my ears to see if I can hear the hiss of wet snow. It is late March 2001 and we are doing mid-day hazard reduction above one of our busiest slopes, Spar Gulch. Brad Benson and Immanuel "Mannou" Roux, our French exchange patroller, are on the next route. Tim Cooney and I are watching their every move. Suddenly there is a flurry of activity. Mannou yells, "Its-a-its-a-its-a …" and Brad screams, "It's a bear!" Moments later, more yelling and "It's another bear!" Poor girl, it's March 25, she's not quite awake and she and her cub are rudely aroused when a five-pound charge goes off 15 feet away from her den.

So here's the situation. The winter's delicate snowpack now has free water during this unusually warm afternoon. Everything we touch is moving, the main route off the mountain which runs under us is closed, our routes aren't finished, and now this poor bear who wants nothing to do with us is flushed out of her den. She's pissed off, she's scared, and she has a cub and … she's headed right for Tim and me. Well, not exactly straight, more like an arc. With every step she and the cub take, they sink in the collapsing snow. We can relate.

Several times I attempt to impress Tim with my vast knowledge of bear behavior. "Don't worry, Tim, she won't bother us." But she keeps getting forced in our direction by the slope and the collapsing snow. Finally at 15 yards we agree without a spoken word that it's time to skedaddle. We don't make it too far when the sow suddenly gets on some compacted snow from previous control work. She and the cub divert over some rocks and disappear. Through the trees below them came a hiss of snow, and I worry for them. We finished up our routes by sending a few more tons of wet snow down to the waiting snowcats.

The next day we found her tracks, and the sow and cub appear to have exited the area. Where would they go? A local naturalist informed us that if scared out of a den, black bears rarely go back. We were sorry that we caused her to leave, but we had no idea that she and the cub were there. The area around the den was left alone in the hope of enticing her back, but no sign was seen over the next couple of weeks.

Postscript: April 15th, Aspen Mountain closes in two days. There is not much snow left and thoughts turn elsewhere. It's been almost a month and no sign of our girl. I decide to have one last look. I remove my skis and hike down to the den not expecting to find much. I peer into the hole and there she is looking right back at me! I'm outta there in a blink of an eye with a big grin. She's back and she looks happy. Me too.

"Hey Brad! Check out this cool cave!"

We're going over there? (Photo: Scott Toepfer ▶)

You've got questions? We've got answers.

by Knox Williams

Q: *"Can you describe why Summit County is not favored by southwest flow for snowfall, but Steamboat is?"*
—Chuck Lenzmeier

A: The answer lies in understanding the effects of orographic lifting. Most precipitation occurs when an airmass is forced to rise, which cools it and brings it to saturation. Orographic lifting occurs when air is forced up and over a mountain range. It is one of four basic lifting mechanisms; it is responsible for about 50–70% of snowfall in mountainous areas.

When air is forced up and over mountain ranges, the first high mountains to get hit usually get the most snow. Mountains downstream get the leftover moisture. Summit County is blocked by other mountain ranges from the northeast clockwise around to the southwest. On southwest flow, the San Juan, Elk, and Sawatch ranges get the most snow and block Summit County. By contrast, Steamboat is blocked only by the Flattop Range on southwest flow, and that flow often bends around the Flattops and comes into Steamboat as west flow up the broad Yampa valley. The result? Steamboat is favored with lift, while Summit County is shadowed by upstream mountain ranges.

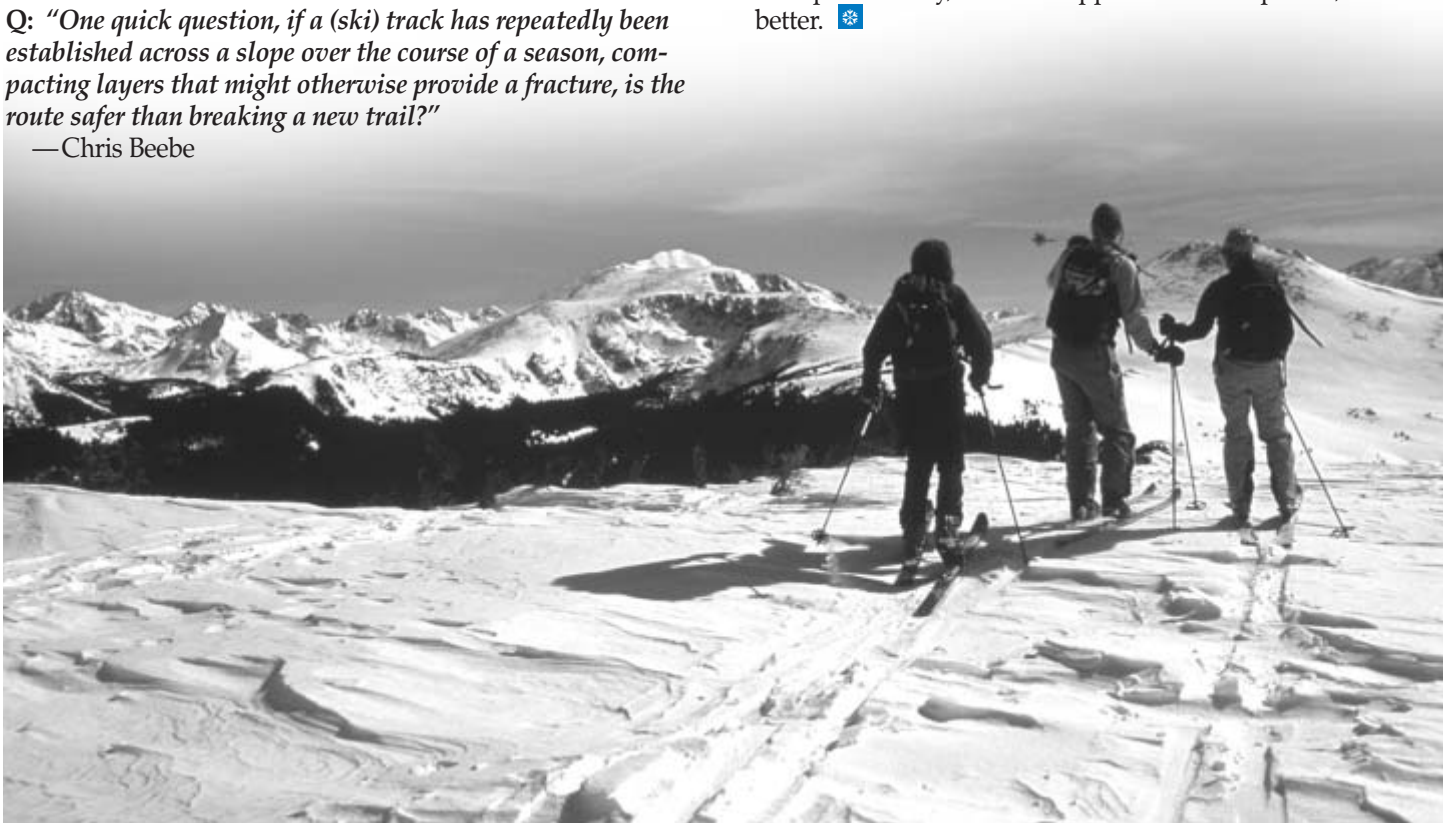
Q: *"One quick question, if a (ski) track has repeatedly been established across a slope over the course of a season, compacting layers that might otherwise provide a fracture, is the route safer than breaking a new trail?"*
—Chris Beebe

A: The answer is, "Yes, but …" A well-compacted trail will be stronger than the adjacent snow, and therefore will provide a little extra safety. The more compaction a track has, the better. The concept here is that compaction will make collapse or shear failure less likely.

Now for the "buts." While your set track may provide a margin of safety, you should not rely on it as being safe. The location of the track is more important than the compaction. For example, it is usually a poor choice to traverse the middle of an avalanche path or the start zone, regardless of whether there is a set track or not. On January 31 in Utah, an off-duty patroller was killed in an avalanche while following a ski track across an avalanche path. That track was set by four other skiers earlier in the day. The route was poor and contributed to the accident.

There is also the problem of being able to find the set track. Stray off the track and any advantage is gone. You also cannot know what additional stress there may be from new or drifting snow, or the weakening effect of the faceting process, since you were last there.

We recommend a track that takes advantage of the terrain to improve safety, and if it happens to be compacted, all the better.



John Hereford: Interview with a Beacon Pioneer

A Question and Answer Interview by Knox Williams and Scott Toepfer

John Hereford was born in Albuquerque, New Mexico and graduated from the University of Colorado in 1976 with a B.S in Electrical Engineering. For several years John followed his education with various employers in Colorado and Oregon (including StorageTech), and taught electrical engineering at Metro State College in Denver in the early 90s. His hobbies tend to run along the same lines as most other people in Colorado … cycling, kayaking and skiing. When John first started backcountry skiing he did what many people still do today: he borrowed gear from friends. Oftentimes when he borrowed a beacon, the people from whom he borrowed did not know how it worked. With his electrical background he knew there had to be a better way. Hence, the Tracker DTS (Digital Transceiving System) avalanche rescue transceiver was born.

John and his family live in Boulder. His company, Rescue Technology, directs the building of the Tracker beacon, working with other local businesses in the Boulder area that supply or fabricate parts of the final product. We conducted our interview with John initially by e-mail and then with a personal chat on a snowy day in early March.

Q: You have an education in electrical engineering. Did job experience following graduation help you later in designing the Tracker?

There was some significant "education" following graduation that helped in designing and developing the Tracker. My career was mainly in analog electrical engineering and product development. Working for a couple of startup companies was valuable in helping me learn some important business lessons related to creating a company to develop the Tracker. Even the time away from the engineering career path helped because it exposed me to more of the bigger picture and allowed me to be refreshed in order to tackle the journey in developing the Tracker and my company.

Q: Why did you decide to apply your EE knowledge to building a better beacon?

I had developed a passion for backcountry skiing, and when I looked at beacon technology, I felt it was antiquated. There had to be a better design. I started with a goal of one that was easier to use, and that meant it had to be directional.

Q: Was it because so few people seemed to really know how to use their beacons that inspired you to come up with a better design? Or did a light bulb go off, and voila, the dual antenna design was born?

Both, really. I saw an incredible opportunity with the lack of sophistication in the technology and the user interface. Beacons hadn't really evolved much in the past 30 years, even with the change in frequency (from 2.275 kHz to 457 kHz) and the addition of lights indicating signal strength. Just adding digital technology to existing designs did not seem sufficient. My first thought was to incorporate some form of a dual antenna, directional system, with digital technology (especially the microprocessor) allowing for the high level processing and analysis needed for a simpler and more user-friendly beacon.

Q: When did this idea first get off the ground?

I started developing the business plan in February of 1994, and began the technical research and design that spring. It was almost four years of over 100 hours per week before we started shipping production units.

Q: How many prototypes did you go through before you had something you liked?

Well, there were lots of designs along the way. After two years, I had developed a big blue box. It worked, but it was way too big and ugly. It was the first prototype, and I named it Bernie, after the St. Bernard. In time, we managed to make it much smaller. I still have Bernie, but we've come a long way since that one.

Q: Any frustrations along the way?

The biggest frustration was how long it took. It never crossed my mind that it wouldn't work. I think I was fortunate that I came in from outside the traditional beacon industry. I was starting with a clean slate and did not have pressure on me to produce something quickly. I was able to start at the beginning and make the best beacon I could.

Q: What's the difference in the traditional analog beacon and the newer digital beacon?

The distinction has gotten a little fuzzy, because some newer analog beacons have digital features, like a digital distance display. In my opinion it's the microprocessor that makes it digital. An analog beacon directly outputs an aural signal (sound) and the user needs to learn to interpret it, whereas the microprocessor in a digital beacon processes a digitized signal (which can be turned back into sound). The microprocessor takes some of the guesswork out of interpreting the signal, by giving a distance and direction to the source. Two antennas do not make the beacon digital, but once you have two antennas, a microprocessor is needed to process all the data fast enough to make it a practical tool.

Q: It seems the only complaint we ever hear about beacons in general is that they are expensive. Can you tell us why?

First, we use the best components possible. Tooling for the case and other custom electro-mechanical parts, along with good antennas are expensive. Second, the production needs skilled

labor and close oversight. Third, market volume is not large. For every beacon sold, probably a thousand cell phones are sold, which holds down the cost of cell phones. I agree that $300 is a lot of money, but compare it to the cost of skis or boots. Boots are just a bunch of plastic, with a liner inside and a little metal on the outside. But you still will pay $500 or more. Mostly it's the cost of tooling.

Q: The Skadi was the first beacon invented (in the 1960s) and for years had a lock on the American market. It was a pretty bold and risky move to come up with a new idea and push it into a skeptical market, wouldn't you say?

It is very difficult to create a market, even if the need is there. Even though the Tracker DTS was new and maybe revolutionary, there was already a growing market (thanks to Skadi and many others) of people that understood the value of having an avalanche rescue transceiver. That allowed us to focus more on beacon training and on the advantages of the Tracker. The analysis, some "skepticism", and the excitement that came with the new technology also fueled interest, information, and education relating to avalanche safety and added to the awareness.

Q: Beacons must be designed to withstand rigorous use and abuse. The first avalanche fatality in Colorado this season (Yankee Doodle Lake, November 28, 2001) involved a beacon being submerged under water for several hours, and it was still transmitting. Could you go into some of the standards that all beacons must meet before they reach the market place?

The only significant standard that deals specifically with avalanche rescue transceivers is the European EN 300 718. *It specifies things like transmit frequency "accuracy", transmit signal modulation, receiver performance, and things like dropping, vibration, strap strength, and water resistance. The only US standards relating to a beacon are by the American Society for Testing and Materials (*ASTM F1491-93*) and the FCC, and these only deal with the transmit frequency and spurious emissions.*

Concerning the avalanche at Yankee Doodle Lake, let me start by saying that all beacons are supposed to meet the EN 300 718 specification of transmitting for an hour at a water depth of 15 cm (6 inches). Water pressure increases greatly as you go deeper and it's difficult to make anything waterproof. At a depth of 1 meter (about where the victim was found), the water will not significantly affect the 457 kHz signal level.

Based on the CAIC's report, the victim was found in the lake 91 feet off shore, and the survivor searched from shore so he was at least 28 meters from the victim. Due to varying

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John with a Tracker DTS Beacon and his dog, Rio. Rio looks a little nervous as he may be out of work as a rescue dog.

John Hereford

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orientation, the effective range of all beacons is 12–15 meters (the recommended search strip width).

That beacon was still transmitting about 10 hours after the accident, which is great. The cell phone, however, was quoted as not usable because it was "waterlogged". It's very disappointing that the beacons were not successful for companion rescue in this accident. But they were extremely useful in Search & Rescue finding the victim and minimizing further use of their time, resources, and exposure.

Q: Can you comment on possible cell phone interference with beacons? How about digital cameras?

Most Radio Frequency (RF) products such as avalanche transceivers and cell phones, and other electronic products like digital cameras, have other significant frequencies that are used for processing, especially for any receiver. These signals and their power and gain levels can cause Electro-Magnetic Interference (EMI) or RFI. For example, a very popular Intermediate (processing) Frequency (IF) is 455 kHz. This is very close to the 457 kHz RF of avalanche beacons. In addition, cell phones also cycle their transmission to "handshake" with their cell. This "pulsing" may cause false signals in some beacons.

Phones using GSM (Global System for Mobile Communications) technology, common in Europe, create slightly more electrical interference than phones using CDMA (Code Division Multiplex Architecture) and TDMA (Time Division Multiplex Architecture) technology, which are standard in the U.S. Cell phones in close proximity to a transmitting Tracker have an insignificant effect on the transmit signal. (CDMA, GSM and TDMA are different frequency and modulation or carrier schemes for cell phones).

To assure optimal performance, the user should turn his or her cellular phone and any other electronic equipment off while doing an avalanche transceiver search with any brand of transceiver, both digital and analog.

Q: What about the problem of metal objects masking the signal of a buried beacon?

I don't see metal objects as being a significant limit to the transmission from beacons. At 457 kHz the wavelength of the signal is 650 meters, which is very long, so we are operating in the near-field. This is one important reason for the use of this frequency in avalanche rescue transceivers — the long wavelength is not disturbed by the snow or the terrain. For a small antenna as used in beacons — small relative to the wavelength — the electromagnetic fields are predominately magnetic. Objects like aluminum shovels don't significantly limit the magnetic field strength (unless it is placed so closely that it affects the electronic circuitry; the blade only blocks the electric field, which is a very small part of this electromagnetic transmission.) Ferrous objects such as a steel tower or iron framework, however, do have an effect on the magnetic field.

Q: We have heard rumors that headlamps with voltage regulators may interfere with the transmission capability of buried beacons. Any truth to this?

Headlamp interference might be valid. I've looked into it and initial investigation shows that the interference involves the receiving units only, we have not seen any disturbance of the transmitter. The very few headlamps involved do have a unique switching voltage regulator. Of course it's only an issue when the headlamp is on and it's close to the receiver. To generate higher voltages and for power efficiency, many products (e.g., a headlamp and the back-light for a Liquid Crystal Display (LCD)) use a switching voltage regulator where the switching frequency is typically in the hundreds of kHz — again close to 457 kHz, which could cause interference. This is where digital technology and processing in the receiver can be an advantage in that extraneous signals or interference can be masked so that the user is not "confused". One way to reduce electrostatic interference, as from a switching voltage regulator or cell phone, is to shield the antennas, which the Tracker does. We will investigate further.

Q: Where do you see beacon technology heading in the next 5 to 10 years?

One of the great things about the latest digital technology in beacons is the capability to make significant modifications. The Tracker DTS had more improvements in its first two years than avalanche rescue transceivers had gone through in the 30 years previously. For example, there may be further improvements in multiple beacon identification and isolation. And we are always interested in increasing the range, if it makes the greater range truly useful and further decreases search time.

Q: Lets change subjects a bit and move to the personal side of John Hereford. Have you or any of your friends been caught or buried in a slide?

I've had several friends caught and injured in slides, including a business associate. Bruce Edgerly luckily survived a large avalanche. He very early saw the value in the Tracker and its technology.

Q: Are you a telemarker, snowboarder or alpine skier?

Alpine/Randonee. Years ago I telemarked, but I became frustrated by my lack of ability at it and my insecurity of using it in the backcountry. I hope to taste it again with the new gear, especially after we move to Steamboat Springs within the next couple of years.

Q: Can you remember a favorite day of skiing?

There have been some very memorable times in the backcountry. The two most recent adventures were a great week in January up at Fairy Meadows, an Alpine Club of Canada cabin in the Selkirks, which included getting helicoptered into the hut and then skiing some wonderful, beautiful, glaciated terrain. And more recently we were up in a familiar area of the Hahn's Peak area north of Steamboat, which has a lot of great snow and different aspects to ski.

Q: Do the newer technology beacons such as the Tracker preclude the need to learn and practice with them?

No. Although the learning curve is now much faster, which is especially important for recreationalists, users should still practice extensively with their beacons. More importantly there should be extensive education in avalanche avoidance. That's one advantage of an easier to learn avalanche rescue transceiver — it allows more time and focus on avalanche prevention. The CAIC does an excellent job in information and education.

We thank you for that compliment, and thanks for talking with us.

Well, maybe it was a little dry this winter. (Photo: Scott Toepfer)

Renewal Notice (or recruit a Friend)

Yes, I will join the Friends of the Avalanche Center. Enclosed is my donation of:

- ❑ $30*, which gives me a CAIC window decal (if I am a new Friend), *The Beacon* newsletter, the Avalanche Wise booklet, and a morning forecast by e-mail.
- ❑ $45*, which gives me all the stuff above, plus an afternoon forecast sent by e-mail.
- ❑ Please accept my additional donation of $_____*
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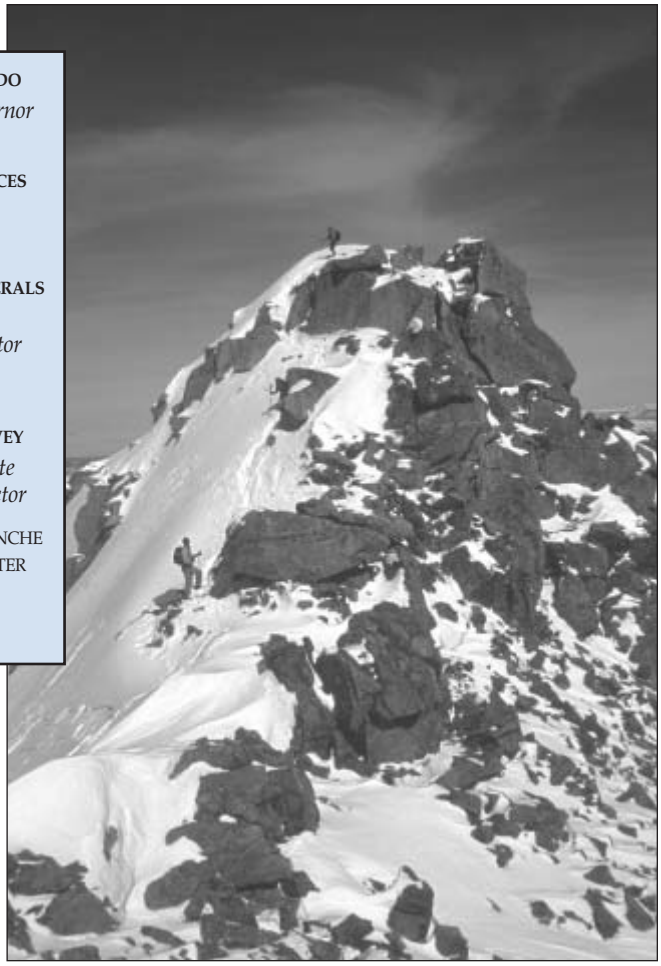

Another high alpine day. (Photo: Scott Toepfer)

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