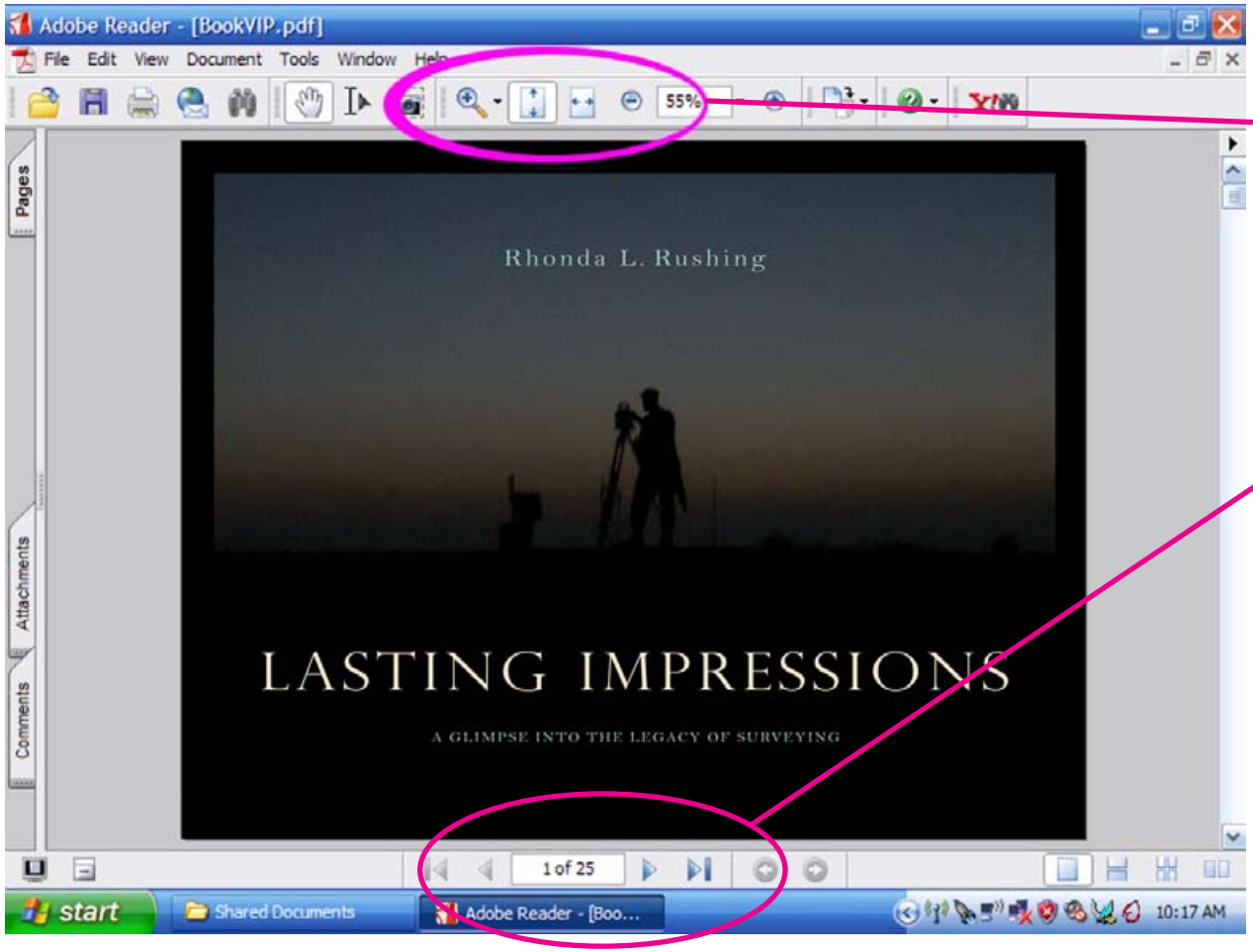
LASTING IMPRESSIONS

MOUNT MCKINLEY... JUST A HIKE UP THE MOUNTAIN



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MOUNT MCKINLEY . . . JUST A HIKE UP THE MOUNTAIN

Why do people climb mountains? Certainly the thrill motivates most, but for others there are more practical reasons to take such risks. For surveyors, there are scientific and professional reasons.

The eight-member climbing team of the June 1989 Mount McKinley Global Positioning System (GPS) Expedition made its way to the summit of North America's tallest mountain, in south central Alaska, for two reasons: to determine the deflection of vertical near a mountain mass like McKinley, and to demonstrate that the technology is now available to measure precisely in remote, high-altitude environments.

Mount McKinley — called Denali, "The Great One," by natives — is possibly the largest massif in the world, since it rises from near sea level. When viewed from Anchorage, Alaska, McKinley seems to stand alone. In comparison, Mount Everest gets a "head start" because it rises from a 14,000-foot plateau in the Himalayas.

And McKinley is considered to be one of the coldest mountains on Earth. Even in June, ambient air temperatures can fall to –40°F. Windstorms can last a week or more with wind velocities sometimes exceeding 100 miles per hour, enough to freeze exposed skin in literally seconds. Blizzards last for days, dropping as much as three feet of new snow per day. These weather extremes are due to the low barometric pressures of this high latitude.

While only a byproduct of the expedition, the GPS measurement of Mount McKinley's summit elevation may produce one of the more profound results. Dr. Bradford Washburn, honorary director at the Boston Museum of Science, in conjunction with Commander Howard Cole of the U.S. Coast and Geodetic Survey, measured Mount McKinley's summit in 1953; his figure of 20,320 feet was verified in 1977. Members of the 1989 expedition kept in contact with Washburn, who made recommendations regarding which bench marks to use to compare with his 1953 measurements. Making ties to the stations used by Washburn during his survey was scheduled for the summer of 1990.

The notion of a Mount McKinley GPS expedition was sparked by a 1986 controversy surrounding satellite measurements of K2, the world's second tallest peak — for a while, it looked as if it might, in fact, be the world's tallest peak. Further satellite measurements allowed Mount Everest to retain its title, but questions remained regarding the use of satellite technology to determine the heights of major peaks around the world.

Ron Cothren, L.S., assistant professor of Engineering at the University of Alaska, Anchorage (UAA), accepted a challenge made at the 1987 Alaska Society of Professional Surveyors Surveying and Mapping Conference and became the project's coordinator. Jeff Yates, a photogrammetrist at AeroMap U.S. Inc., in Anchorage, signed on as assistant project coordinator.

Equipment and Personnel Gathering

Cothren spent more than a year searching for GPS receivers light enough to be backpacked to the McKinley summit. Finally, in late 1988, he learned that Ashtech Inc., had developed 15-pound units. These were modified with cables and batteries adapted to arctic conditions.

With this success, planning began in earnest. Preparations included testing equipment in the UAA cold room, obtaining permits from Denali National Park, arranging for food and other supplies, and organizing the radio communications. The extra time gained from the delayed start of the expedition also allowed Cothren and Yates to assemble a climbing team instead of paying for a professional guide service.

Harsh summit conditions called for an extremely durable monument. Berntsen International, Inc., of Madison, Wisconsin, developed a four-inch bronze/magnesium alloy cap, attached to a one-half inch stainless steel rod via a special locking mechanism. An ice auger bit was attached to the first rod for setting the monument into the ice cap.

Enough food for eight climbers for 28 days, based on a daily intake of 5,000 calories per person, was purchased and packaged. Tents, sleeping bags, ropes, climbing hardware, stoves, fuel, snowshoes, crampons, shovels, clothes, etc. had to be purchased, sorted, and packed, and medical kits were prepared. In addition to the necessary survival gear and supplies, the team members would also carry the scientific equipment: GPS receivers and antennas, gravimeter, radio gear, and solar cells to recharge batteries.

Just as important as obtaining the right equipment and supplies was the selection of the best qualified participants. The final selection of the eight team members rested on the climbing and scientific skills each individual would contribute to the overall strength and cohesiveness of the group. It was essential that each member not only have physical strength, but also an easy-going personality to curb squabbles that can occur at high altitudes. In addition to interpersonal problems, high altitudes can also cause such sicknesses as cerebral or pulmonary edema that can kill climbers in as little as two hours if they can't be brought down to lower altitudes. Other debilitating extreme altitude illnesses include hypothermia, dehydration, carbon monoxide poisoning from cooking stoves, physical and mental fatigue, and lassitude. The climbing team consisted of these members:

- Brian Clark of the Anchorage Health Clinic served as physical trainer and nutritionist.
- Ron Cothren served as project coordinator and surveyor.
- Mike Dagon of Alaska Test Labs in Anchorage was expedition leader.
- Drow Millar of Millar Video Productions, San Anselmo, California, was the videographer.
- Stephen Parker of Arctic Slope Consulting in Anchorage was the medical advisor and geologist.
- Peter Richter of the National Park Service was surveyor and communications coordinator.
- Vernon Tejas of Genet Expedition, Anchorage, served as assistant expedition leader and technical mountaineering advisor.
- Jeff Yates was the photogrammetrist and assistant project coordinator.

The previous climbing experience of the team members was quite extensive. Dagon, Parker, and Yates successfully climbed Mount McKinley in 1987. Tejas had made the climb 21 times and had also climbed in Antarctica and on Mount Everest. Clark had made numerous summer and winter climbs in south central Alaska. Millar's experience included 18 years of mountaineering in Colorado and California, ten years of rock climbing, and a trekking adventure in Nepal. Richter had been mountaineering in Switzerland and Alaska for 25 years, and also had extensive experience on Alaskan glaciers. Cothren, the only team member with no previous climbing experience, practiced on peaks of less than 6,000 feet and trained with the Alaska Mountain Rescue Team on a glacier near Anchorage.

To avoid and survive the many hazards of Mount McKinley and succeed with the GPS expedition, the team's preparation had to be thorough and complete. Because of its location at approximately 60° North latitude, McKinley is considered to be physiologically about 3,000 feet higher than it actually

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is, compared to equivalent elevations in the Andes or Himalayas. Physical training began at least six months in advance. This included weight training, aerobic exercises, and running stairs while wearing 50-pound packs. Team members also practiced pulling each other out of crevasses and climbing out of crevasses. Technical rope work and safety and emergency procedures were rehearsed repeatedly before arriving on the mountain and continued during the climb — safety was the predominant concern. Avalanches and icefalls from shifting of the glaciers can occur at any time without warning. Falling into a snow covered crevasse is an ever-present danger.

The team chose to ascend McKinley via the popular West Buttress Route, pioneered by Washburn during his 1953 survey. This route has been misleadingly called "just a hike up the mountain," but climbers soon learn that factors such as unpredictable weather, lack of oxygen, and mistakes as small as tripping on a boot lace at the wrong moment can result in death — no McKinley route should be taken lightly. Team members spent much time discussing strategy for different parts of the mountains. For instance, when team member's various skill levels were assessed, using skis was ruled out as too dangerous for a roped-together team. Snowshoes were used instead.

Surveying Strategies

With the aid of Paul Brooks, chief of the U.S. Geological Survey (USGS) Alaska office, and Don D'Onofrio, National Ocean Service/National Geodetic Survey (NOS/NGS) coordinator in Alaska, the National Park Service granted the expedition permission to place a permanent USGS monument on the summit, providing a reference monument for repeat measurements, as scientists theorize that these mountains are still growing.

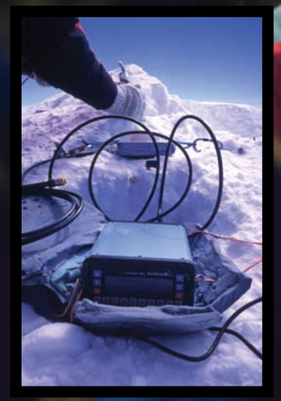
As planned, GPS summit observations would be performed on two separate days. The first four-member team would reach the summit, install the monument, and observe for two hours. They would then leave the receiver on the summit to be picked up by the second team. The second team would carry up a second receiver, set it up, install a fresh battery in the first receiver, and record observations for two hours with both receivers. This strategy, however, called for matching two small satellite windows (from 1:00 to 5:00 p.m.) and two weather windows on two separate days — rather unlikely on McKinley, where weather conditions dictate when climbers can and cannot move, and when scientific observations can and cannot be made.

In addition to the harsh environment and the possibility of mechanical, electrical and/or human failure, expedition members learned that a major solar flare was predicted for June 17, initially scheduled as an observation day. To minimize unpredictable effects of the flare, the observation dates were set back.

The Expedition Begins

On May 31, all expedition members arrived at the Talkeetna Air Taxi facility at the Talkeetna Airport, ready to be flown into the 7,100-foot base camp. However, due to inclement weather, flights did not begin until the morning of June 2. It took four flights to transport all eight climbers and gear to base camp.

After the 1,100 pounds of gear were divided among the team members, the climb to the summit — 15 miles north and 13,200 feet up — began. Due to the weight of the gear, two to three trips were required to transport supplies and equipment between each camp. The team travelled at the recommended pace of 1,000 feet in elevation per day, allowing better acclimation to low



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oxygen levels. The team reached the UAA medical camp at 14,200 feet on June 10.

Unfortunately, one expedition member, Clark, was unable to overcome altitude sickness, so he decided to wait at the medical camp. Also, during the first of three trips from 14,200 to 17,200 feet, Cothren was instructed at approximately 16,800 feet to descend due to apparent exhaustion. He was helped back to the 14,200-foot camp by Parker, where he was treated for hypothermia. He was able to rejoin the team later that night.

After ferrying two loads to the 16,400- and 17,200-foot elevations, the team left the 14,200-foot camp and reached the 16,400-foot camp by late evening on June 16. Two weeks prior at this location, an unexpected wind gust ripped loose a tent with two climbers inside, propelling the tent 1,300 feet down the slope to the edge of a deep open crevasse. Fortunately only frostbitten and bruised, the climbers were later airlifted off the mountain.

Early on the morning of June 17, the team climbed along an exposed ridge to the 17,200-foot elevation. Upon reaching this level, two members began assembling camp while the other five returned to the lower camp to retrieve the remainder of supplies cached there.

Most McKinley climbers set up their highest camp at the 17,200 foot level and make their summit attempt from that camp. The expedition members agreed that, because of the additional weight of the scientific gear and the additional transport time due to the low oxygen content at these elevations, extra time could be gained by camping at the 18,000 foot level. The higher camp location would reduce the time required to leave Denali Pass, reach the summit, and install the monument, while still leaving sufficient time within the satellite and weather windows to set up the GPS receiver and record two hours of continuous GPS data on two separate days.

After stashing some supplies and a tent at the 17,200-foot elevation, the team reached the 18,000-foot camp at Denali Pass on June 18, and moved the remainder of the supplies to the higher camp on June 19. They arrived at the chosen camp site and began setting up in blizzard conditions. Snow blocks were cut to build boat shaped walls approximately eight feet high and three to four feet thick to protect the tents from the notoriously high winds of Denali Pass. The team settled in, hoping for clear weather in the morning for a chance at the summit.

Two days after making camp at Denali Pass, the weather allowed the first team to try for the summit, so the GPS base team was notified that Team One was on its way. To ensure simultaneous GPS at the summit and at the base stations, it was decided early on that the base stations would observe every day during the time when the summit teams could be on the summit, regardless of positive radio contact.

Team One reached the summit at 1:00 p.m. on June 21 in clear –10°F weather, with gusty winds. The USGS monument was augered into the summit to a depth of 4.4 feet. Then the GPS receiver, lithium batteries (one primary and one backup), antenna, and connecting cables were assembled and secured with ice screws and cords. Shortly after the power was turned on, the receiver locked onto five satellites. GPS data was collected for two hours before Team One left the summit to return to camp. The GPS receiver continued to collect data until the batteries expired.

Because only seven climbers made it to the 18,000-foot camp, the group decided that Tejas would summit on both observation days — he had the distinction of being the first person to successfully ascend and descend

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Setting the Monument

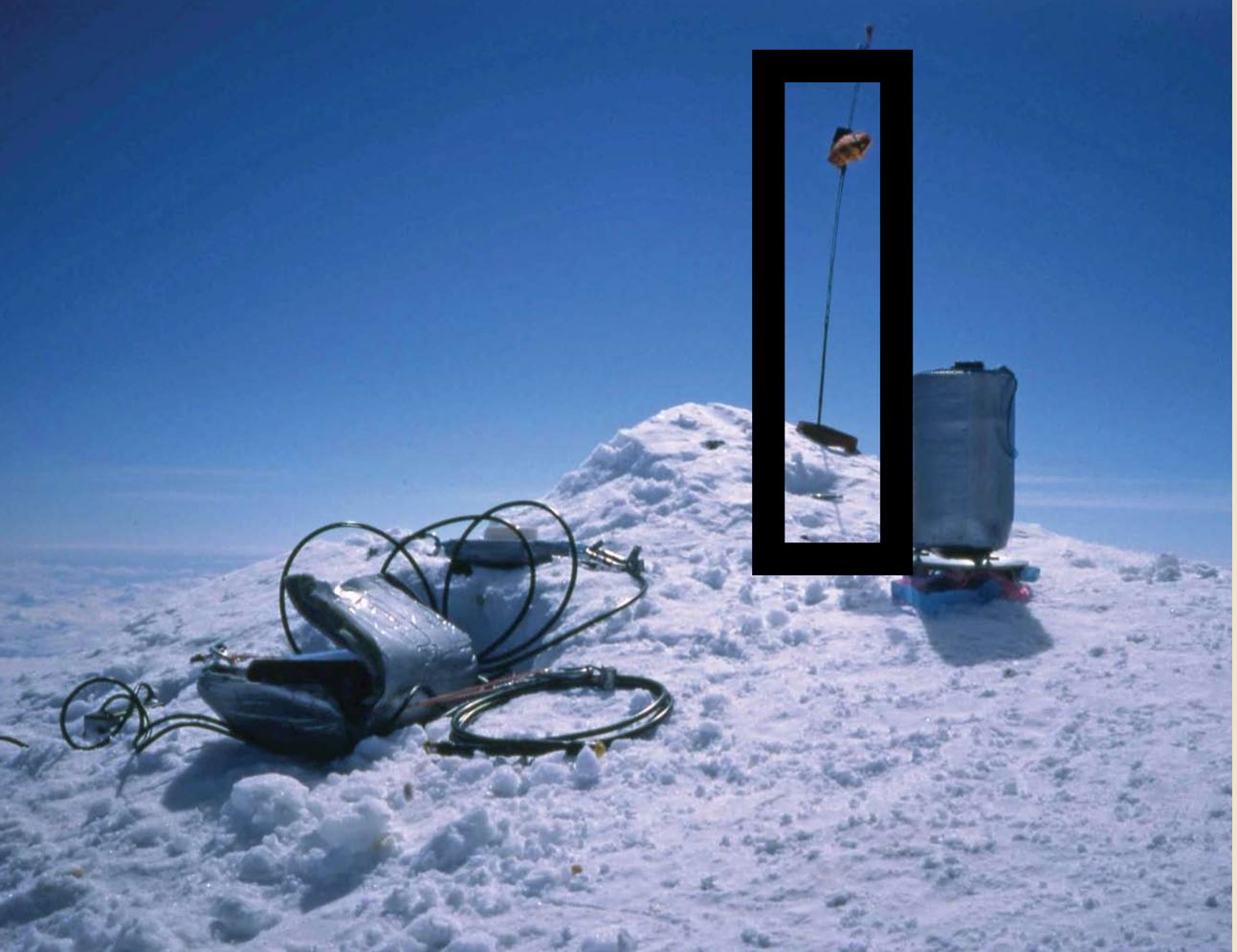
Prior to the climb, there was some discussion on how best to place the monument on the summit of McKinley. From aerial photographs and actual knowledge from prior visits, we knew there was no exposed rock that was safely accessible on the summit in order to permanently mount the survey marker. As with Mount Everest, the highest point of actual rock is not known. It is also not known exactly how deep the ice is over this point — it could be covered by two to 20 feet, or more, of ice and snow. Further complicating the placement of the monument, it is suspected that the ice actually flows down and away from the summit area much like the glaciers lower down on McKinley. It was known going into this project that placing the monument in ice and not in rock would result in a non-permanent placement. Therefore it was decided the monument would be safely placed at or very near the highest point on the continent.

Of concern to the group was what would happen if the summit ice was so hard the rod could not be drilled using a ratchet and "hand-power." There was no possible way we could have used a power drill, as the tool and batteries would have been too heavy. To test the effectiveness of the ice auger and ratchet tool, prior to the expedition, the entire mechanism was tried on a very hard piece of ice found at a nearby glacier. Not only did the drill bit easily auger into the ice, the process was not overly difficult. The ratchet supplied ample leverage to drill into the hard glacier ice. Following this test, we were confident the actual placement of the rod and monument would be successful.

When we reached the highest point, there was little time to gaze out at the wondrous sight all around and below us as there was much work to do. Everything depended on the actual monument placement, so we first concentrated on getting it properly set. In addition to the cap itself, Berntsen International, Inc. had produced several rods that snapped together. Rather than bringing one long rod, it was decided early on to bring several that could be easily interconnected. Not only would these be easier to carry in a backpack, but if we had struck extremely hard ice or possibly the rock summit before the rod was fully set, we did not want the monument "sticking up" out of the snow. Having several individual pieces allowed us to "customize" the depth of the base rod in the ice and snow summit. At the very base of the rods was an ice drill or auger and the extension rods connected to the bit. A ratchet tool was used to hand-drill the bit and rods into the ice. Once the rods had been drilled to a depth of over four feet, the monument was attached and locked into position.

Consequently, the drill bit, extension rods, and monument were quickly and securely set into the ice, and the GPS measurements could begin. Prior to setting the monument, each of the climbers on our expedition placed their signatures on the underside of the cap. Additionally, I also placed two small stones directly underneath the monument which my three-year old son, Tyler, had found in our driveway and had given me just before our departure onto the mountain, one for him and one for his soon-to-be-born sister.

Since placing the monument in 1989, climbers more recently have reported that there is no sign of the monument on the summit. The assumption is that the monument sank into the ice, much as a coin will sink when placed on a block of ice, or some unscrupulous adventurer has yanked the monument out of the ice and taken possession of a truly unique souvenir.



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Mount McKinley solo in the winter. Other expedition members who summited first were Dagon, Yates, and Millar. While fortunate to have an unlimited view from the summit, the team was constantly aware of the wind-stretched clouds hovering overhead, indicating the approach of high winds. These clouds did descend on the summit shortly after the team left.

Team Two made a summit attempt on the morning of June 22. Low visibility and increasing winds forced them back to camp after several hours. The storm would keep the expedition members confined to their tents and protective snow block walls for three days. Because only two three-person tents were carried to the 18,000-foot camp, one of the tents sheltered four climbers — a most intimate situation. For an escape from the confines of the tent, each climber took a turn working on the snow block wall to keep it intact.

The storm subsided by June 24, and the second summit team was ready early. Team Two consisted of Tejas, Parker, Richter and Cothren. The visibility was approximately two to three miles, the temperature was –15ºF, and there was no wind. Aside from getting cold feet, Team Two summited without any problems and set up the second GPS receiver. Fresh batteries were connected to the GPS receiver left by Team One, after digging the drifted snow out from around the connectors. Fortunately, the equipment had weathered the storm well. Both receivers began tracking five visible satellites soon after they were powered up.

During the two hours of GPS data collection, Tejas, who had brought along a parasail, took advantage of the height and strong winds to become the first person ever to parasail off the summit. He drifted down through the chilling air to approximately the 19,000-foot level, stashed his parasail, and climbed back up to the summit. By the time he arrived, the GPS data collection was completed and the winds had picked up considerably. Visibility most of the day had been one mile, but was now reduced to several feet. The team packed up the receivers, roped up, and began their descent in the storm. On the exposed summit ridge it was necessary for each member to grope his way along with ice axes. Thanks to the experienced mountaineers on the team, everyone made it back to camp. It was later learned that this was the worst storm of the summer season. It damaged tents of other climbing teams, causing them to retreat down the mountain for shelter and repairs.

Early morning on June 25, the team packed up and descended to the 17,200-foot camp. The supplies and tent that had been cached had to be dug out and packed up for the continued descent to 14,200 feet.

Tejas again took out his parasail and flew from 17,200 feet to 14,200 feet, whistling and yodeling all the way down. All the members reached the UAA medical camp by 11:30 p.m., June 25. The next morning, Tejas decided to wait and help the UAA medical camp personnel pack their supplies into helicopters and ride out with them. The remaining seven members began their long descent from 14,200 feet to the base camp at 7,100 feet. There was some talk of stopping at the 11,000-foot camp, but once it was reached all members agreed to push on through the night to the base camp because they were anxious to get home. They reached the base camp at 4:00 a.m. on June 27. Expedition members began flying out with various air taxis by 7:30 a.m., and all were back celebrating in Talkeetna by 8:00 that same evening.

— Jeffrey Yates, Photogrammetrist, Anchorage, Alaska

THANK YOU!

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