

**TURNAGAIN PASS AVALANCHE
ACCIDENT REPORT**

March 21, 1999

*Prepared by
Doug Fesler and Jill Fredston
Alaska Mountain Safety Center, Inc.
May 5, 1999*

TURNAGAIN PASS, ALASKA AVALANCHE ACCIDENT

Prepared by Doug Fesler and Jill Fredston
Alaska Mountain Safety Center, Inc.
May 4, 1999

Synopsis: On Sunday, March 21, 1999, a slab avalanche ½ mile wide and up to 7 ½ feet deep was triggered by snowmachiners in Turnagain Pass, in the Kenai Mountains of Chugach National Forest. In all, 6 snowmobilers were killed, 3 injured, 1 was partly buried but uninjured, at least 5 others were dusted as they tried to escape, and 9 snowmachines were destroyed or damaged. An unknown number of other snowmachiners (6-12, estimated) narrowly escaped. Immediately following the avalanche, witnesses in the area responded with shovels and probes to search for survivors. Organized rescue arrived within an hour but the scene was chaotic, with a large search area and an unknown number of victims. Two victims were dug out Sunday night while three others were found as part of a large search effort that took place March 22-24 (Monday-Wednesday). One victim has not been located to date. *Special Note:* Because of the size and complexity of this accident, and the difficulty in obtaining consistent information from a variety of sources, certain facts may be in error or missing completely.

Report: Sunday, March 21, 1999 was a clear, warm sunny day following a succession of storms involving heavy snowfall and a winter of cooler-than-usual temperatures. By noon, the snowmobile parking area at Turnagain Pass was jammed to capacity (100-150 snowmachines) with overflow spilling onto the sides of the Seward Highway. Turnagain Pass is a mile wide valley divided by the Seward Highway which runs in a north/south direction. Snowmachiners are restricted to the west side, while the east is set aside for backcountry skiers and snowboarders. Midway on the western side of the valley is a natural ramp, called the Knob, that snowmobilers use to access the western ridge overlooking Turnagain Pass and Seattle Creek, a parallel valley to the west.

Around 2:30 (times vary slightly) P.M., a large avalanche, 4-6 feet deep by ½ mile wide released naturally to the north of the Knob, in an area out of view to most snowmobilers, but witnessed by several skiers (Bocarde, Havens, Wunnicke, et al) on the opposite side of the valley. Two snowmobilers, Brent Snow and his wife were at the base of the path when it released. Unable to get his machine started, Snow jumped on his wife's machine. As they sped out of the runout zone, they were dusted by powderblast (a fast-moving, billowing wave of displaced air and snow particles preceding the bulk of the descending snow) but escaped unharmed. When they returned for Snow's machine, they found it partly buried by debris at the toe of the slide as were all of the tracks from previous snowmobilers that day. Another couple snowmachining nearby were not caught. Even earlier, another slide (the east face of Pyramid Pk) had released naturally 2 miles to the north on the same aspect. Unfortunately, many of the other snowmachiners in the area either never heard about these two slides or failed to recognize the importance of the message.

At approximately 3:45 to 3:50 P.M., another release occurred ½ mile to the south of the Knob. Only minutes earlier several snowmachiners had been in the area hill-climbing, but none were caught. It is not known whether the slide was a natural or human-triggered. Moments later, those gathered near the base of the slide (Ken Seagle, Aaron Arthur, Alan ?, Brian ?, Will ?, and others) talked about the hazard and decided they better "pack it in" but first they wanted to make one more climb. Earlier in the day, Aaron Arthur and friends had been involved in making an extreme snowmachining film.

At around 4 P.M., a fourth slide released, most likely triggered by highmarkers trying to reach the top of the mountain. This fracture, interconnecting several avalanche paths, extended roughly ½ mile south from the southern side of the Knob, almost linking with the avalanche that had run 15 or 20 minutes earlier. Breaking at approximately 2800 feet elevation, the fracture depth measured 6-7 ½ feet thick for most of the distance across (see fracture profile information). The debris and powderblast reached the maximum normal runout of the paths, stopping at approximately 1,000 feet in the northern portion of the path, near the powerline alignment. Horizontal distance from the crown face to the toe of debris was .9 miles and 1,750 vertical feet. When the slide occurred, numerous people were spread out on, above, and below the slope. Four men (Ken Seagle, Dan Demers, Aaron Arthur, and an unknown man riding a "Power Special") were in the process of hill climbing.

Ken Seagle was just within the southern flank of the fourth slide in the process of hill-climbing (about ½ way up), when he looked over his shoulder and saw the whole mountain to the north avalanching. He turned his machine and rocketed toward the debris of the earlier slide in a successful attempt to escape. He said he was traveling at speeds of approximately 50 mph over debris blocks 4-5 feet in size, causing him to become airborne approximately 75% of the time.

To his right (north), approximately ½ way up the mountain, was Dan Demers, who had gotten his RXL short track stuck while hill-climbing and was digging it out when the avalanche ripped out above him. Demers was unable to free his machine and never had a chance to escape. He and his machine were completely overcome, tumbled, and carried approximately 1/3 of a mile (horizontal distance) and 500 vertical feet downslope. His machine, though totally destroyed, was partly visible on the snow surface (facing downslope, cocked to the right) and found within minutes by Seagle and others. The first person to arrive with a probe found Demers after 1-2 minutes of probing. Demers was upslope from the machine 5 ½ feet and 2 feet to the left (south). His feet were under 2-3 feet of snow and his head was approximately 5 ½ feet under. His body was horizontal to the slope. According to Seagle, Demers was found at 4:46 in the afternoon. CPR was performed by a nurse without result.

To the right (north) of Demers was an unknown individual riding a Power Special who was last seen out-running the avalanche. It is believed he escaped, since no one was reported missing, but to have escaped from this location required exceptional luck.

Aaron Arthur was in the process of making a long high traverse from south to north and was approximately ¾ of the way up the northern portion of the path when it released. According to witnesses (Steve Estes, Ken Seagle, and Ray Richards), Arthur passed several bald areas (devoid of snow) at mid-elevation until he reached a point just below a steep slope (measured at 48°-50°) near a patch of willows. When he was at his highest mark on the traverse, the avalanche released, causing Arthur to be swept off his fast-moving machine. Carried downslope an undetermined distance, Arthur remains buried at the time of this report. The fracture line was estimated to be 300 - 400 vertical feet above him (or 500-600 linear feet).

His machine, a borrowed 700 RMK (Rocky Mountain King), was found approximately 600 vertical feet below his last seen location (approximately ±1600 linear feet downslope of the top of the Knob). Arthur most likely took a parallel trajectory slightly to the south of his machine's descent. Of the four men (Steve Estes, Ray and Rex Richards and Fred Maranville) watching Arthur from their vantage point at the top of the Knob, three managed to get their machines started and speed off as the slide headed their way. Estes, unable to start his machine, opted instead to run north toward some nearby

mountain hemlocks. Almost immediately he was hit by the powderblast, but managed to hold onto a tree as the turbulent powderblast hit him and debris passed 20 feet away. His machine was only dusted. The other three (Ray and Rex Richards and Fred Maranville), blitzed over the southern edge of the Knob and were almost immediately overcome by the slide which, by then, was traveling an estimated 80-90 mph. They were caught, violently tumbled, and carried toward the lateral edge of the debris approximately 600 vertical feet and 1600-1700 lateral feet below the top of the Knob. When the snow came to rest, Ray lay dazed with a possible concussion and a punctured lower lip, 4 feet downslope from his broken machine (broken headlight and cowling) which was lying on its side, skis pointing uphill. Ray remembers seeing a snowmachine hurtling through the air just before being hit by the slide. He is unsure of whose machine it was. Fred, approximately 30-40 feet above Ray, came to rest buried beneath his overturned machine, which lay on the surface. Despite a badly bruised leg, he managed to crawl from his location and establish contact with the others. Both Rex and his machine ended up about 50-60 below Ray, out of view over a steeper roll-over of debris. Rex, stunned by a broken nose and lacerated face, started running toward the edge of the slide, 20-30 feet away. His machine landed upside down with only its ski tips showing. Broken glass, anti-freeze and blood could be seen at the site the next day. These men were extremely lucky not to have been killed.

The avalanche continued downslope at 80-100 mph, hitting several groups of people in the process. Victor Jones, who had been sitting on a bench below the Knob, north of the center of the path, was just starting downhill when he was hit by the slide. The force carried him and his machine 1,700 to 1,800 linear feet (and ± 100 vertical feet downslope), burying both. Jones, who was not found until Wednesday, was uncovered from 7 feet of snow 111 feet diagonally upslope from his Polaris 440 machine.

Jones' partner, Ray Debor, was approximately 150 feet downslope from Jones, heading downhill when he was hit from behind. Debor never knew the slide was coming. He and his machine were carried to within 70 feet of the toe of the slide. His machine was buried to the windshield while he was still sitting on the seat, buried to his knees but uninjured. The other two members of this group, Shane Brown and Brian Kirk were at the bottom of the slope, roughly 150 feet below Debor, waving Jones down. When they saw the slide coming, Kirk drove downhill towards the powerline and Brown drove south, parallel to the alignment. Both were dusted by the powderblast but uninjured.

Two other victims, Chris Scott and Jodi Combs were riding together somewhere in the runout of the path (location and direction of travel unknown) when they were hit, tumbled, and buried not far from Jones resting position. Scott was found dead Sunday evening buried under 7 feet of snow, approximately 18 feet diagonally upslope from his machine (Summit) which had its seat and handlebars above the snow. Combs' machine (600 Rocky Mt. King) was found Sunday night with its handlebars sticking out of the snow. Combs was found Monday afternoon, approximately 132 feet diagonally upslope from his machine. He was buried roughly 7 feet deep, with his head uphill, supine on his back, with his feet higher than his head. Scott's machine was located almost directly uphill of Combs' machine (see map).

The snowmachine (Arctic Cat) of the sixth victim, Jeff Saunders, was found Sunday night crossways underneath Scott's yellow Summit. Saunders' position at the time of the slide is unknown. He was found Monday afternoon, approximately 50 feet upslope diagonally from his machine and buried roughly 7 feet deep.

Along with the three machines (belonging to Scott, Combs, and Saunders) found Sunday night in the lower search area, two helmets were also located nearby, on the surface, roughly 6-8 feet apart. One was positively identified as Victor Jones'. The other (black, older model, gold lettering) must have belonged to either Chris Scott or Jodi Combs. Jeff Saunders had his helmet on when found.

Evidence indicates that the avalanche was quite turbulent right to the end of the runout zone. A video of the avalanche, shot from Tincan Ridge on the other side of the highway by 17 year old Jeff Piakowsky, shows 6 to 8 other snowmobilers fleeing the slide. The total number of victims caught and close escapes may never be known.

Immediately after the dust settled, witnesses responded from all directions to several areas of the avalanche and 911 calls were made to alert authorities. Debris covered an area greater than ½ mile by ½ mile, typically deeper than 10 feet. For the first couple of hours searchers worked independently in three search areas – “South Bench” where Dan Demers was buried, “Lower North” where Scott, Combs, Saunders, and Jones were buried, and “Upper North” where Aaron Arthur is likely to be buried.

The first organized rescuers to arrive on the scene were the Alaska State Troopers and the Girdwood Fire Department, followed shortly afterward by Chugach Powder Guides, the Alaska Mountain Rescue Group, the Alaska Search and Rescue Dogs, the National Ski Patrol, Mt. Alyeska Pro-Patrol, the U.S. Forest Service, the Alaska Mountain Safety Center, and others. Several helicopters were on-site and used to transport rescuers to the site. An aerial, scene safety assessment was done by the Dept. of Transportation and Public Facilities avalanche forecaster in AST Helo 1. By nightfall, roughly 7 P.M., the decision was been made by on-scene Troopers to clear the area and call the search off until daybreak. They felt this was the only way they could gain control of the scene and determine how many people were unaccounted for. Mission organization took place Sunday night at the Girdwood Fire Station.

On Monday, roughly ± 200 people were involved in the search effort for more than 12 hours. On Tuesday, approximately ± 350 volunteers searched another 12 hours, including 98 snowmobilers to transport food, equipment, and searchers to the site. Roughly 450 people responded Wednesday, including National Guard personnel. The weather during the operation was generally poor to bad. On Wednesday, there were 30-40 mph winds, heavy wet snow, and poor visibility. Due to storm conditions and increasing hazard, the official search for the last person was terminated early Thursday morning, March 25. On Friday and Saturday, approximately 40-50 friends and relatives of the remaining victim (Aaron Arthur) probed “unofficially”. Saturday night, the family of Aaron Arthur asked all searchers to stop searching because they did not want searchers placed at risk. That afternoon, another snowmobiler was killed by an avalanche while playing highmark near Eureka, in the Chugach Mts. 100 miles to the northwest of Turnagain Pass. In all, 12 avalanche fatalities occurred in Alaska from March 21 to April 29, 1999.

Rescue Summary:

Sunday evening, 3/21:

Dan Demers machine found on "South Bench." Demers found by spot probing. Head 5 ½' deep, feet 2' deep, 5 ½ feet slightly upslope of his machine.

Machines belonging to Chris Scott, Jeff Saunders, and Jodi Combs all found in close proximity in "Lower North," roughly 4-5' deep. Parts of Scott's and Combs' machine were visible, Saunders' machine was directly underneath Scott's. Two helmets were also found on the surface in this same area; one belonged to Victor Jones.

Chris Scott found in "Lower North" by coarse probing. 7' deep, 18' (estimated by pacing) upslope diagonally from his machine.

Machine belonging to Aaron Arthur was found partly buried, on its side, in "Upper North."

Monday, 3/22:

Jodi Combs found in "Lower North" by coarse probing. 7' deep, 132' (estimated by pacing) upslope diagonally from his machine.

Jeff Saunders found in "Lower North" by coarse probing. 7' deep, 50' (estimated by pacing) upslope diagonally from his machine.

Tuesday, 3/23:

Search continued in "Lower North" for Victor Jones and in "Upper North" for Aaron Arthur. An Alyeska Ski Resort cat was used to blade debris off of the most likely search area for Jones.

Wednesday, 3/24:

Victor Jones snowmachine found downslope of the other three machines in "Lower North." Jones was found about an hour later, in late afternoon. He was 111' (measured) upslope diagonally from his machine. He was found directly underneath a cat track where several feet of debris had been bladed off Tuesday, in an area that had been probed 6-8 times. His total burial depth was 7'. The top of the machine was buried 5-5 ½ feet deep.

Rescue notes:

Typically, most snowmachine victims in avalanche accidents are found within 40' of their machines, more often upslope than downslope. To date, no victims are known to have been found farther than 200' from their machines. What is interesting about the Turnagain Pass accident is that the position of all four victims in "Lower North" relative to their machines held true (see attached map). All four machines traveled further than the bodies. Three machines (Scott, Saunders, Combs) were roughly 15' from the edge of the debris. The victims bodies were found roughly 18-132' from their machines, essentially in parallel trajectories. This pattern was identified early in the search and used to help locate Saunders and Jones.

Magnetometers, metal detectors, and a ground radar detection unit were used to search the debris without result. The latter machine was run directly over the cat track where Jones was buried but did

not detect the body. Rescue dogs were also utilized without result, perhaps because the debris was dense and had multiple ice layers.

Most areas were probed multiple times before the victims were detected. This can be attributed to the crude nature of probing, inexperienced searchers, dense debris, and the ineffectiveness of conduit probes.

Critical Data:

Terrain Factors:

- *Elevation:* Starting zone: 2,800 feet
Runout zone: $\pm 1,050$ feet
- *Aspect:* Predominantly SE
- *Starting Zone Configuration:* Mostly open planar slopes with some convexities midway and some areas of channeling.
- *Lower Track and Runout Zone:* Mostly planar and concave with some alluvial fans.
- *Slope Roughness:* Generally smooth tundra-covered ground with some rocky patches and low brush (willows and alders).
- *Path Width:* Approximately $\frac{1}{2}$ mile.
- *Path Vertical Drop:* 1,750 feet.
- *Starting Zone Slope Angles:* Measured above the site of Demers body and machine (southern portion of the path): 32° - 33° for the first 200'-300' below the fracture line and generally between 37° and 39° on the steeper portions of the slope below the convexities. Measured above the northern side of the path (above Arthur's location): 32° for approximately 20' below fracture line and then 48° - 50° below the roll-over (immediately above Arthur's last seen area).
- *Runout Zone Angle:* Slightly inclined (0° - 5° estimated) except for some small steeper (60-100 foot) benches in the lower runout zone.
- *Runout Angle (Alpha angle):* 23.5° and 24° (measured) for the northern and southern portions of the path respectively.

Snowpack/Avalanche Factors:

- *Type:* Hard slab, human triggered
- *Classification:* HS-AO-5-O-J
- *Debris Depth:* Estimated at 15'-20' at the deepest, with most being deeper than 8'-10'.
- *Fracture Profile Data:* Fracture depth averaged ± 6 feet. A fracture profile taken near the south end of the avalanche, above Dan Demers site ("South Bench"), revealed a stepped fracture consisting of a 34" thick slab of rounded grains and partially metamorphosed new snow failing on a 1/3 inch thick layer of early facets. This shear plane was created by near surface facets formed during a 5 day period of clear weather that occurred about one week before the accident. The slab above was created by subsequent storm activity. Boot penetration was to the knee. Once the upper layer failed, it stepped down an additional 4 $\frac{1}{2}$ feet, shearing near the top of a thick layer of well-developed facets which had been formed during a three week cold, clear spell in late January and early February. In many places the snow failed as a stepped fracture, but in some, the failure occurred as a single slab with a thickness of up to 7.5 feet (measured).

A fracture profile taken on the north end above the Aaron Arthur site ("Upper North") indicated the slab failed on the same two layers, but at different depths. Here the slab failed 6.5' deep on the thin faceted layer, then stepped down an additional 30" to the deeper faceted layer. At mid-elevation, the avalanche appeared to run to the ground (on facets) in many places, but the bed surface in the starting zone was predominantly the deeper faceted layer.

- *Slab Depth:* variable, 6' average, 7 ½' maximum. Some bare places were observed at mid-elevation prior to the avalanche in the vicinity of the highmark trigger area. Probably more than 3' was available for entrainment at lower elevations, with deeper deposits higher and on lee slopes.
- *Fracture Length:* Approximately ½ mile.

Weather Data: Snowfall in this area was sufficiently deep for winter recreation by late October. Later January and early February were characterized by below normal temperatures (-10° to -30° F) and little or no snowfall. From the end of February until the date of the accident, relatively heavy snowfall fell on almost a daily basis, except for a short period of clear, cool weather which occurred about a week before the accident. The day of the accident dawned clear, warm, and windless.

Major Contributory Factors of the Accident:

- A major snowfall had ended the day before creating an additional load to already stressed slopes and buried weak layers.
- Persistent instability was known to exist area-wide. Recent avalanche activity could be easily observed at numerous locations from the Seward Highway en route to the site. Additional avalanches continued to fall in the area during the day.
- The warm sunny weather on the day of the accident acted like a magnet to draw backcountry recreationists to the field. Warming of the surface layers may have made them more susceptible to human-triggering in shallow areas.
- Four people highmarking or hill-climbing on these steep, snow-loaded slopes greatly increased the probability that an accident would happen and that it would be triggered by the victims. Having numerous others in the runout zone at the same time exacerbated the outcome.
- Many of the victims were inexperienced in evaluating snow stability or analyzing terrain from an avalanche perspective, and thus were ignorant of the hazard;
- Others, were aware of the potential hazard but underestimated the degree of risk they were taking or overestimated their ability to deal with it. Many ignored the public warnings about the potential avalanche hazard distributed via various media sources during the previous week.
- Few had proper rescue equipment or knew how to use it.

Victims:

Fatalities: Jeff Saunders, age 29; Dan Demers, age 37; Jodi Combs, age 26; Chris Scott, age 28; Aaron Arthur, age 29; Victor Jones, age 37.

Injured: Ray Richards, age 24; Rex Richards; and Fred Maranville.

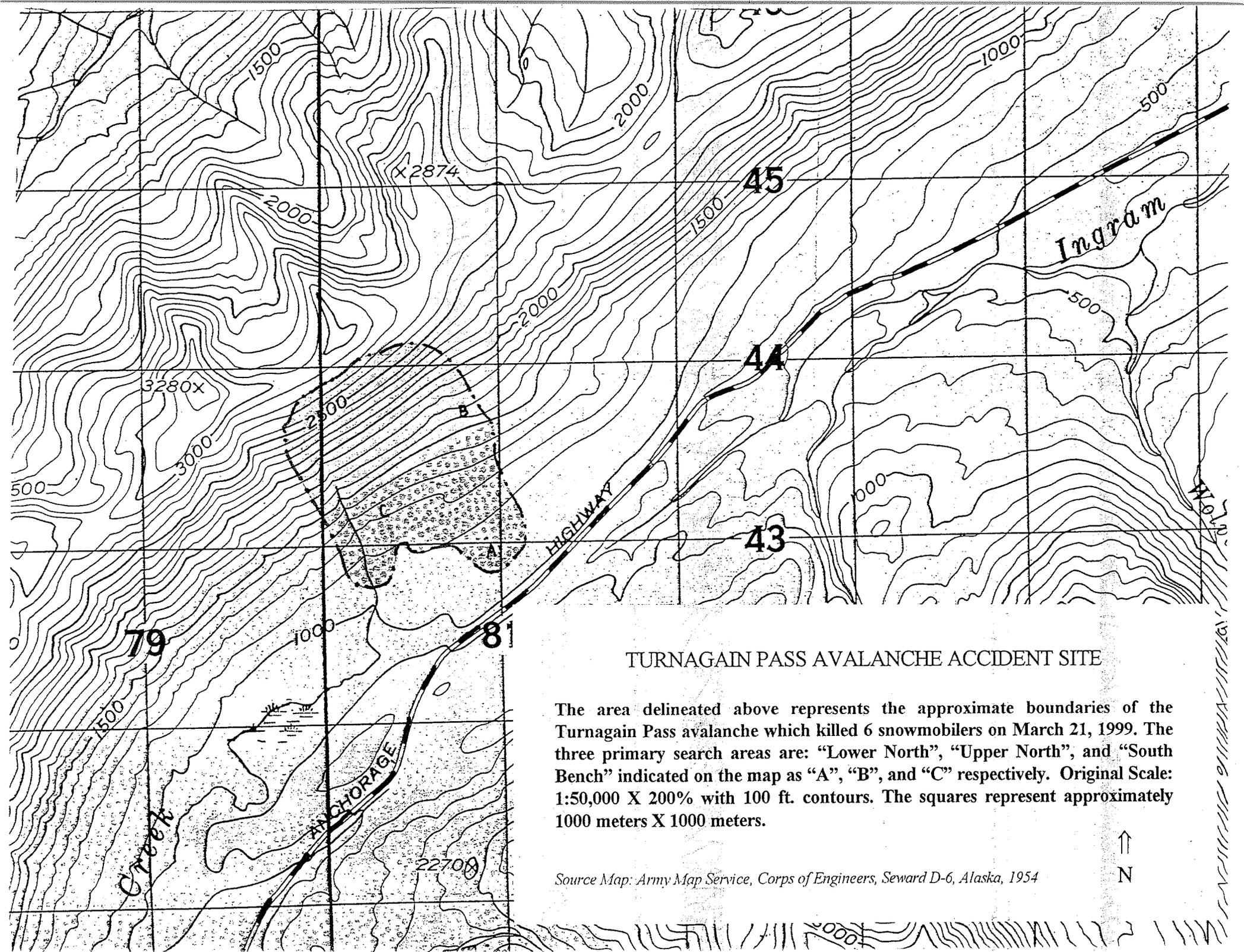
Others Caught in Debris: Ray Debor, age 35.

Others Dusted by Powderblast: Steve Estes; Shane Brown, age 25; Brian Kirk, age 24.

Sources and Information Contacts:

Note: Other reports re: this accident have been compiled by the Alaska State Troopers, the U.S. Forest Service, Alaska Search and Rescue Dogs, and Elmendorf Air Force Base Third Civil Engineer Squadron. Extensive media coverage also exists, including photographs by the Anchorage Daily News.

- Attachments:**
- 1) Topographic map of avalanche area;
 - 2) Map of relative locations of victims and machines;
 - 3) Map of relative distances of victims and machines;
 - 4) Oblique photo of the Turnagain Pass avalanche accident site;
 - 5) Photos of the fracture line and track above Dan Demers burial site;
 - 6) List of sources and information contacts.

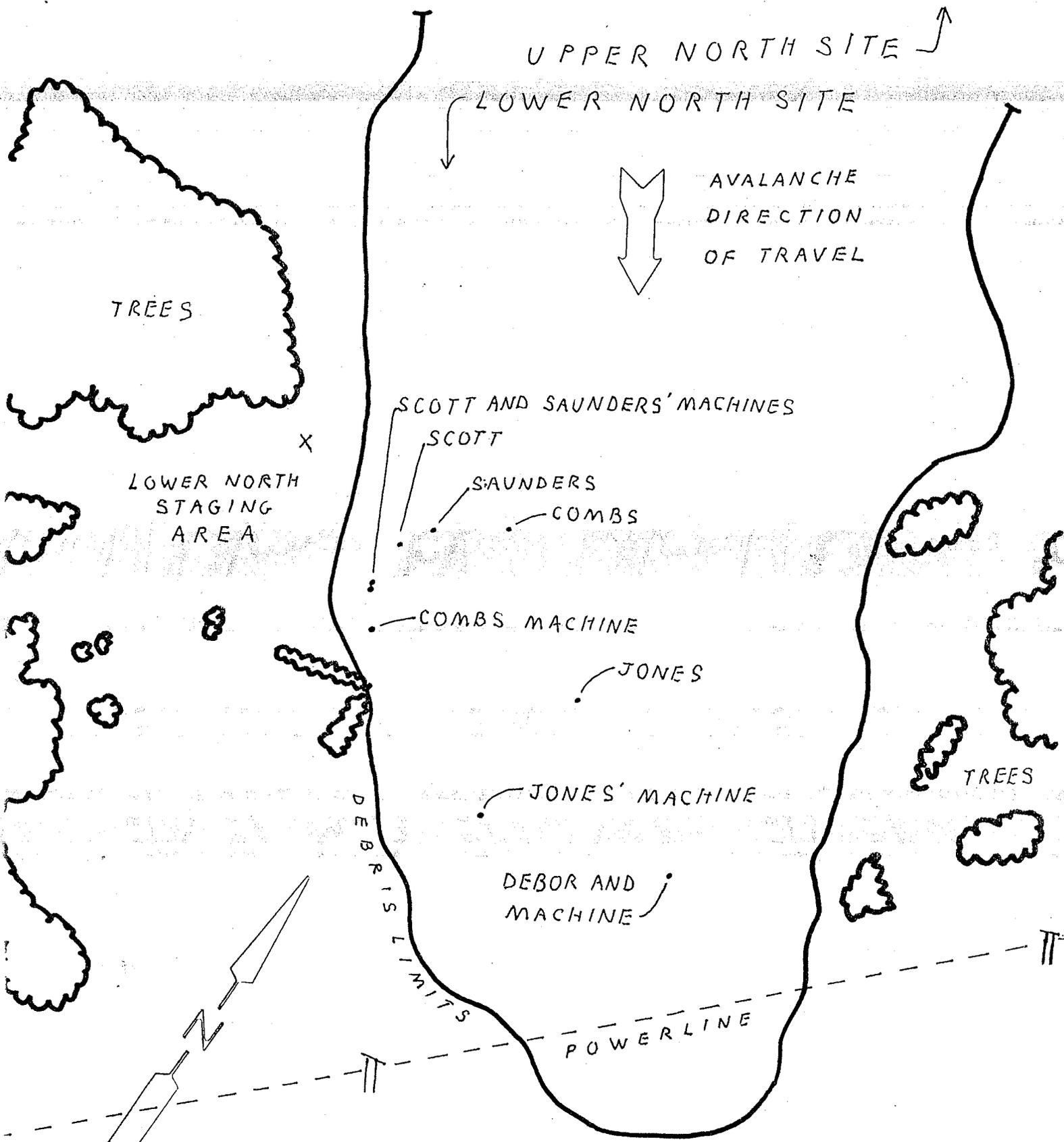


TURNAGAIN PASS AVALANCHE ACCIDENT SITE

The area delineated above represents the approximate boundaries of the Turnagain Pass avalanche which killed 6 snowmobilers on March 21, 1999. The three primary search areas are: "Lower North", "Upper North", and "South Bench" indicated on the map as "A", "B", and "C" respectively. Original Scale: 1:50,000 X 200% with 100 ft. contours. The squares represent approximately 1000 meters X 1000 meters.

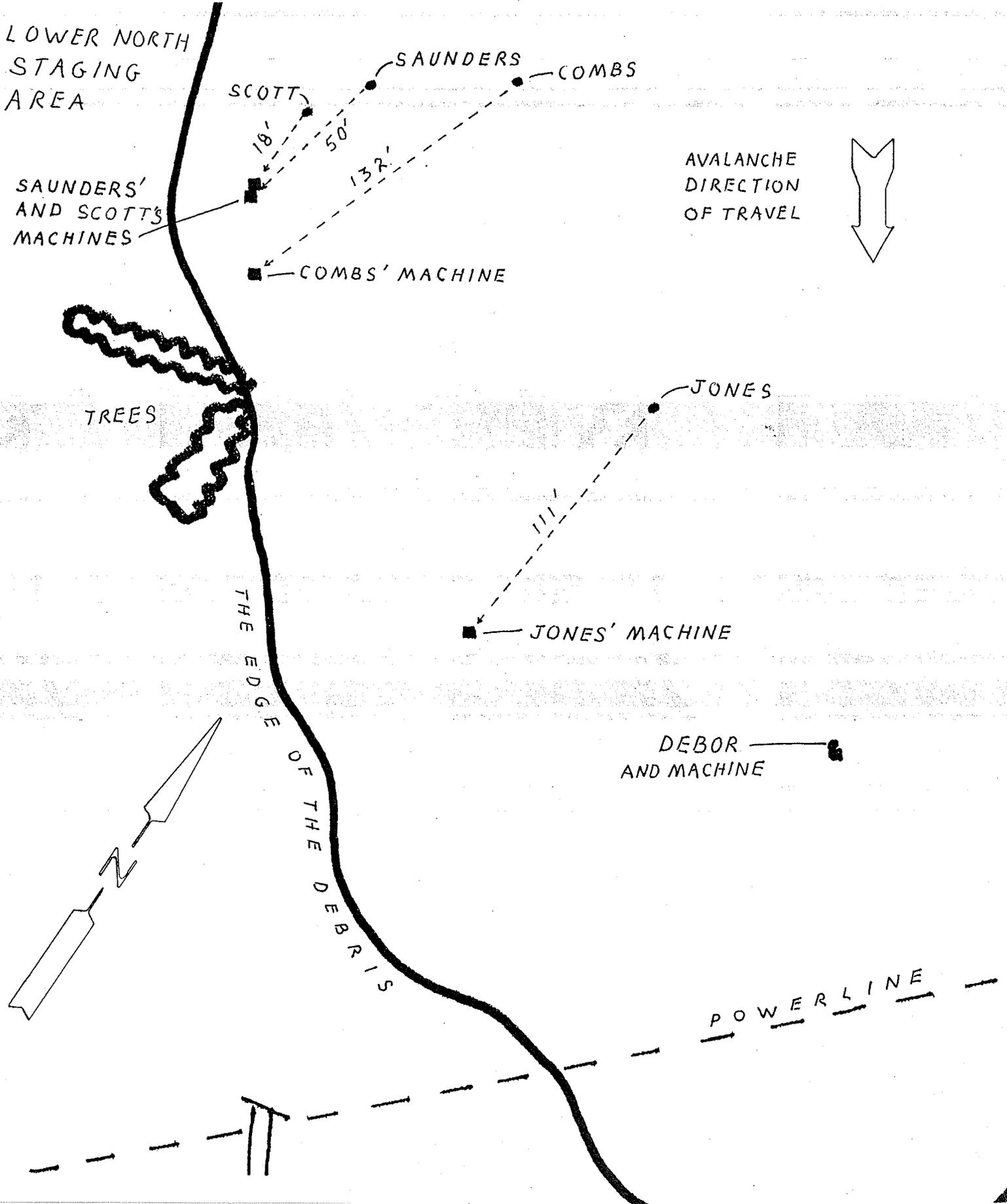
Source Map: Army Map Service, Corps of Engineers, Seward D-6, Alaska, 1954

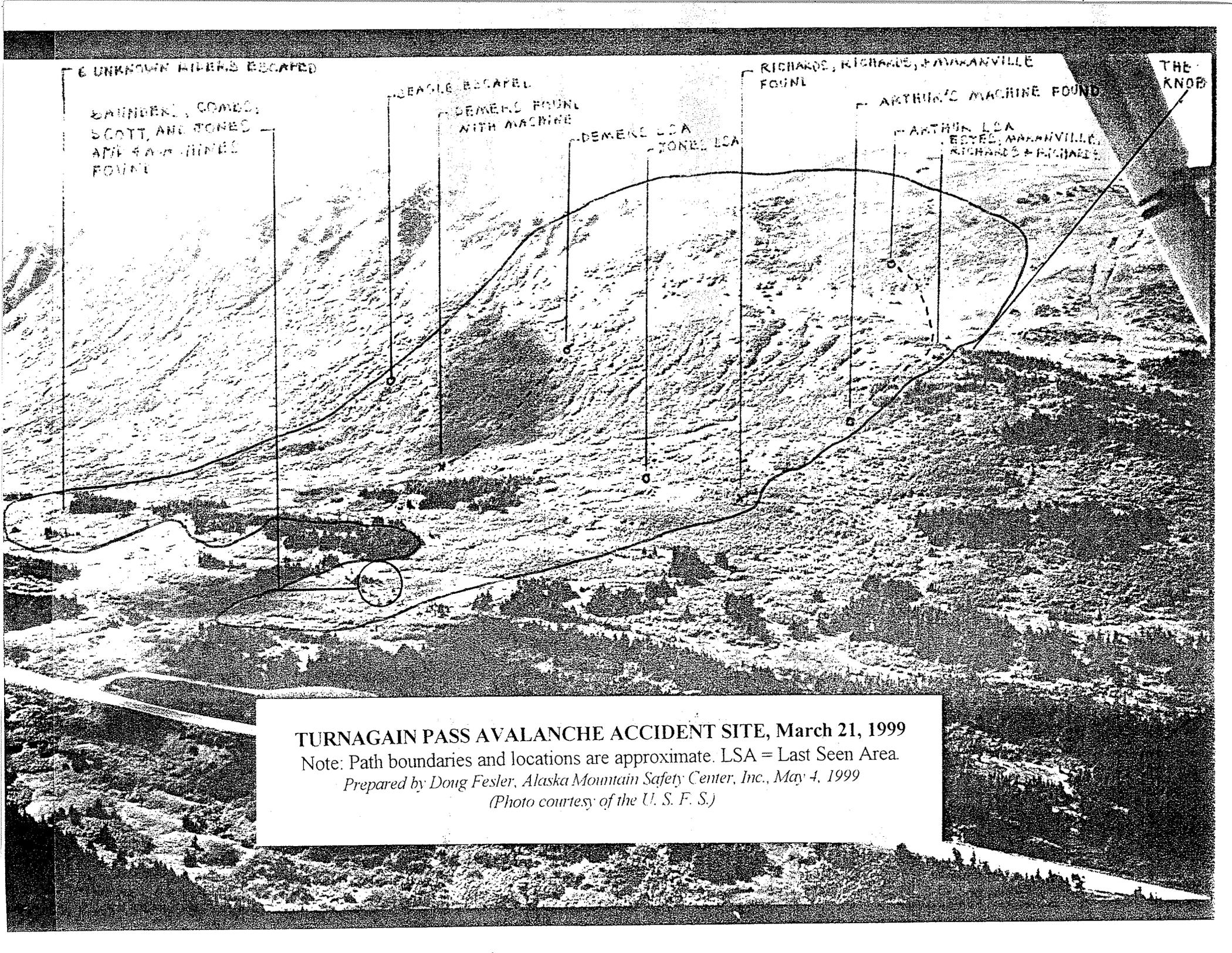




RELATIVE LOCATIONS OF VICTIMS AND MACHINES AT THE TURNAGAIN PASS AVALANCHE SITE: Based upon aerial photos taken two weeks after the accident and measurements taken at the time of the recovery. Relative positions are drawn approximately to scale. (Photos by Jill Fredston and drawing prepared by Doug Fesler, Alaska Mountain Safety Center, Inc.)

RELATIVE DISTANCES OF MACHINES FROM VICTIMS AT THE TURNAGAIN PASS AVALANCHE SITE: Based upon aerial photos taken two weeks after the accident and measurements taken at the time of the recovery. Relative positions are drawn approximately to scale.
(Photos by Jill Fredston and drawing prepared by Doug Fesler, Alaska Mountain Safety Center, Inc.)





TURNAGAIN PASS AVALANCHE ACCIDENT SITE, March 21, 1999

Note: Path boundaries and locations are approximate. LSA = Last Seen Area.

Prepared by Doug Fesler, Alaska Mountain Safety Center, Inc., May 4, 1999

(Photo courtesy of the U. S. F. S.)



Turnagain Pass Avalanche Accident, March 21, 1999: Taken above Dan Demers burial site, the top photo shows the crown face at its deepest. For scale, the man is 6 feet tall. The photo below was taken at mid-elevation in the general area where Dan Demers was highmarking. Typically, an avalanche which fails to the ground indicates a buried weak layer of well-developed facets such as those that formed during the cold weather in late January and early February. (*Photos by Paul Wunnicke*)



