



# ICE PICK

**It was a ski-equipped LC-130 like this that DMS fourth-year student Malcolm Schongalla (above) was copiloting during the aborted 2006 rescue flight that he describes here.**

**“Three miles . . . Two-point-five . . . Two miles . . . Missed approach point,”** intoned Lieutenant Tim Novak, our plane’s navigator.

A blizzard was raging outside our Air National Guard LC-130 as we were trying to come in for a landing. We were by then just a few hundred feet above the ground, in the middle of a whiteout—a maelstrom of snow and turbulence. Somewhere below us lay WAIS Divide Camp, Antarctica, where we’d been sent on a rescue mission.

Five pairs of eyes strained out the plane’s windows for a sign—any sign—of the bamboo flags marking the camp airstrip’s safe landing area. But not a thing was visible through the opaque nothingness. “Go around,” I said. The pilot, Lieutenant Colonel Lloyd East, had flown Air Force planes on every continent, in wartime and peacetime, and had just about seen it all. His steady hands advanced the throttles, and we climbed away from the unseen ground to try another approach.

It was January of 2006, and I was the flight’s copilot, getting my first taste of some of Antarctica’s worst weather. Our mission that day was to evacuate a worker from a WAIS (West Antarctic Ice Sheet) camp back to McMurdo Station, on Antarctica’s Ross Island, nearly 900 miles away. We made several unsuccessful approaches, each time descending to the minimum altitude permitted in such weather. Several inches of ice built up on our wings, and we were paying close attention to our dwindling fuel supply.

Finally, we had no choice but to return to McMurdo. It would be another 24 hours before the weather broke and a different crew was able to make it in. Fortunately, this worker did not require emergency treatment himself; he had been alerted to a family crisis back in the U.S. and was needed there. We did everything we could to get him home quickly, but in Antarctica, one soon learns, Mother Nature calls the shots.

**On the highest,** driest, and coldest continent, my unit, the New York Air National Guard’s 109th Airlift Wing, flies LC-130s—the world’s largest ski-equipped transport planes—to the most remote destinations on Earth. Since my first season there, in 2006, I’ve managed to work

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**When a Dartmouth medical student picked Antarctica as the place to serve one of his elective rotations, he knew he was consigning himself to seven weeks of ice, snow, and cold. But he came away with warm feelings for those who work at the far end of the Earth and a deepened appreciation for wilderness medicine.**

**By Malcolm Schongalla**

For a **WEB EXTRA** with more photos from Schongalla’s time in Antarctica, see [dartmed.dartmouth.edu/w11/we01](http://dartmed.dartmouth.edu/w11/we01).



In the early months of the Antarctic summer, this nearby seasonal icepack can serve as a runway for McMurdo Station's airfield—but mid-summer melting calls for a move onto permanent sea ice.

**I breathed in the crisp, dry air and took in a bustle of activity: forklifts, strange-looking trucks with six-foot-high tires, and people in giant parkas were scurrying everywhere.**

three more visits into my medical school schedule. In the late fall of 2010, I returned for another seven-week flying deployment. But this time, I would not just be flying. I've always had a strong interest in wilderness medicine, and this trip would also serve as one of my DMS electives; I would be using some of my time there to see how wilderness medicine was practiced in the frontier communities of the Antarctic.

**Mid-November** of 2010 found me in Christchurch, New Zealand—a stunningly beautiful stepping-stone to Antarctica. Each season, hundreds of scientists, support contractors, and Air Force personnel pass through this picturesque city on their way south. In November, it is, of course, summer there, and the lush, warm climate offers travelers a final taste of temperate weather before they depart for weeks, or months, of polar conditions.

Most of those bound for Antarctica complete the final leg of the trip aboard an Air Force LC-130 (which is about the size of a 737, though much less luxurious inside) or an even larger C-17. The C-17 is so big its fuel tanks alone hold more weight than the equivalent of a fully loaded LC-130, and it can

also carry the weight of another fully loaded LC-130 on its cargo deck.

On this trip south, I was a passenger in the back of a C-17. Even though these behemoths lack skis for landing on snow, in good weather they can land on a solid-ice runway—if the ice is thick enough. After a four-and-a-half-hour flight, we touched down on McMurdo Station's ice runway just a couple of days before Thanksgiving. McMurdo is the largest of the continent's 16 major research stations, each operated by one of eight different nations; the U.S. operates three of the 16 stations, plus numerous smaller field camps.

I stepped off the plane onto the seasonal icepack. The crystal-clear panorama was surmounted by a bright blue sky, and it was a relatively balmy 15 degrees below zero Celsius (5 above Fahrenheit). I breathed in the crisp, dry air and took in the bustle of activity: forklifts, strange-looking trucks with six-foot-high tires, and people in giant parkas were scurrying everywhere. An active, smoking volcano almost 13,000 feet tall, Mount Erebus, dominated the horizon to the east. An odd mirage formed by cold air settling onto the ice, known as Fata Morgana, cast an illusion of massive cliffs off to the west along the Royal Society range, overlooking frozen McMurdo Sound. The planes in my unit's LC-130

squadron sat parked at the other end of the airfield, having arrived some weeks earlier, in October, for the opening of the summer season.

An enormous bus, dubbed "Ivan" (the "Terra Bus" . . . get it?), pulled up to carry the flight's crew and passengers half a mile across the ice shelf to terra firma. I looked forward to settling in and eventually meeting the doctors, nurses, and other staff who keep the continent's U.S. citizens healthy.

But first I got to join hundreds of other jogging enthusiasts for McMurdo's annual Thanksgiving "Turkey Trot" 5K race, then enjoyed a five-star holiday dinner whipped up by the cafeteria crew. For those who spend "the season"—October through February—working here, the occasional holiday banquets are essential morale boosters. Besides turkey, lobster, and apple pie, the Thanksgiving menu featured what in that setting are true luxuries: fresh vegetables, salad, and real (rather than powdered) milk. It was a warm welcome!

**I soon established** a daily routine—mostly flying, plus some regular visits with medical personnel.

Dr. Harry Owens exemplifies the kind of person who is attracted to polar medicine. McMurdo Station's medical director and chief physician, he is a big fellow with an even bigger smile. He has a confident manner that comes from spending many years roughing it on the frontier. Dr. Owens is a veteran of wilderness medicine, a generalist who has spent more time in Alaska and the Amazon jungle than in modern hospitals. The last three austral summers, he's worked at McMurdo. A clinician's clinician, he boasts that during his long career "I've never ordered a CT scan." That's not because he doesn't see a use for such scans, but because in 40-odd years of practice, he's never been anywhere with a CT machine nearby. He can't imagine practicing any other kind of medicine, making him a rarity in this day and age.

Owens sees some interesting and sometimes challenging cases in Antarctica. If, on rare occasion, he encounters a situation too serious for McMurdo's small clinic, he relies on the U.S. Air Force to evacuate the patient to New Zealand. Many of the injuries he treats are hardly a surprise, given the environment. Working outside in subzero temperatures and biting winds is an invitation to frostbite, especially when metalwork is involved. And the heavy machinery that is omnipresent can result in trauma, burns, and electrocutions. Most minor injuries can be treated in the clinic, which boasts a modern x-ray room and the biggest physical therapy suite on the continent. More serious cases are



There are plenty of planes—but no trains and almost no automobiles—in Antarctica. Most travel there is by air or snowmobile, above, or on specialized vehicles like "Ivan, the Terra Bus," below, an all-wheel-drive, off-road bus equipped with monster truck tires.



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stabilized and evacuated north, accompanied by military flight nurses and aeromedical technicians—crewmembers who have been hardened by service on medical evacuations from Afghanistan and Iraq. All in all, evacuations are necessary only a handful of times a year; the U.S. Antarctic Program has an excellent record when it comes to occupational safety and mishap prevention.

**Despite the hazards** inherent in the polar environment, most patients are not trauma cases or emergencies. The majority represent the scourge of any deployed operation: simple infectious illnesses, often wearily referred to as "the crud." Ubiquitous hand-washing stations, vigilance regarding vaccinations, promotion of condom use, and other simple preventative measures remain a doctor's best weapons. It's hard to walk through a



“McMurdo General Hospital” reads the sign on the side of Antarctica’s busiest medical clinic. McMurdo’s population averages 1,100 in the summer, but only about 125 during the winter.

**Most patients are seen in one of the fully equipped general exam rooms. The three inpatient rooms and three-bed emergency room are rarely used but are available if needed.**

doorway anywhere at McMurdo without passing a hand-sanitizer dispenser. Dr. Owens and his team also take care of mild chronic diseases, such as controlled diabetes and hypertension. But McMurdo’s population is pretty healthy, not surprisingly, as everyone must pass a thorough physical exam and psychiatric interview before traveling there.

Owens and his colleague Dr. Adam Colombo, an Air Force major and flight surgeon, invited me on a tour of “McMurdo General Hospital.” Originally built by the U.S. Navy (which ran McMurdo until the late 1990s), the small clinic offers more than initially meets the eye. Most patients are seen in one of the fully equipped general exam rooms. The three inpatient rooms and three-bed emergency room are rarely used but are available if needed. A simple pathology lab can handle basic tests, and a state-of-the-art x-ray suite is connected via the internet to radiology offices in Australia and Texas. And no former Navy clinic is complete without a hyperbaric dive chamber. Scuba-diving is an essential means of studying the teeming wildlife of McMurdo Sound, and dozens of dives are made under the ice every year. Sea vessels also occasionally need underwater repairs by commercial divers—such as in 2007, when a Russian container ship broke a main screw. The hyperbaric chamber has

proven its worth several times. Without it, decompression sickness in this remote region would be an agonizing death sentence.

McMurdo, with an average summer population of 1,100 (compared to an average of 125 people who winter over), has the continent’s busiest clinic—there are sometimes as many as five patients in a day. But a number of injuries and illnesses also occur deep in the field, far from the relative luxuries of the clinic. Most of the U.S. camps are at least a few hours’ plane flight away, and, as I’d learned in 2006, you can never count on the weather.

**When I first** saw Juli, the physician assistant at WAIS Divide Camp for the 2010-11 season, she was dressed like a giant banana. A remote research camp becomes a tight-knit community, and a small number of people share many important jobs. One of Juli’s jobs that day was to marshal our arriving aircraft into the cargo area. As we slid our ski-plane to a stop on her hand signals, the flight deck was full of chuckles. We were quite taken by her outfit and supposed that making a bright-yellow banana costume must be the kind of thing that snow-bound personnel do to break up the monotony of months on end in a barren snowfield.

The day soon offered another diversion. While the cargo we’d brought with us was being unloaded, we learned that an unpredicted storm had settled in over McMurdo. There’d be no going back that night, so we had an afternoon and evening free to explore; this was the chance I’d been looking for, to learn about the medical facilities in a field camp.

**Juli and her paramedic**, Aaron, were stationed for the whole season at WAIS Divide, one of the larger field camps. Experts in drilling ice cores return there year after year and have extracted some of the oldest ice cores known to science. Cores from WAIS Divide have contributed substantially to our knowledge of the paleoclimate record. Last season, the camp set a new drilling record, reaching bedrock at 10,928 feet (more than two miles) below the surface. WAIS Divide, by the way, sits only 5,793 feet above sea level. And, yes, it’s ice all the way down. In many parts of Antarctica, the continental bedrock is pushed that far down by the overwhelming force of the ice cap. Geologists predict that the bedrock would be well above sea level were it not for the weight of the ice above it.

Juli escorted me to her medical tent, which is spartan even by the standards of McMurdo’s clinic but typical of the medical facilities in camps housing 50 to 100 people. Juli and Aaron dispensed basic medications, splinted sprains or breaks, and decided when patients needed evacuation. Their entire clinic was a room-sized, insulated tent with a heater, a single cot, and a few shelves of equipment and supplies. Fortunately, as of mid-season, they had needed to evacuate only one or two people for relatively minor injuries. Given the scarce resources, they were proud of the care they were able to provide using their training and ingenuity.

But despite the best efforts of people like Juli and Aaron, the polar environment remains a huge medical challenge. Extreme temperatures and weather are the rule, not the exception. And thanks to an ice cap that is miles thick, Antarctica has earned the title of the “highest continent,” too. Few people realize, for example, that the South Pole station sits 9,300 feet above sea level—almost twice as high as Denver. At many Antarctic camps, acute mountain sickness (AMS) is a very real threat for new arrivals.

High-altitude acclimatization is carefully monitored by the U.S. Antarctic Program, and travelers must follow strict guidelines before being allowed to spend a night at any of the higher camps. Even so, the headaches, nausea, and general misery of altitude sickness are not uncommon. I vividly re-



When Schongalla landed at the remote WAIS Divide Camp, above, it was the camp’s physician assistant—dressed in a bright-yellow banana costume—who directed the plane to a stop. Below is the camp’s cozy dining tent, the location for most social activities.



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member a brush I had with altitude sickness while hiking up Pike’s Peak during college. I felt worse at its 14,000-foot summit than I ever had before. Though I was in perfect health, nothing made the pounding headache or nausea go away as long as I was on the summit. Fortunately, I was able to hitch a car ride down, and I felt better immediately.

**But that’s not** an option on Antarctica, especially if bad weather sets in. Thanks to the program’s acclimatization protocols, it is rare that an evacuation is required for AMS. But it can happen, and for that reason so-called Gamow bags are standard equipment not only at the camps but also in our aircraft survival kits. A Gamow bag is an inflatable tube, big enough to hold one person. Powered by a simple foot pump, these air-tight, inflatable chambers provide a temporary pressurized micro-



A row of bright yellow tents stands out against the Central Transantarctic Mountain Range at this remote research camp—one of several that Schongalla visited during his seven-week stay.

**If they are lucky, one or two members of such a research team might have wilderness first responder or emergency medical technician training. A big first-aid kit might be their only resource for days.**

environment. Descent is the only way to treat life-threatening conditions like high-altitude pulmonary or cerebral edema, but a Gamow bag can buy valuable time for anyone afflicted. Although some drugs can be used prophylactically against these conditions, they can strike unpredictably and with tragic consequences.

As small a community as WAIS Divide is, many camps are even smaller. One of my first flights of the season took me to the southernmost tip of the Ross Ice Shelf, where we dropped off about 20 scientists for a stay of a few weeks. The researchers had previously identified some interesting geological features deep beneath the surface. Investigations like these have a variety of purposes. Some involve unique snow and rock formations. Physicists may study the flow of glacial ice streams or place seismological sensors. In some places, the wind collects meteorites into natural caches that are ripe for the picking. Other sites, near mountain ranges, hold treasure troves of dinosaur fossils, from a warmer time in Antarctica's history. Such research teams are usually small. If they are lucky, one or two members might have wilderness first responder or emergency medical technician training. A big first-aid kit might be their only resource for days. A request for air evacuation has to be called in by satellite

phone or radio. And because the snow is not always marked with landing flags, a rescue flight may not be able to land unless the weather is fairly good. In many respects, the brave researchers who venture out on these missions are among the most profoundly isolated travelers in the world.

Sometimes, a medical condition arises that has nothing to do with the polar environment, yet Nature still holds people at her mercy. This reality caught the public's eye in 1999, when Dr. Jerri Nielsen was the South Pole Station's only physician during the long, dark winter. In the middle of her tour of duty, she discovered a lump in her breast, which she ultimately diagnosed as a deadly cancer. Given outside temperatures well below  $-50^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$ ), plus the perpetual darkness of winter, a rescue landing was deemed impossible. It was possible, however, to send a C-141 over the pole to airdrop the medical supplies she needed to give herself chemotherapy.

At the very earliest opportunity, weeks sooner than usual, the Air Force organized a flight to pick up Dr. Nielsen, as well as another station member who had a hip injury. The sun had not yet fully risen, so station workers marked the approach end of the landing area with flaming 55-gallon drums. The early-season mission, in the long, frigid dawn

of the South Pole's springtime, was a logistical and medical triumph. Nielsen made it home and received further treatment that pushed her breast cancer into remission; she told the tale of her ordeal in an autobiographical account titled *Ice Bound: A Doctor's Incredible Battle for Survival at the South Pole*. Sadly, her cancer eventually recurred, and she succumbed to metastatic disease in 2009.

Nielsen is not the only doctor with a harrowing tale of survival on the ice. A mere 18 months after her rescue, Dr. Ronald Shemenski became the second doctor rescued from the South Pole in recent times. In April, a month after the last sunset of the season, he came down with gallstone pancreatitis. After weather delays and several failed attempts by Air Force and civilian aircraft, a break in the weather allowed a small Twin Otter plane to make it in. The slogging, 9,000-mile roundtrip rescue mission began and ended at Punta Arenas, Chile. Shemenski was lucky—as a rule, a midwinter rescue from the South Pole is simply not an option.

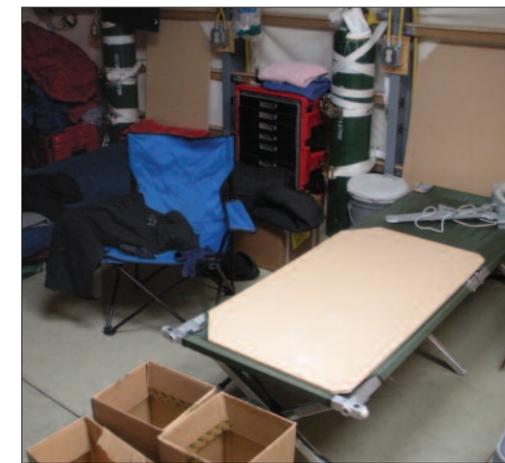
Perhaps the most remarkable polar medical saga happened in 1961. Antarctic exploration was still relatively young, and explorers were even more isolated than they are today. That year, Dr. Leonid Rogozov was the lone physician with a Soviet team at Novolazarevskaya Station, a remote outpost on the opposite side of the continent from McMurdo. One day, Rogozov was distressed to note a worsening pain in his lower abdomen. In the middle of winter, with no hope of rescue, he diagnosed himself with acute appendicitis. Antibiotics proved futile, and he found himself in the unenviable position of needing to perform an appendectomy on himself. Using only local anesthesia, and forgoing gloves in order to retain the maximum sense of touch, he and two assistants successfully removed his inflamed appendix in a two-hour operation. Rogozov recovered and completed a successful expedition.

But the Soviets learned their lesson and from then on sent two doctors on every trip. The lesson I was learning was that it could be dangerous to be a doctor in Antarctica!

**When I arrived** at McMurdo in November, early in the season, the ice runway had not yet melted under the 24-hour sunlight of summer. It could still support the weight of even the heaviest Air Force transport planes. In a few short weeks, however, under the onslaught of nonstop sun and warming ocean currents, the entire airfield turned into a slushy quagmire. At that point, the air operation had to be moved 14 miles away, onto permanent sea ice, at Pegasus Airfield. This annual transition is usually accompanied by little fanfare, but



The medical facilities are basic by U.S. standards even at McMurdo Station; above is one of the three beds in its emergency room. And they are more spartan still at the smaller research camps; below is the lone bed—a cot—at the camp pictured on the facing page.



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it has serious implications. Instead a five-minute drive from town out to the wintertime runway, aircrew and passengers have to make a rough hour's drive out to Pegasus Airfield. The road is treacherous and sometimes impassable. Some slushy puddles can swallow a snowmobile. This presents no small challenge to an ambulance driver transporting a patient who requires emergency evacuation. Nearby Williams Airfield, an emergency diversion location, is actually named after an unfortunate Navy vehicle driver who, decades ago, plunged through the ice on his tractor and was never seen again. Traveling across the ice shelf is commonplace, but it is not something to take lightly.

The transition to Pegasus Airfield occurred uneventfully last season. Soon it was my turn to work a week in the office there, supervising flight operations. One morning, an unusual message came in.

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## Ice Pick

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"We have a 65-year-old gentleman from Concordia Camp," the message began. It turned out that a senior scientist at a European camp was on his way to Pegasus by light aircraft, in the company of his camp's doctor. He had developed a bad cough quite rapidly and was now very weak and in pain. Pneumonia was suspected. Concordia Camp, also known as "Dome Charlie," sat nearly 11,000 feet above sea level, and it was no place to try to ride out a potentially serious illness. I notified Dr. Owens that, if he wanted, I could ask my standby crew to fly him north that same day. But first, Dr. Owens needed to check him out.

This time, the weather was working in our patient's favor. After an uneventful flight, he arrived at Pegasus around lunchtime. In his condition, an hour's ride over bumpy ice roads would have been torture, and valuable time would have been lost. We decided to dispatch a helicopter instead. Minutes later, he was in town and under the care of Drs. Owens and Colombo. A chest x-

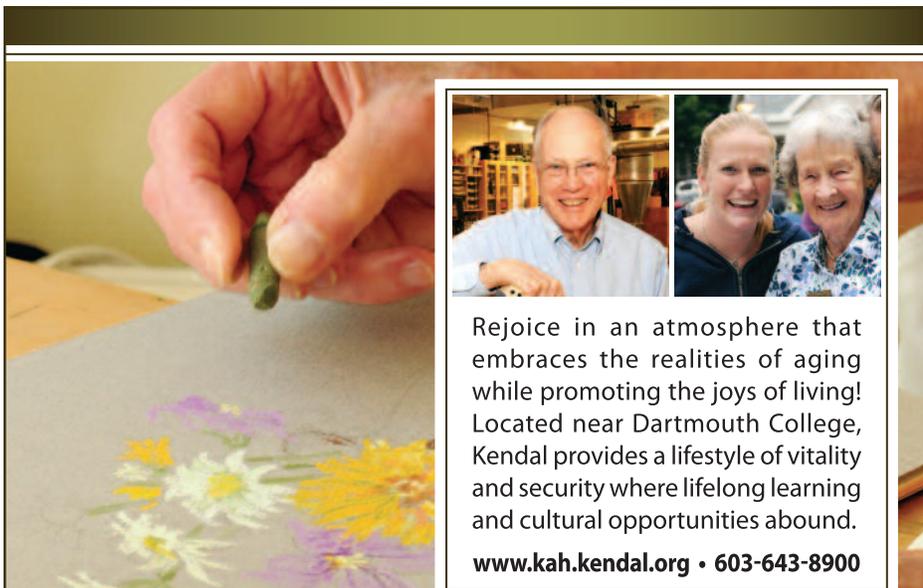
ray looked clear, but his platelet count was dangerously low. The connection between high altitude exposure and platelet count is not fully understood, and past research has been contradictory. There was probably something else going on here. The patient was an Antarctic veteran who was seemingly well-acclimated, so the cause of his symptoms was uncertain at that point. Regardless, his condition was deteriorating and this was a clear-cut case for evacuation.

Soon, the helicopter whisked him out to the airfield again. It was now late in the afternoon, and my alert crew was facing an eight-hour flight that would land in Christchurch well after midnight. The flight nurses made the patient comfortable in the aircraft, the crew started their engines, and they were soon bound for New Zealand. Less than 24 hours after his evacuation began, the ailing scientist arrived at a fully-equipped hospital partway around the world. It took seven rides, in five different vehicles, by the time all was said and done.

It was satisfying to play a part in a successful rescue mission, and I thought back on all I had learned during this expedition.

Every visit to this far end of the Earth offers an opportunity to contribute a little bit to a prodigious research program. I appreciated the chance to learn firsthand from scientists working on the front lines of research. And this year, thanks to the kindness of people like Dr. Owens, and the misfortunes of various fellow expeditioners, I had also learned many lessons from the front lines of medicine. In January, as I made my last takeoff from Pegasus, heading north, all these lessons occupied my thoughts. Every trip is different, but what really made this season stand out for me was the taste of wilderness medicine on the polar frontier.

Leaving Antarctica, I'd already learned, is always a bittersweet moment. A visit there involves adventures, challenges, and friendships that you can't find anywhere else. It's one of the few places I know that is simultaneously monotonous and unpredictable. Yet despite its appeal, at some point one begins to miss familiar sights and sounds and to wish away the monochromatic, alien landscape. So although I was happy to be heading back to New Hampshire, I was already looking forward to my next trip south. ■



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