# CHAPTER 7
# Building Plateau

The flight from Amundsen-Scott on 4 January 1966 was charged with excitement, not only on my part but also on the part of the pilot and crew. Plateau Station was open about three weeks by the time of my flight. I was the second wintering over scientist to make this flight, succeeding Rob Flint, our Scientific Leader who was on the first flight. Landing and takeoff procedures were not at all routine at this point. The air on the high plateau was much thinner than anywhere on the continent. The temperatures were colder, but worst of all for the pilots, the top several hundred feet of snow was less dense than most places in Antarctica. Radar could not give a "ground" or snow surface reference but would look right through it, not seeing much difference between the air and the snow surface.

As we came in for a landing I was allowed in the cockpit behind the copilot and could see a lone Jamesway hut and a scattering of freight crates all over the place. I was immediately self centered with a concern that a region of the snow might not have been left untouched for my delicate radiation measurements and drift experiments. Even the inversion study assumed a snow surface relatively undisturbed, but if tracks and crates were strewn all over I feared losing that purity. The pilots, on the other hand, were concerned for our safe landing on a still uncompleted landing strip. The big traxcavators, needed to pound down the snow surface for a hardened ski way, were not yet delivered. Those flights were to follow in the very next days.

The pilots also were more than concerned with takeoff. Surface temperatures were near thirty and forty below zero at low sun angles of the midnight sun and would warm to twenty below near the noon day sun. Fuel lines were always in danger of freezing. The drag of the soft snow was the greatest fear. The account of the Navy of the first flight to leave Plateau Station clearly spelled out the troubles only the pilots knew and each new plane into Plateau Station had to learn these problems over again for the first time.

> "Once the initial camp was established and the first personnel were secure in their tents with their equipment and rations, the aircraft prepared to return to McMurdo. The soft snow which had yielded so readily to the flag now became a clinging mass on the Teflon-covered skis of the straining LC-130F. In addition, the thin air at this high elevation could not satisfy the power requirements of the aircraft's turboprop engines. Repeated takeoff attempts were made until finally the rapidly diminishing fuel load reached the point where one more try would tell the tale. If not successful, the newly established Plateau Station might very well be provided with an all-aluminum, ski-equipped building. The pilot taxied 14,000 feet downwind, turned around and lined up with his tracks. After an agonizing, fuel-consuming, 15-minute wait to allow the tracks to solidify, full flaps were lowered and all available power applied to the engines. Using full throw of the controls to steady the aircraft as it began to "lope" in its tracks, accelerating ever so slowly, the pilot called for jet assistance take off (JATO) as the air speed crept past the 60-knot mark. Instantaneously, the eight JATO bottles fired to give an additional 8,000-

> pound thrust, and the Hercules was muscled free of the snow at 75 knots, far below its design performance of over 100 knots required for a normal takeoff." (Marion E. Morris, Commander, USN, Commanding Officer, Air Development Squadron Six; "Air Operations, Deep Freeze 66", *Antarctic Journal of the United States*: July-August, 1966, page 154-155)

The landing was the roughest I ever experienced as we bounced and veered left and right in previous airplane-ski plowed groves. We coasted and coasted seemingly forever before coming to rest and then had a difficult time turning in deep thick but soft snow as we taxied to the area of clutter and saw about a dozen men trudging out to meet us. On the ground I saw a large number of "wired corners" or three geometric planes made of cross hatched wire with each plane at ninety degrees to each other. These three perpendicular planes made a corner for what might serve as a room in a doll house and didn't appear to serve any purpose. The pilot told me that they were radar reflectors. The Plateau Station, without its permanent radio station equipment set up, had no homing beacon. It was simply too small to find. These "corners" would reflect a radar signal exactly back at the airplane that beamed out the radar ray. They worked like a corner in a handball court where the ball reflects exactly back to the spot from where it was hit if fired into a tight corner.

The first person I met was Charlie Roberts with his USARP bag and a barometer slung over his shoulder as a rifle. He was leaving on the very plane I arrived in so we tried to converse over the thunder of the four engines of the LC-130F, which never were turned off. He and Rob had insisted and obtained the position of Plateau Station close to the "ridge" of the high plateau of East Antarctica. His experienced reading or interpretation of the sastrugi indicated the strongest winds were from true NW and the secondary or weaker, most likely more frequent winds seemed to come from the NE.

Charlie assured me that I had an excellent Scientific Leader in the person of Rob Flint. Flint had demonstrated to Charlie his understanding of all the scientific programs and especially the valuable and unique inversion study. Together they fought the Navy and successfully held to the science proposals by orienting correctly the station base line, the thousand feet between the emergency camp that would be built on the front of the current Jamesway hut, and the main camp still at dock side back in McMurdo. This was the expertise I had hoped for from Charlie. The baseline was oriented perpendicular to the interpreted prevailing wind direction so that the balloons could be launched and tracked sideways from the baseline and the two theodolites at each end.

I imagined correctly that the practical minded Navy would desire to build both parts of the camp as close together as was safe while as a scientist I wanted the two parts of the camp as far away from each other as possible. I'm glad Charlie and Rob were here instead of me. Politically and in a bravado sort of way I would have been overwhelmed by last minute changes and the research projects would have been put in jeopardy. What ideas are agreed to in the comfort of conference rooms, or at one political level are all together different ideas in the field or at different political levels.

Charlie also assured me that he calibrated the station barometer to the extent that he could and he would arrange for final calibration next summer. The station barometer was taped on a bed post where Charlie slept, which was probably mine for most of the time to come.

Charlie established a snow stake field, the black field, of forty-nine dowels in a grid with each stake ten metres apart seven hundred feet north of the summer camp and suggested I measure it once a month. It was our only way to measure snow accumulation on a plateau with no limit to drifting. We simply laid out a grid of wooden dowels and measured their height of exposure out of the snow. The wind would scour snow out of one place and deposit snow in another place. We hoped by measuring enough dowels over a large enough area the average would give a meaningful measurement. We

routinely ignored our footprints in the grid.

The plane was fully off loaded. The flight crew pulled Charlie into the plane as he shouted to me, "Good Luck, You have a Doctor for whom you don't want to get sick!" My briefing and in-the-field training were started and, as quickly, were over. I was the only meteorologist at Plateau.

It was incredibly cold!

Although the walk from the aircraft to the Jamesway was a reasonable hike, it seemed infinitely long and left me wondering if I was physically up to life on the high plateau. I was more than thankful that Rob willingly assisted with hauling my personal gear while I collapsed dragging my "DO NOT FREEZE" box. The high altitude, unexpectedly, was taking its toll. I was exhausted. I was breathing as though I had run more than five miles when I had only walked about five city blocks.

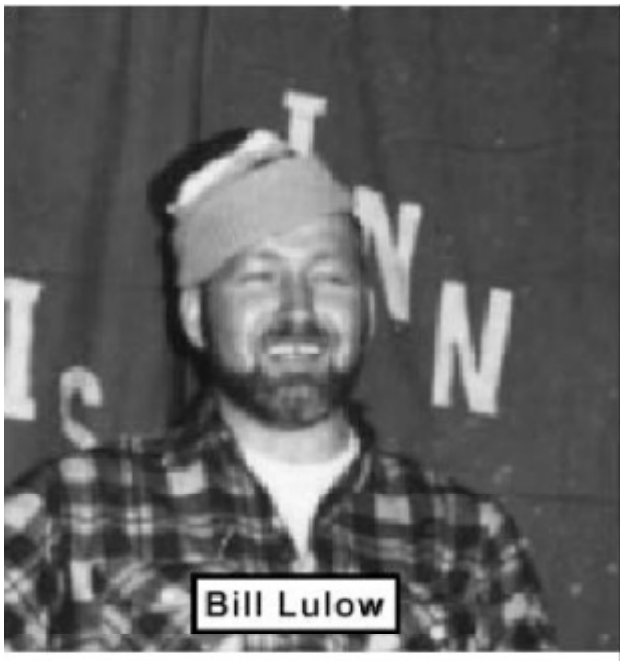
After we walked the first fifty yards I felt a loud click in my nose. I felt nothing on my face and Rob turned, stopped and told me to remove my "bear claws" and use my hands to thaw out my frozen checks and nose that were as white as the snow. In the process my hands went numb; they were beginning to freeze. Before reaching the Jamesway my feet went through intense pain, then became numb and the last many yards seemed to be twisting sideways rendering walking very difficult. I was more than scared. Rob suggested I was wearing too many clothes and needed to get used to the cold. Wrongly I did not confess how cold I really was. Very quickly each of us learned there were no polar heroes. Everybody was cold. Some acclimatizing did occur. We all did toughen. But we all remained cold and were no longer afraid to confess it.


Rob Flint escorted me to the Jamesway hut, a long canvas building with wooden arches making a round ceiling from the ground and up. At one end was an oil space heater and some open room for tables at times of eating. The other end was filled with bunk beds. The heater gave the old fashioned heat a wood burner used to give in Tanna's kitchen. It was the place to go when you were cold. In Antarctica, yes, you desperately wanted to embrace the stove, but the warming of truly frozen parts was so intensely painful that I found myself internally at war with the desire to be warm and fear of the warming pain.

Inside the Jamesway Dr. Jimmy Gowan, the Navy's Officer in Charge for the coming winter, greeted me and introduced me to the other wintering over Navy personnel: Jerry Damschroder, a mechanic cross trained as a heavy equipment operator; Bill Lulow, the only married guy of all of us wintering over and the station cook; and Ed Horton, the youngest (being younger than twenty) and the radio man.

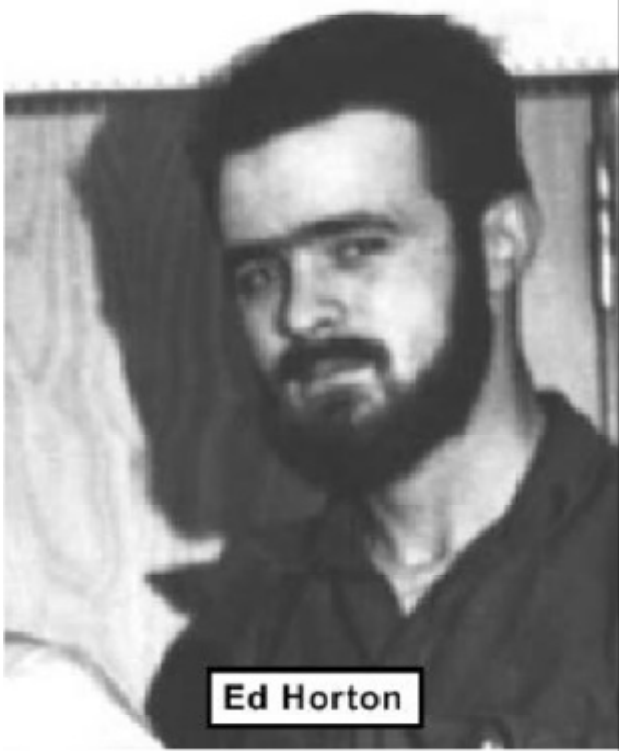
Bill, mostly called Lu or Lulu, was cooking for everyone, but looked sicker than a dog being

unable to keep any food down because of altitude sickness. I wrongly thought my ill feeling was a hangover, but the continual huffing and puffing was a mark of the temporary disability that was rapidly coming. I didn't believe it would happen to me, but everyone was waiting and watching for the moment when I would cave in to the altitude sickness. When hit, I too did not eat for several days. When I tried to sleep I would wake in a cold sweat with my heart pounding. My lungs gave me incredible chest pains and I breathed in panic as though I would never be able to breathe again. At about 12,000 feet above sea level in the polar regions where the atmosphere is thinner because of the drawing of air to the equator on a spinning earth, we only had 60% of the normal oxygen content.


Bill Lulow

Not eating or drinking spared me another cold function until the next day, the use of the camp outhouse. It was simply a wooden crate with a seat with a hole over a deeper hole in the snow. I learned to train myself not to need the outhouse until about 1730 LST when the sun's angle gave a touch of warmth. At -30 º F any heat was more than acceptable and the whole camp knew it. A competitive line formed at that critical sun hour.

After a few hours of rest, Rob encouraged me to move around, get stability with walking, and gear up for a quick walk outside again. In misery I knew this is what I had come for. I nearly sat on the stove in my long underwear, followed Flint's advice and only used one pair, and spent the next half hour putting on the outdoor clothes, snow pants, wind breakers and parka. According to Flint I was still over dressed. He was right.


Ed Horton

He gave me a tour of the outside and we surveyed the science side of the camp. The windward side of the base line was set aside for minimum disturbance. What looked like chaos from the air was well organized. Really little or no disturbances to the snow surface on the scientific side had occurred. Obviously we had to walk to the instrument sites but it was not a place to make tracks without a carefully debated reason.

Rob led me to the supply cache. It provided a partially physical job outdoors during my needed acclimatization and constantly checking the manifest and unpacking needed equipment had to be done.

In the supply cache I came across many crates of the Navy's more than four hundred movies. We did not have control over the order of things as they were brought to Plateau Station. As things were

placed on the docks at McMurdo they were airlifted to Plateau Station, I believe, according to airplane space rather than need. So the camp had its year supply of movies because morale had a high priority but we had no chief supply of electricity. We had no movie projector. We had no time to watch movies.

During the first several days I was at Plateau Station, severe weather shut down air operations at McMurdo and we did not get supplies. We had more than enough food and heating oil for our little camp, but the temporary supply of beer had been drained dry. Art Weber, the architect of Plateau Station, in desperate need himself entertained everyone going through alcoholic withdrawal with this song:

"All day I face
the barren waste
without the taste
of Black Label.

Cool Black Label.

Old Dan and I
with throats burned dry
and souls that cry
for Black Label.

Cool clear Black Label.

The nights are cool
and I'm a fool,
each star's a pool
of Black Label.

Cool Black Label.

But without a dawn
I'll wake and yawn
and carry on
to Black Label.

Cool clear Black Label."

(Bob Nolan, "Cool Water", with polar revisions by Art Weber)

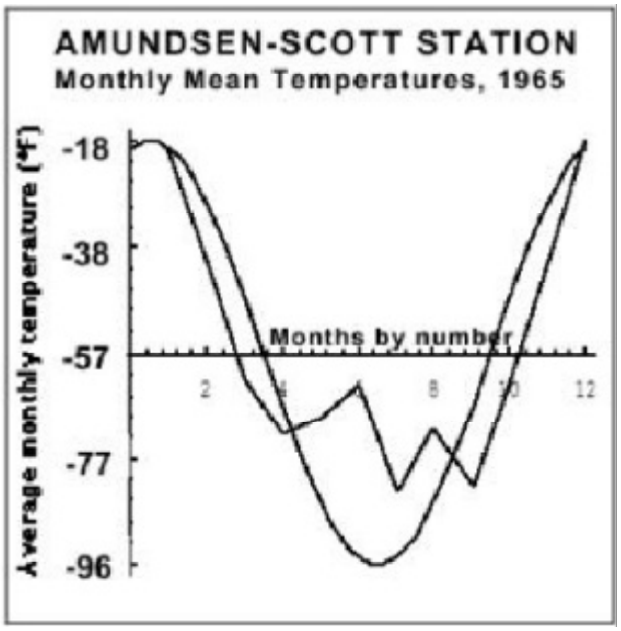
In a wise move back at McMurdo I borrowed a U. S. Army CRREL (Cold Regions Research and Engineering Lab of Hanover, New Hampshire) ice core kit from Anthony Gow, a New Zealand geologist and glaciologist. I was to send it back to McMurdo as soon as my kit was shipped. I never found the kit shipped to Plateau. The next year, it was found by my replacement at Plateau, the Australian, Bob Dingle.

Everyone at camp was waiting for my ice core analysis that would enable me to predict the coldest temperature the coming winter. Charlie recorded the warmest temperature Christmas eve as -6 º F. If one dug deep enough, one would find a level of earth, in this case snow, where the temperature would no longer change with depth. This temperature was the average annual temperature. My borrowed ice core kit had a sharp cutting ring at its base that cut a doughnut ring into the snow

leaving the doughnut center undisturbed. This cutting ring was at the base of a tube about a metre long that allowed an ice core, unaltered, to be pulled to the surface. Attached to the top of this tube was a "T" bar that I could twist to drill this tube down into the snow and pull up the undisturbed core. New sections of pipe were successively added between the ice core tube and the "T" turning bar.

I started drilling on my own, but very quickly Captain Donald R. Pope, CE, USA, Naval Support Force Representative, came over first to observe my activity and then to pitch in with the difficult and heavy work as our core hole got deeper and deeper. Each metre another metal section was added to the drilling device making it heavier and heavier. The deeper we drilled, the harder and colder the snow became. Due to both the weight of the drill kit as well as the hardness of the ice, by the end of a very long and exhausting day, we both had to push and turn with all our might to continue drilling. We reached a depth of ten metres. The recovered core of snow had a temperature of -70.0 º F. Considering that the average temperature at the South Pole the year before, which I obtained from Ron Stevens, was -57 º F it was going to get real cold at Plateau Station. I didn't feel bad at all about referring to the South Pole as the "banana belt".

I was forewarned by Prof. Lettau of a common error scientists made during IGY trying to forecast the low temperature for the winter in Antarctica. The easiest thing to do was to take the difference between the current warmest temperature, -6 º F, at Plateau and subtract the snow core temperature that represented the annual average, -70 º F, to get a change of 64 F º. By assuming this warm temperature deviation from the annual mean to be the same symmetrical deviation below the mean for the winter's minimum temperature at Plateau, I could have wrongly predicted a severe cold temperature breaking all world records with -134 º F.




The winter in Antarctica is a kernlose winter, a coreless winter. Instead of a typical cosine curve symmetrical about a mean, the winter temperatures below the mean flatten out. The experience of interior stations in Antarctica such as South Pole and Vostok seem to routinely have such kernlose winters. Their lowest temperature for the winter occurs seemingly any random day during the polar sunless winter. Monthly mean temperatures at Amundsen-Scott Station showed this kernlose shape instead of a commonly expected cosine wave.

The symmetrical cosine wave would wrongly predict for the South Pole an average mid winter temperature as low as -96 º F whereas South Pole really only had -83 º F for the average of the coldest month of July. Looking more closely at the monthly mean temperature data I obtained while at the South Pole, it is observed that the jagged plot of real data is roughly two-thirds depression for the winter cold temperature when compared to the full rise above the mean for the summer months.

Many scientists gave many different reasons for these warmer than expected polar winters. Over the South Pole existed a powerful polar vortex rotating clockwise as westerly winds. As a cold core low it weakened near the ice surface and probably permitted warmer cyclonic weather from the oceans surrounding Antarctica to penetrate deep into the interior keeping winters warmer than expected.

Or the ocean storms surrounding the Antarctic became stronger with greater contrasts of air temperature between the interior polar icecap and the maritime air. More violent storms would develop and penetrate deep into the interior of Antarctica bringing warmer air.

Or katabatic air drew the very cold dense air out of the high interior of Antarctica permitting warmer air to sink over the interior of the icecap.

For empirical reasons only I used this two thirds figure to forecast the low at Plateau. If the drop of temperature for Plateau from its high temperature of -6 º F to the cold snow core temperature of -70 º F was 64 degrees, then two thirds of that change was 43 F º yielding an anticipated minimum winter temperature of only -113 º F. I didn't like the empirical method. As a student of Lettau's I was a disciple of his doctrine that empirical data without a theoretical base was nearly useless. Since he would not let me in on his secret theory about kernlose winters, I could not wait for his prediction to reach Plateau Station. I felt the obligation to provide Captain Pope and the Navy the best known prediction, with theoretical base or not, that they might adjust their calculations for fuel supplies to our little isolated camp. Our very lives were dependent on it. For a Navy man to stay so close to my observational work was a display of just how critical this data of the unknown Antarctic Plateau really was.

I had no idea what Lettau's exact theory was, but he obviously wanted publicly to test and publish the results from his university desk. I gave the snow core temperature to Ed Horton to radio the results to Prof. Lettau in Madison. He never received the message. It never dawned on me that I might have also mailed him these ice core results. Nevertheless the traverse ice core data was made public a month later and soon after published in the *Antarctic Journal of the United States*.

Actually -113 º F, colder than I could imagine at that point, was the new coldest record established for the South Pole that last winter in 1965. The Russians at Vostok recorded -127 º F close to the IGY. My warmer prediction meant no new record. Out of deference to Prof. Lettau's intended prediction Captain Pope and I kept this prediction a secret. Captain Pope was quite relieved. My work convinced him that the extremes others had predicted would not happen and the fuel supplies planned now would be adequate. As the flight schedule became strained and cold bad weather hit McMurdo, this more realistic forecast for a kernlose winter, supported with such an authority as Lettau, was welcomed and set the authorities of the Naval Support Forces at ease.

A radio message came through while Captain Pope and I were drilling our snow core. His wife had a child. We took a break. Under Captain Pope's bunk was a case of Treacher's Gin. There was no vermouth, no mix of any kind. Such trivial shortages do not stop the American military. The entire camp lifted high glasses filled with snow and pure gin, a drink we named "White Hell" and toasted the new father of the camp this very long distance from his family.

> "At United States stations, independent authority exists for scientific and logistic support programs, integrated only by the concern of the individuals for the success of their mutual endeavor. At Plateau Station, there were seven men on location, each of whom felt himself significantly responsible, in one way or another, for the successful consummation of all of the previous efforts. These included the naval Officer-in-Charge of the Station [Jimmy Gowan], the Scientific Leader [Rob Flint], the National Science Foundation representative [Bill Austin], the Bureau of Yards and Docks representative [Art Weber], the manufacturer's technical representative [Alberta Trailer Company], the SeaBee Officer-in Charge [Lieutenant James D. Ramsey, CEL, USNR], and the Naval Support Force representative [Captain Don Pope]. To attempt to integrate the feelings of responsibility of all these strong and

dedicated men on a formal basis in the usual hierarchy of command appeared impossible. It was felt that to do so would have diminished their individual feelings of responsibility and dedication and reduced the effectiveness of the group as a team. Captain Donald R. Pope, CE, USA, the Naval Support Force on-site representative, was instructed that he was in residual charge of establishing the station, but that he would not take over full responsibility unless the informal relationships started to break down. Planning and preparation had been so thoroughly done, and the cooperation was so good, that the construction, supply, and fueling of the station proceeded without a hitch, giving Captain Pope no occasion to exercise his authority." (*Antarctic Journal of the United States*, July-August 1966, page 160)

Shortly after a JATO takeoff of an LC-130F supply plane, our camp experienced a rather frightening and severe snow quake. Rob Flint related the quakes to the now frequent almost daily supply flights putting stresses and strains on many thousands of feet of snow and ice thickness. Such quakes could be due to simple settling but also could be due to one snow mass shearing from another mass resulting in a dangerous crevasse nearby the camp. Crevasses were the single most dangerous thing to fear on the high plateau. Sir Douglas Mawson, a Lecturer of Mineralogy and Petrology at the Adelaide University, described the fatal consequences of such a crevasse encountered on his march with Dr. Xavier Mertz, a Doctor of Law from Basle Switzerland; and Lieutenant B. E. S. Ninnis, degreed at Dulwich England and commissioned in the Royal Fusiliers. They were searching for the South Magnetic Pole on the plateau over at Longitude 148 º East inland from George the Fifth Coast.

"Mertz was well in advance of us when I noticed him hold up his ski-stick and then go on. This was a signal for something unusual so, as I approached the vicinity, I looked out for crevasses or some other explanation of his action. As a matter of fact crevasses were not expected, since we were on a smooth surface - well to the southward of the broken coastal slopes."

"On reaching the spot where Mertz had signaled and seeing no sign of any irregularity, I jumped on to the sledge, got out the book of tables and commenced to figure out the latitude observation taken on that day. Glancing at the ground a moment after, I noticed the faint indication of a crevasse. It was but one of many hundred similar ones we had crossed and had no specially dangerous appearance, but still I turned quickly round, called out a warning word to Ninnis and then dismissed it from my thoughts."

"Ninnis, who was walking along by the side of his sledge, close behind my own, heard the warning, for in my backward glance I noticed that he immediately swung the leading dogs so as to cross the crevasse squarely instead of diagonally as I had done. I then went on with my work."

"There was no sound from behind except a faint, plaintive whine from one of the dogs which I imagined was in reply to a touch from Ninnis' whip. I remember addressing myself to George, the laziest dog in my own team, saying, 'You will be getting a little of that, too, George, if you are not careful.' "

"When I next looked back, it was in response to the anxious gaze of Mertz who had turned round and halted in his tracks. Behind me, nothing met the eye but my own sledge tracks running back in the distance. Where were Ninnis and his sledge?"

> "I hastened back along the trail thinking that a rise in the ground obscured the view. There was no such good fortune, however, for I came to a gaping hole in the surface about eleven feet wide. The lid of a crevasse had broken in; two sledge tracks led up to it on the far side but only one continued on the other side."
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> "Frantically waving to Mertz to bring up my sledge, upon which there was some alpine rope, I leaned over and shouted into the dark depths below. No sound came back but the moaning of a dog, caught on a shelf just visible one hundred and fifty feet below. The poor creature appeared to have broken its back, for it was attempting to sit up with the front part of its body while the hinder portion lay limp. Another dog lay motionless by its side. Close by was what appeared in the gloom to be the remains of the tent and a canvas tank containing food for three men for a fortnight."
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> "We broke back the edge of the lid and took turns leaning over secured by a rope, calling into the darkness in the hope that our companion might still be alive. For three hours we called unceasingly but no answering sound came back. The dog had ceased to moan and lay without a movement. A chill draught was blowing out of the abyss. . . ." (Sir Douglas Mawson, *The Home of the Blizzard*, London: J. B. Lippincott Co., Vol. 1, p. 238-240)

Today the region toward the coast from this sad site is known as Ninnis Glacier. In the end starvation and frost overwhelmed the party of two that was left and finally only Mawson returned alive. A Mertz Glacier lies next to Ninnis Glacier.

Rob elected Art Weber and me to go with him to look for the possibility of crevasses existing in the immediate region. We used a snowmobile, geared to pull heavy sledges and to be used as a replacement for dogs. Thus the snowmobile moved only two miles per hour so that a man could walk alongside or behind a sledge the snowmobile was pulling. We spent a large part of a long polar day being very cold taking turns standing high on the snowmobile in an effort to see any change in the coloration of the snow that might suggest a great crevasse hidden beneath a snow bridge over the top. With the snow many thousands of feet thick at Plateau Station, such a crevasse could be of a similar great depth. I remember, in the humor of polar bravado among the three of us, concluding that none of us had come to be comfortable. It was time to declare the camp a safe place and stay or strike fear and fly home. At about five miles from camp boldly the three of us declared the snow surface to be safe.

A high point of Operation Deep Freeze 66 for the entire continent was the construction of Plateau Station. It began for us with the delivery of the first international orange colored van, which grossed out the LC-130F that landed on 7 January 1966.

Four vans would make up the major living and laboratory quarters of Plateau Station. Each van was 36 by 8.5 by 8.5 feet with a maximum weight of 23,000 pounds. Inflexible measurements were established by the limits of the LC-130F. Each van was constructed of prefabricated wood framework, plywood wall construction three inches thick with rigid polyurethane insulation and aluminum sheeting on the outside. Special care to eliminate nails from the outside to the interior of the walls was necessary. The loss of heat through one nail was equivalent to letting the door open for more than an hour. Old fashioned wooden peg construction and modern glues served well in eliminating these nails. Cork strips covered the wall studs to reduce further thermal conductivity.

The first van contained the meteorology lab to be shared with geomagnetics, one of the two

observation domes, a very small office for the camp doctor and two bunk rooms. Rob told me that the effectiveness of the defrosters for the meteorology observation domes was very uncertain even though the balloon launches and the tracking of the balloons required them as essential. Design engineers simply could not guarantee their defroster working at the anticipated extreme temperatures. Moisture inside the camp would be too overwhelming. Really these domes looked beautiful. They were 4.5 feet in diameter on fixed air tight mountings with hot air ducts distributing dry hot air in a spiral manner over the interior of the domes as a defroster might. I had hopes. Finally, I thought, we can always track the balloons outside by standing in the cold air on the roof.

The bunk rooms, each shared by two men, came with built-in extra long beds at Rob's request. According to Rob, all polar heroes were tall. As it turned out, he was the only person taller than six feet. The seven others were close to my height of five feet eight inches with Bob Geissel and Jerry Damschroder even shorter.

A second van included the radio shack, a darkroom, a kitchen, and a bathroom that also had the laundry facilities keeping all the plumbing in this one unit. Sewage would leave the main sewer and go through an electrically heated pipe to the outside for more than twenty feet perpendicular from the camp on the windward side (the scientific side) so as not to be accidentally hit by heavy moving equipment. The heated pipe then would aim downward several feet into the snow. After an initial chemically treated wash to start the polar sewer pit, bacteria and warm water of the raw sewage simply dug its way deeper and deeper beneath the surface.

The third van, built for the other side of the main camp, housed the aurora lab with an aurora tower above it along with two more bunk rooms. This lab also contained the very-low-frequency (VLF) radio receivers.

The fourth and final van housed a fuel tank and two high compression supercharged 75 kilowatt Caterpillar diesel generators. Only one generator ran at a time and it provided all the electricity and heat for the entire camp. No heat was lost. Exhaust heat of the diesel engine was passed through a heat exchanger to warm the camp and finally snorkeled through a large tank for melting snow to provide water before being expelled to the outside.

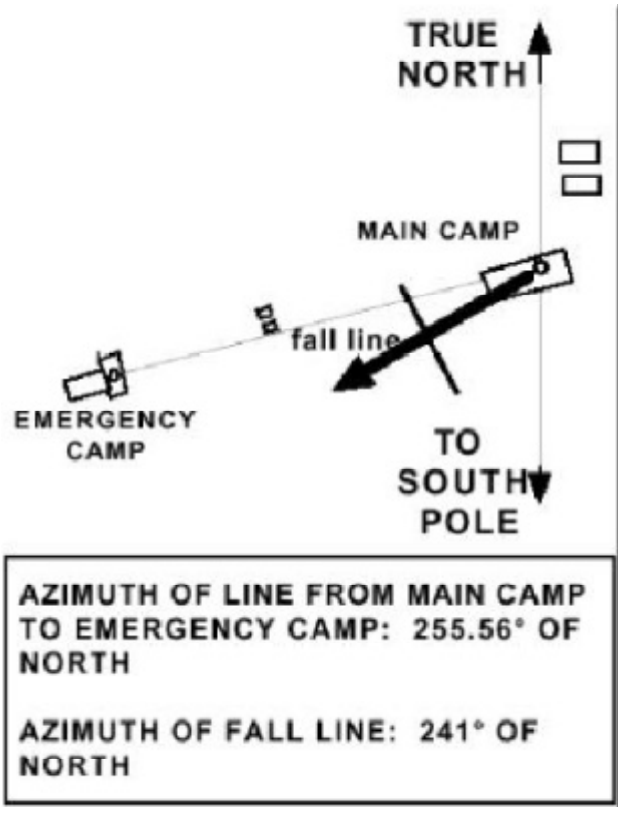
Two vans formed the windward wall. Two vans formed the leeward wall. A "permawalk" made by building a floor and a ceiling between the two rows of vans gave considerable extra living space which was fashioned by our wintering over team into "Lulu's bar and grill," a dinning area, a movie theater, and a tavern on the opposite end with a comfortable reading or living room in between. An additional smaller van, the emergency camp to be added to the Jamesway a thousand feet away from the main camp, was also another of the many airlifted supplies during the now very hectic season for Plateau Station.

The "seabees" gallantly built Plateau Station out of these vans with two additional Jamesway huts for storage in the twenty-four hour sunshine in air temperatures falling as low as -50 º F before they finished construction. While the eight of us wintering over were expected to acclimatize to the high altitude, these "seabees" faced the demand for high speed construction as the summer season shortened for our station. They were racing against the clock, the temperature was plummeting, and we had no records to know if we were ahead or behind schedule. From time to time an individual needed an uplifting snort of oxygen. Frost bite plagued these brave builders that the eight of us might have a safe and warm place in the severe winter that was coming.

During the supply season, with many flights, at times more than one a day coming into Plateau Station, my work provided essential weather observations for the Navy. Ice fog became an increasing

threat as the sun's angle fell lower and lower in the midnight sky. The high plateau was featureless. Making visibility observation without empirical numbers would be wrong. I needed to place visibility markers, bamboo poles with different color flags, at the one mile, two mile, three mile, and five mile distances from the main camp. I placed them both in a northwest and a southeast direction. The only thing I can recall of these placements was that it was cold and numbing sitting on our slow moving snowmobile. Jumping off the drag sledge to measure the distance meter on a bicycle wheel pulled behind kept blood circulating. I quickly learned the feeling of a "click" in my nose or ears or cheeks as the signal of frost and would immediately look into the sun for its warmth while taking off my mittens to warm the frozen parts with the warm flesh of my hands.

Returning from one of these visibility marker excursions I remember seeing more and more of the main camp taking shape as the third and then the fourth van was pushed into place, but what I saw was to my disliking. I adamantly complained about air exchangers and the tall aurora tower at the main camp and the curved roof of the Jamesway hut so close to the emergency van being obstructions to the theodolite tracking of the balloon ascents planned for the winter night for the Great Temperature Inversion Study. To me these observations were THE most critical of all observations. Initial plans called for all tall obstructions to vision to be on the windward side. Even after Charlie Roberts had correctly determined the direction of the prevailing winds it seemed that the buildings themselves could simply have been turned around. With a fifty-fifty potential of orienting the building correctly, they were oriented wrong. By the time I knew what was going on, it was too late. Of course one can always turn portable buildings around but with the season growing short, all complaining on my part proved futile. Yet, thanks to the builders, they did put the meteorology lab room with its observation window and dome on the windward side. Last minute confusion in the field was responsible for losing some tracking data in the winter.




Passionate disputes and tension quickly can emerge. The sensitivity of Navy Captain Pope and the support of Rob Flint were major factors keeping the construction on its hurried schedule. They gave encouragement to all parties equally passionate on their requirements. Instant compromises of my idealism without experience were never easy to take. Hardest of all to come to grips with was the realization that my own demands for exacting needs might in fact put survival of all at risk in this soon to be isolated camp. I was rarely a team player, but it was now time to learn that requirement and leave rugged individualism behind. Both Flint and Pope were good teachers.

The Navy did take considerable care keeping the windward side of the camp free from heavy equipment tracks. High free standing antennas were kept in line with the sun and the station to keep shadows away from the place where Lea Stroschein would be placing his radiometers. The emergency camp, placed nearby in any other situation, had to be placed 1000 feet away. The unusually long distance apart maintained the needed long baseline between theodolites. At great cost of time special

cables were laid down between the two camps.

Once the main camp was physically put together, amassing enough fuel for the coming year, and a second year for security, became a race against the lowering midnight sun. Not expected, but so serious as to put in jeopardy the wintering over plans, was the discovery that the diesel fuel would not flow from the fuel bladders into the main camp generators. As an emergency solution, the "seabees" constructed a large hill between the main camp and the ski way so that the fuel would be assisted by gravity. At some risk but also due to shortness of time, the hill was left lower out of concern for my balloon tracking needs.

Diesel fuel turns to thick jelly and does not flow as it gets colder so this contingency had to be met and in fact had been planned for from the beginning. Two-thirds of the fuel pumped into the generator room was only circulated for its own heat needs and not used by the generator. Instead it was pumped back out into the cold bladders keeping the fuel warmer than -65 º F. How this was going to work at the severe winter temperature, time would tell.

Fifteen thousand gallons of diesel fuel was then air lifted to Plateau Station. More than twice the amount needed strained the method of keeping the supply warm, but it was necessary in case next summer proved to be colder or of more violent weather and the resupply flights couldn't get through. Historically, in Antarctica a few resupply efforts were cut off by bad weather, leaving the wintering over crew expecting to be relieved, stranded. This was not in the American experience, but still a contingency that needed to be accounted for.

Likewise, nearly three years supply of food was airlifted and stored in two different places at Plateau Station. A one year supply was stored in a food cache at the emergency camp and a two year supply was stored near the main camp with a snow barrier dividing that two year supply. Fire was a chief fear behind the planning and placing of these caches. A fire in the desert snow had to be fought without water. The French lost an entire station to fire not too many years earlier. Jerry Damschroder trained us routinely in fire fighting tactics.

**19 January 1966. "We are in an escalating military stalemate. There is an honest difference of judgment as to the success of the present military efforts in the South. There is no question that the U. S. deployments thwarted the VC hope to achieve a quick victory in 1965. But there is a serious question whether we are now defeating the VC/PAVN main forces and whether planned U. S. deployments will more than hold our position in the country. Population and area control has not changed significantly in the past year; and the best judgment is that, even with the Phase IIA deployments, we will probably be faced in early 1967 with a continued stalemate at a higher level of forces and casualties." (Memorandum by Assistant Secretary of Defense McNaughton.)**

Once the main camp was built sufficiently to the point where heat was flowing, Hugh Muir, Bob Geissel and Lea Stroschein were airlifted from the South Pole to Plateau Station. I remember Lea was a bit perturbed at the lengthy waiting at South Pole and now the shortness of the season left for his research work. A short radiation program had been planned for this summer season. This was aborted. There simply was no electricity for scientific recorders until this point in time. The smallness of this remote station simply meant there were not beds or even floor space for any more people. It was easy to see the need to compromise another person's research.

The "seabees" finished their work on 22 January 1966 and turned Plateau Station over to Lieutenant Jimmy Gowan and Rob Flint. I expressed my thanks to Captain Donald Pope. As a military man with all the military discipline, which I knew nothing about as a civilian scientist, he was faithful to his mission, to guarantee us a safe habitat for the next two years. He did that. At the same time he

was understanding and trusting of the scientific research, which could not have gotten started, much less finished without his guidance of all parties. I wished him well, drank one more "White Hell" to his new child, and stood at attention as his plane carried the "seabees" to their next duty station - Da Nang.

As soon as we were able to occupy the main camp and the meteorology lab, Lea Stroschein and I could begin the frantic work of establishing our meteorological research station. Every instrument placed in or above the snow had to be carefully calibrated with known standards. Every instrument had to be coddled into performing at the extreme cold temperatures. Take the standard instrument to measure temperature as an example. It was a thermohm sensor that changed its electrical resistance according to temperature. Normal expansion thermometers simply did not work in polar regions. But this device was mounted in a large bell shaped aerator that had a motor and a fan that drew air past the thermohm sensor. Many tests were made to insure that no warmth from the motor that moved the fan would come in contact with the thermohm. In addition the thermohm was mounted one hundred fifty feet up wind from the main camp to insure a minimum of heating influences from the camp.

An aerovane was mounted on a ten metre mast and continually was plagued with frost buildup that had to be removed manually. This meant climbing the mast every several days to clean it.

The standard mercurial barometer had to be mounted on a post that passed through the floor of the meteorological lab without touching the building. This was done to eliminate any of the spurious vibrations of the generators rumbling on the camp floor. By maintaining this independently standing barometer, a mound of frost always existed on the met lab floor near the barometer post.

Several of Stroschein's radiometers, I believe the CISRO Funk radiometers measuring the total global radiation and net radiation, had polyethylene domes that needed constant inflation by air. Any forced air from the camp would either be too warm and drastically influence the radiometers or would be contaminated with much moisture making the radiometers clog up with ice crystals. Lea designed a forced air flow from a pump mounted under the somewhat cool theodolite observation dome next to the met lab that forced the air through a bath of pure ethyl alcohol. The alcohol absorbed any moisture that might have leaked into the system. Then the air was pumped out to the radiometers about three hundred feet upwind of the main camp. This long distance insured the air temperature would be the same as the air temperature surrounding the radiometer. My fear always was that the alcohol would freeze, but pure alcohol froze at -179 º F, considerably colder than the expected minimum temperature for Plateau Station.

After the departure of the "seabees", the last major event of summer was the arrival of the Queen Maud Land Traverse and they were long overdue. On 29 January 1966, first not being able to locate Plateau Station, they sighted an inverted mirage of one of my five mile markers, and the South Pole-Queen Maud Land Traverse II led by Edgard E. Picciotto of the Laboratory of Nuclear Geology and Geochemistry at the Free University of Brussels arrived at Plateau Station. Bob Behling, a glaciologist from Ohio State, a close friend from way back in my college freshmen days at the University of Wisconsin at Milwaukee, was on the traverse. By the end of my employment as a research meteorologist with our government, most of these men on the traverse had become personal friends.

Bob Behling and I learned an interesting fact about printed news, whether in major newspapers or institutional newsletters. Unless the story is about a major crisis, all other stories are printed because of personal showmanship. The Milwaukee Journal, a leading newspaper for Antarctic stories, did not carry a single line about two of their home town boys even though both Bob and I were on different operations of this major exploration of the last large unknown region of Antarctica and the earth's surface. Because we did not promote ourselves the newspaper missed the local story in spite

of National Science Foundation press releases.

At the beginning of the Antarctic resupply season, the Traverse II personnel were air lifted from Amundsen-Scott Station to the Pole of Inaccessibility, 82 º 07' South 55 º 06' East, a small unoccupied station established by the Soviet Union. The eleven man team excavated their traverse vehicles from under the drifted snow of the previous winter, refitted them with their scientific instruments, and after a long twenty-three day period began their late zigzag trek of exploration to Plateau Station. They hoped to traverse to the Greenwich meridian before turning to Plateau Station, but because of the late start, the very soft snow surface, and a dangerous crevasse region, they turned by Longitude 9 º East.

> "On January 4, the traverse unexpectedly encountered a heavily crevassed zone at 82 º 45' S. 15 º 02' E., and a day was spent retrieving one of the Sno-Cats, the front pontoons of which broke through a snow bridge. The main crevasses, several tens of meters in width and 5 to 7 kilometers (3 to 4.5 nautical miles) in length, were oriented in an approximate east-west direction. The crevassed zone is above a major anomaly in the bedrock topography, an abrupt rise of over 1,200 meters (3,900 feet) over a horizontal distance of less than 9 kilometers (5 nautical miles). Two similar crevassed zones were identified by aerial reconnaissance at approximately 82 °30'S.08 °E., and 82 °S.22 °E." (Edgard E. Picciotto, *Antarctic Journal of the United States*, July-August, 1966, p. 129-131.)

The traverse party survived on the 22,000 pounds of supplies they carried and three air drops of additional supplies and fuel. They effectively completed their exploring researches returning with new maps of the surface and subglacial rock topography, of the geomagnetic field, and studies of the physical and chemical properties of the ice sheet. They traversed 725 nautical miles in forty-five days at an average speed of sixteen miles per day without loss of life and with the gain of the last hole in the world's map filled in.

**South Pole-Queen Maud Land Traverse II**

| | | |
|---|---|---|
| Robert Behling | Glaciology | Ohio State |
| John Beitzel | Geophysics | Wisconsin |
| William Bowman | Engineer | Wisconsin |
| John Clough | Geophysics | Wisconsin |
| Douglas Elvers | Geomagnetics | USCGS |
| William Isherwood | Geophysics | Wisconsin |
| Scott Kane | Glaciology | Ohio State |
| Olav Orheim | Glaciology | Norsk Polarinstitutt Norway |
| Edward Parrish | Engineer | Wisconsin |
| Edgard Picciotto | Glaciology | Free Univ. of Brussels Belgium |
| Richard Robinson | Engineer | Wisconsin |

New and old faces of men, men you knew had come through things you would have given your eye teeth to experience and at the same time would have feared, arriving in a manner different from an airplane, struck a strange sense of connection. A polar party immediately erupted. A major wine supply recently flown to Plateau was discovered frozen, corks exploded, bottle necks broken and lost to the tasteless snow. Pure medicinal alcohol, 200 proof rot gut, mixed with grape kool aid powder was served in a punch bowl and was the drink of choice. What I once thought was a major drunk these polar rats drank for breakfast. The wintering over Navy lifers would not be out done drinking so they never stopped.

Barely able to walk the next day, all wintering over scientists assisted the traverse scientists prepare their traverse vehicles for evacuation. An instant sobering occurred when we hit the fresh -53 º F air. The remainder of LC-130F flights (six) brought fuel to Plateau Station and carried traverse equipment back to McMurdo.

Rear Admiral F. E. Bakutis, Commander, U. S. Naval Support Force, Antarctica, visited Plateau Station the next day for a national dedication ceremony during which he raised a flag, praised the military for both the supply operations to the traverse and the building of Plateau, and presented his

personal proud feeling over the ability to impress the nation's will in the most remote place on earth. With ceremonies over, the drinking celebrations started all over again.

The special navigation equipment of the traverse assisted us with some finalized measurements.

Final coordinates for Plateau Station: 79 º 14.8' South and 40 º 30' East.
Actual altitude of Plateau Station above sea level: 11,890 feet.
Ice thickness: 10,170-10,335 feet.
Bedrock beneath Plateau Station: 1,700 feet above sea level.
The local slope of ice: 0.0008 or 0.8 metre rise per kilometre at a down slope direction toward the azimuth 241 º clockwise from true North.
The local acceleration due to the earth's gravity was 981.929 centimetres per second per second.

The drilling equipment of the traverse with the help of Bob Behling provided me with a more realistic average temperature for the climate at Plateau Station. Behling drilled to a depth of 50 metres and recorded a temperature of -72.6 º F. I passed this information on to the University of Wisconsin men with the instructions to provide Prof. Lettau with these results and made my own revised but only empirical guess for the minimum at Plateau to be -118 º F, only slightly cooler than previously guessed.

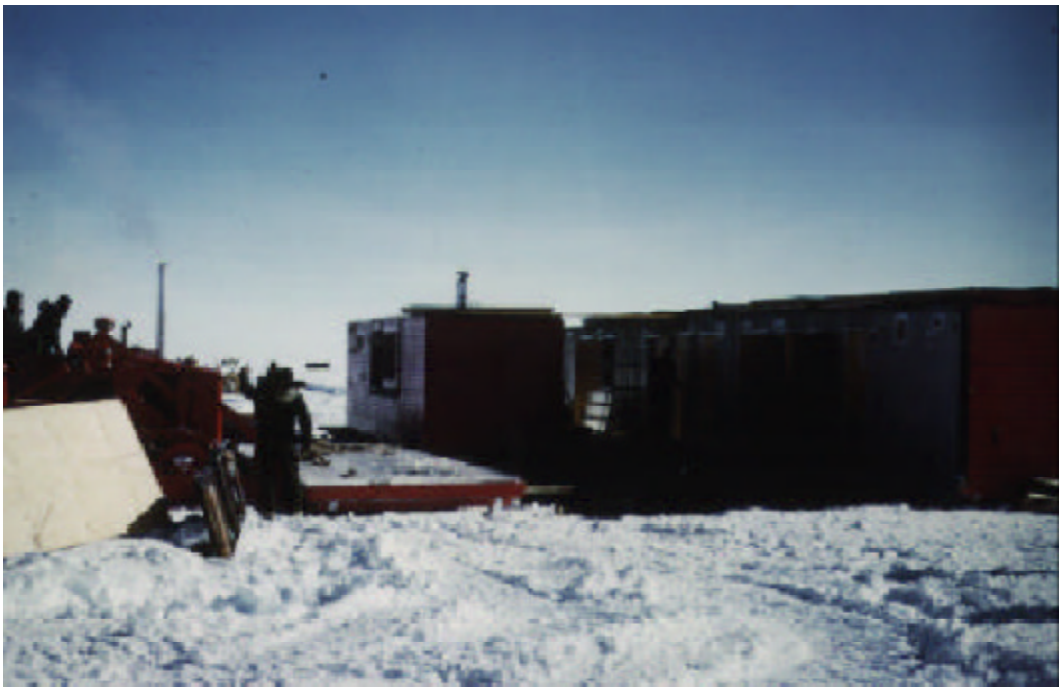
From 2-4 February, Rob Flint, Bob Behling, Bob Geissel and I set out on a long snowmobile adventure to establish an "L" shaped snow stake field for long term climatological accumulation measurements. This was a very large shaped "L" with a bamboo pole placed into the snow emerging out of the snow exactly one metre high every 1200 feet or about five poles per nautical mile for ten miles for each leg of the "L". We did different parts of this field each day, spending more than six hours on the open snowmobile and sledge with temperatures plummeting to -55 º F. All of us came home with a difficulty with walking although I, as snowmobile driver and the least active on the trip, had to be carried into the camp with very frozen feet.

Our camp doctor, Jimmy Gowan, had to make a big deal over it. I appreciate the medical advice, the care with which he removed my cold clothing so as not to rip off any frozen flesh and then the bathing and soaking of the frozen tissues in water warmer than body temperature at about 102 º F, but he scared me with the frantic radio messages back to Deep Freeze Headquarters. I feared he might be sending me home. I believe it was Rob Flint who stuck his neck out for me and asked or sent another message down playing the seriousness of the frozen limbs. Nonetheless, when I returned to the States, Dalrymple's Polar and Mountain Research Labs at Natick were more than interested in examining the footwear, the bunny boots, I was using. When they heard the length of time, my inactivity while driving the two miles per hour snowmobile, and the low temperature, they were more than satisfied that the footwear was OK. The conditions were indeed severe.

As the temperature continued to fall with the lower and lower sun angles, all summer personnel were evacuated as the last supply and traverse removal flights hastened away. A real fear existed at -65 º F. Fuel lines of the aircraft could freeze. The fuel itself could freeze. The metal of the aircraft became brittle. The cold snow bonded more tightly to the aircraft's skis. We bid farewell to Bob Behling, to Leander Stroschein, and to everyone else. We received our last mail. A chaplain asked if anyone needed communion? Lulu announced that there were no Catholics on board and the chaplain quickly got back on the plane. 10 February 1966 the fifty-third and last LC-130F flight took a final load of traverse material and straggling "summer tourists," never slowing the props the entire time on the ground at -66 º F and blasted off with JATO for the last time.

Jimmy Gowan and Rob Flint, Jerry Damschroder and Hugh Muir, Bill Lulow and Bob Geissel, Ed Horton and I were all standing outside. I was now hardened to the cold with a need of only one pair of long underwear and stared at the long condensation trail of that last plane until it evaporated. Silently each of us returned to our tasks ALONE.

**Off loading the first section of the main camp building at Plateau Station**
**January 1966**

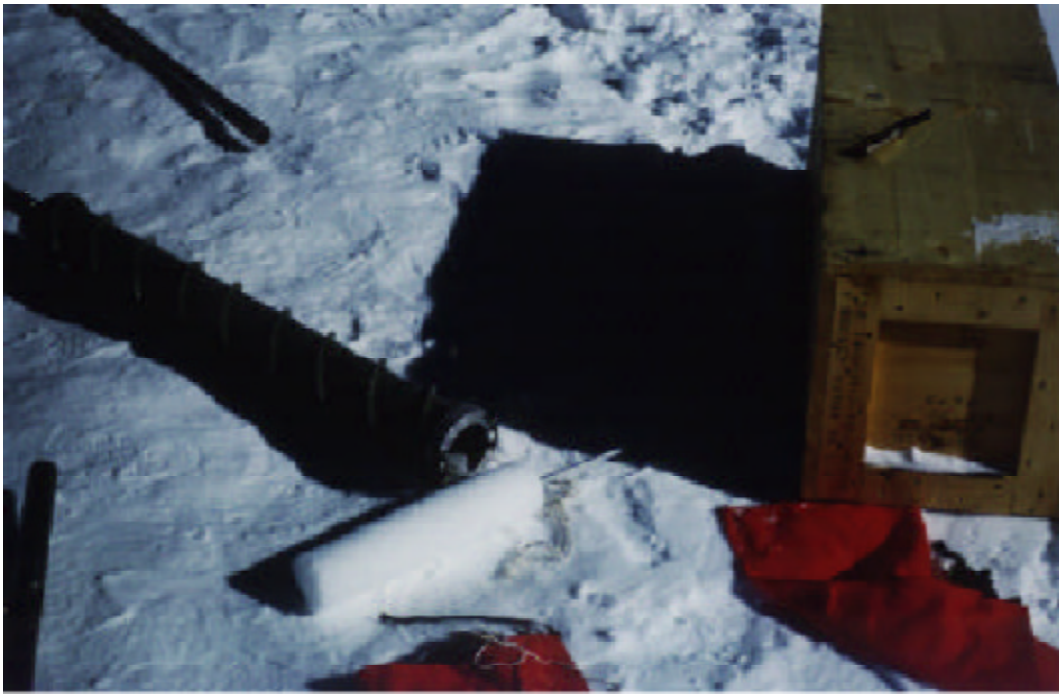


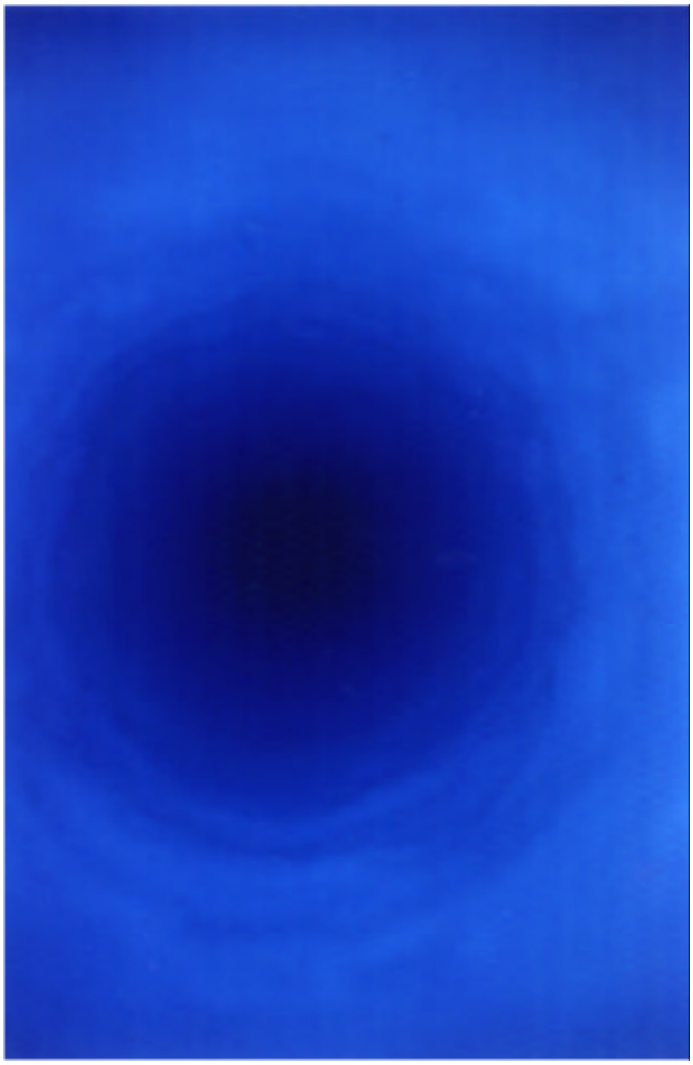
**Top: US Navy “Sea Bees” push the main camp sections together**
**January 1966**

**Bottom: Completed main camp**
**November 1966**

**Top: “Gardening” Plateau style—green ink and snow**
**December 1066**

**Bottom: Obtaining the temperature of a partial core with a snow drill**
**to a depth of 100 feet, January 1966**





**The deep blue hole 100 feet into the snow**
**January 1966**