An Account

of the

DISCOVERY DEEP TRAVERSE

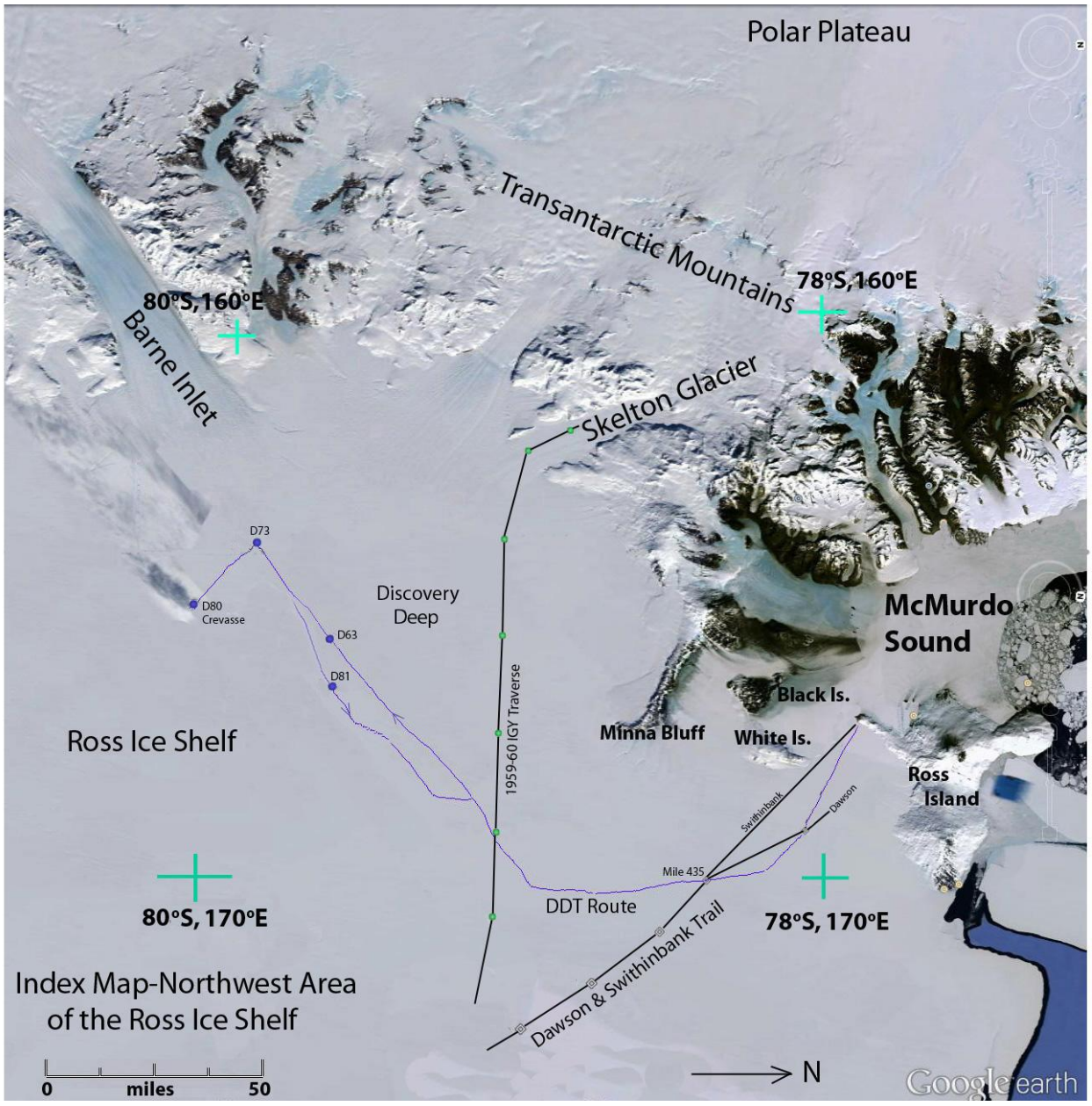
On the Northeastern Part of the Ross Ice Shelf

Antarctica

February - March, 1960

by

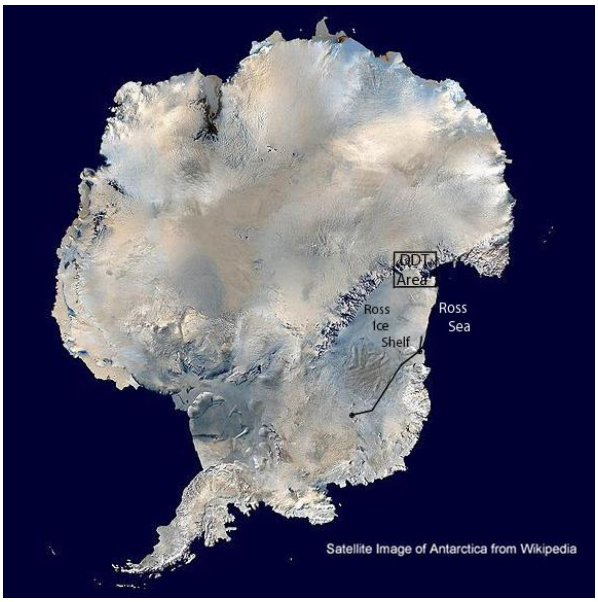
Edwin S. Robinson


Polar Plateau
Transantarctic Mountains
80°S,160°E
78°S,160°E
Barne Inlet
Skelton Glacier
D73
D80
Crevasse
D63
D81
Discovery
Deep
McMurdo
Sound
Black Is.
Minna Bluff
White Is.
Ross
Island
Ross Ice Shelf
1959-60 IGY Traverse
Swithinbank
Dawson
Mile 435
DDT Route
80°S, 170°E
78°S, 170°E
Dawson & Swithinbank Trail
Index Map-Northwest Area
of the Ross Ice Shelf
0
miles
50
N
Google earth

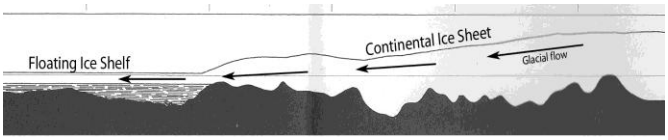
Discovery Deep Traverse Account Preface (written in March, 2014)

The report below was written during the Antarctic winter of 1960, shortly after we had returned to McMurdo Station from the Discovery Deep Traverse (DDT), a journey over the northwestern part of the Ross Ice Shelf travelling in Tucker Model 843 SnoCats. This journey was one of several US traverses to explore the interior of Antarctica. They began as part of the International Geophysical Year (IGY), a 67-nation global science program, which commenced July 1, 1957, and ended December 31, 1958. Each traverse travelled in two or three vehicles, Tucker SnoCats, each towing a large sled or trailer loaded with supplies. Average speed was about 3 miles per hour. Following the IGY these inland traverses continued until 1968 with support from the United States Antarctic Research Program (USARP), eventually surveying approximately 40% of the Antarctic interior.

Discovery Deep Traverse was not part of the original traverse program. It was proposed in January of 1960 when two brand-new enlarged Tucker SnoCats were shipped to Antarctica for use on the McMurdo to South Pole Traverse scheduled for the 1960 -1961 south polar summer. On previous traverses smaller SnoCats had proved to be reliable vehicles for travel over the polar ice sheet. But the larger new SnoCats had never been tested. So, why not make a one month traverse, and try them out. The senior authorities were unenthusiastic! It was late in the season, and the polar night had already begun. All the better we argued, since the oncoming bitter cold and winter storms close to McMurdo Station would better replicate conditions which we could expect next season on the south polar plateau. Reluctantly, permission was granted, and DDT became part of the oversnow traverse program.

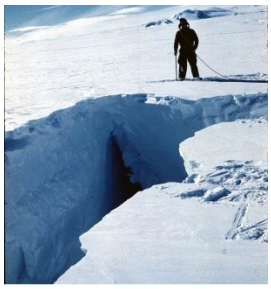


Readers not familiar with Antarctic geography can examine this Google Earth satellite image. Observe that the Antarctic continent is indented by a large embayment named the Ross Sea. Also note that the southern part of the Ross Sea embayment is covered by a layer of floating ice called the



Ross Ice Shelf. Examine the cross section which shows that the inland ice covering Marie Byrd Land very slowly flows outward toward the Ross Sea. At the coast this ice comes afloat, and spreads over the southern Ross Sea forming the permanent layer approximately 1000 feet thick, which is the floating Ross Ice Shelf.

Discovery Deep Traverse was a journey over the northwestern part of the Ross Ice Shelf. One scientific objective of this traverse was to measure the thickness of the ice shelf, and the depth of the Ross Sea beneath it.



Travelling over the vast mass of ice covering Antarctica can sometimes be dangerous. There are places where large fractures called crevasses have opened in the ice. They range from inches to feet to tens of feet wide. Blowing snow can form a crust over a crevasse sometimes completely hiding it. This crust, called a crevasse bridge can collapse when an unwary traveler crosses it. So, watch out!

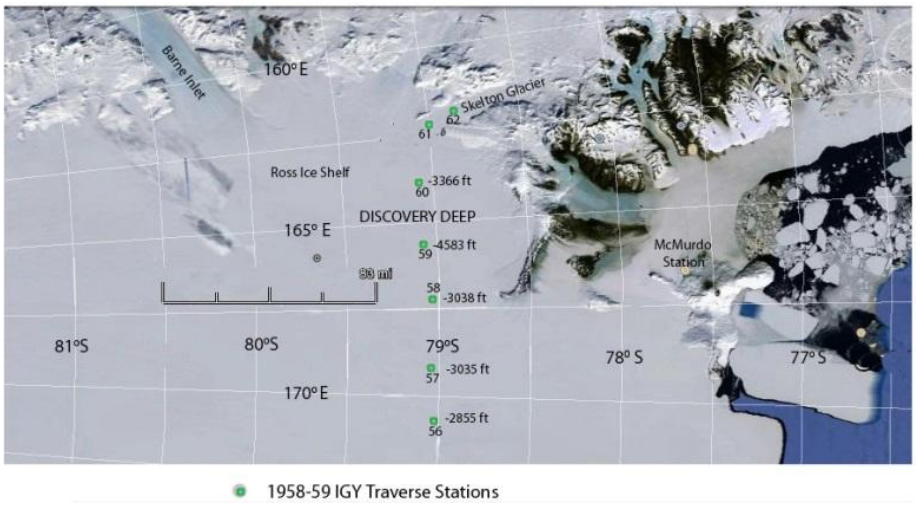
An Account of the Discovery Deep Traverse – February-March, 1960

by Edwin S. Robinson (written August, 1960)

The experiences of the Discovery Deep Traverse are still fresh in my mind, although it has been four months since our return to McMurdo Station on March 28, 1960 after completing this traverse. The idea of making this traverse on the northwestern part of the Ross Ice Shelf was proposed several months ago as a means for field testing the two Tucker Model 843 SnoCats before taking them on the long McMurdo to South Pole traverse planned for next season. These are newly designed SnoCats, somewhat larger than the vehicles we had been using for oversnow travel. They arrived at McMurdo Station by ship last December, and had never been tested in the Antarctic environment, or anywhere else for that matter.

Tucker Model 843 SnoCat

In addition to field testing the new vehicles the Discovery Deep Traverse also had a scientific purpose. Seismic soundings done on the 1958-59 traverse, led by Albert Crary, recorded ocean depths close to 4500 feet near the northwest border of the Ross Ice Shelf, the deepest found anywhere beneath the ice shelf. They named this area Discovery Deep. I wanted to find out if this was a basin confined to the Moore Embayment just south of Black Island and White Island or if it was linear trough extending along the coast for some greater distance. On Discovery Deep Traverse we could make seismic and gravity soundings along profiles to clarify the nature of the ocean bottom. The proposed journey would take three weeks or so, and would cover about 550 miles.



At McMurdo Station beginning in mid-January our efforts were directed toward getting the vehicles and equipment ready by February 15th. Jack Long was in charge of the vehicles. He had helped design them at the Tucker factory in Oregon after having spent a year at Byrd Station as traverse mechanic, and he had been on two 3-month traverses while there. So everything concerned with vehicle operation and maintenance was his responsibility, and his ingenuity made him invaluable as a traverse man.

Meanwhile I began to organize the scientific program. It appeared possible to carry out the same overall program as had been done on the earlier traverses, since the Russian exchange scientist, Sven Evteev, had arrived and was interested in going on the trip. Sven is a glaciologist with one year in the Antarctic behind him besides extensive work in the Arctic and throughout Russia. So Sven handled the glaciology program while I had the seismic, gravity, and magnetic measurements to manage. We all felt a fourth man was necessary since the seismic program is a two man job, and the multiple tasks of traverse life require a fourth. So I set about to find an assistant geophysicist. New Zealand scientists at Scott Base were all busy with their own programs, and so were the other civilian personnel at McMurdo, so I began looking to the Navy. At first I wanted Bob Cox, the chief electronics technician. Jack had some others he wanted to ask, but I felt since the man would be my assistant, I wanted to pick him. After much delay it was decided that Cox was needed too much around camp, so then I asked for Marty Wise, another electronics technician who had been at Byrd Station with me. I knew he was a capable man. Again after much discussion it was decided we could take him with us. Besides his other duties he would maintain our radio equipment and test various radios for communication with McMurdo. So the four man field party was finally assembled, and our departure was about three days off. During this time I was also busy mounting my seismic

Discovery Deep Traverse Party: left to right: Jack Long, Marty Wise, Sven Evteev, Ed Robinson.

equipment in the SnoCat and testing it, and testing other equipment: the gravity meter, the magnetometer, and the navigation instruments, since I was also to do the navigation.

Meanwhile Jack was having his troubles with the SnoCats. Exhaust leaks necessitated rerouting the engine exhaust which was a time consuming job. And so when February 15th arrived we found we weren't ready to leave. The Navy loaned us two large 10-ton sleds and loaded 1600 gallons of diesel fuel. I spent one day loading drums of gasoline, oil, antifreeze, grease, etc. which were also needed for vehicle maintenance.

Otter Aircraft used to reconnoiter proposed Discovery Deep Traverse Route (US Navy Photograph)

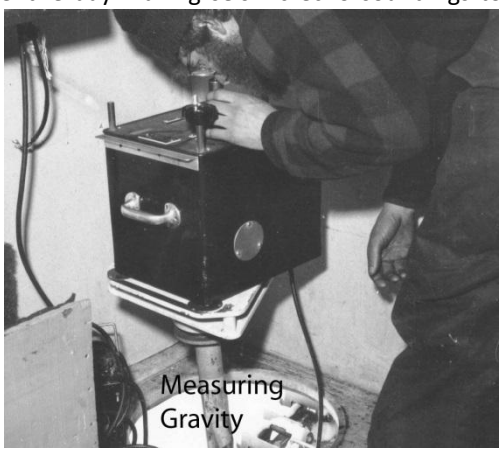
Part of our preparation included a flight to reconnoiter the route for crevassing. Since we would be travelling near the Barne Inlet, we didn't want the same trouble which resulted in a serious crevasse accident for the New Zealand field party in November. Jack, Sven, and I made this flight down the coast as far as the Barne Inlet where overcast weather prevented further reconnaissance.

As departure time approached we became more rushed with numerous last minute preparations. So many supplies to take and so many little changes to be made on the new vehicles. There were times when I was a little irritated by Jack's assuming to arrange things which I considered my responsibility, mainly the planning of the route which I felt I should determine. I would tell the Navy we were going one place only to hear that Jack had before given them different information without consulting me. I think each of us rather jealously guarded what he considered his responsibility and came to a little friction where we overlapped. Jack is strong-willed and assertive, and likes to run things without interference, while I am more conservative and like to get other peoples' ideas before acting.

We were not ready on February 15th, and told everyone that it would be about three days more. After this delay again we had to postpone for a few more days. After a while the venture became known about the base as the "Mañana Traverse", as we were forever putting off departure until the next day. Trail flags had to be made, last minute utensils had to be checked out from supply, sleds to be loaded and tested, gyro-compass installed, food packed, spare parts, welding equipment and all the necessary things for field repairs had to be found and loaded, and many other things. And the weather was getting worse as winter approached. Since lengthy field journeys seldom departed so late in the season, many people about camp had to be convinced that it was still safe. Sven was still getting used to speaking English, but was always a willing worker, and knew exactly what he needed for his part of the program.

Finally everything appeared to be ready. We were very eager to be away and done with all the last minute annoyances. Many of the summer people to whom we said good-bye many times because of our delays were themselves leaving on the ships for New Zealand. Their departure for the comforts of home contrasted to our departure for the discomfort of an expedition didn't add to our morale. We planned to be off on the morning of February 26th. Again, last minute delays kept us until noon, but after lunch we headed over to the SnoCats. But the weather was worsening and soon high wind and snow were upon us and we again had to put off departure. Fortunately this blew over in a few hours, and at three o'clock we piled into the SnoCats amid camera clicks and many well-wishers. The loaded sleds were over the hill down on the sea ice, so several people came in the SnoCats with us over the hill for the last good-bye. We were taking the two new large SnoCats each pulling a heavily loaded 10-ton sled travelling with two men in each vehicle. Soon the sleds were hitched, the last pictures taken and we were off.

At this point I would like to discuss the planned routine which the traverse party would follow. Altimetry is an important part of any gravity research. Therefore, it was necessary to obtain as good elevation data as possible for each gravity station. To do this I decided to have the vehicles travel three miles apart and stop every three miles at which time simultaneous readings on altimeters in both vehicles were made. This minimized the changes in atmospheric pressure with time and measured the difference in elevation between the two points. Starting from a known point these successive readings would give elevations along the traverse route. So the routine was to begin travelling about eight o'clock in the morning reading altimeters together. One vehicle would then proceed ahead for three miles, then stop and call the other by radio. We would then take about 15 minutes to get gravity, magnetic, glaciology, and altimeter observations. Then both SnoCats would travel on for the rest of the day three miles apart stopping every three miles. About six o'clock the lead vehicle would stop, allowing the other to catch up in time for the radio schedule with McMurdo Station and supper. It was planned to stop at four or five sites along the route to spend an entire day making seismic echo soundings to determine ocean depth and ice thickness. Between these widely spaced soundings changes in ocean depth could be estimated from the gravity values measured every three miles, which provided more detail about the irregularity of ocean depth. During the one day stops a much more comprehensive glaciological study was made of the near surface snow by digging a 2-meter deep pit and core drilling to 10 meters.



So, after leaving McMurdo at 4 PM on February 26th Jack and Sven drove ahead three miles first, then Marty and I drove up to them. We decided to camp here since it was about six o'clock and we wanted to straighten out things in the SnoCats and get a good night's sleep since we had finally got away from McMurdo. Marty and I were driving the seismic SnoCat. In it was mounted all the seismic electronic equipment and the gravity meter. This SnoCat is 25 feet long and about six feet wide. The back part has a table about six feet in length along each side, and several cabinets and drawers. In the forward part are two bunks, upper and lower, which fold up against the wall. A third bunk in the back folds up also, and two extra mattresses are provided which can be used on the tables so five can sleep comfortably inside. In the front is the driver's seat and a passenger seat with the engine between. The 180 horse power diesel engine is entirely inside so it can be more comfortably maintained during cold weather. The vehicle has 5' 11" headroom. Jack and Sven drove and slept in the glaciology SnoCat, so named because Sven was the glaciologist and had his equipment there. This SnoCat has the same overall dimensions but is divided into two rooms. The back room for cooking and dining has a table with bench against the wall on one side. The cooking bench on the other side had the three burner Coleman camp stove and a snow-melter for water. The front room had two bunks and a table. Both rooms have several drawers. The gyro-compass was mounted in this SnoCat since we planned that it should travel ahead, and this helped the driver steer a straight course.

That first night we got ourselves squared away. We got up at 6:30 AM on February 27th, had breakfast, and started the cats by 8:00 AM. We hoped to make about 30 miles travelling southeast along the route followed by Charles Swithinbank's traverse a few months before. We would keep to this route until we had passed between Ross Island and White Island and were far enough east to get around the crevasses of Minna Bluff. The day was beautiful and clear. Jack started off and drove about three miles. We waited for his radio call but it didn't come. Try as we might we couldn't raise him and finally we saw him heading back. Together we tuned up the radios and he and Sven headed off again. This time we still couldn't get him. Marty was pretty frustrated because he was the radio expert and couldn't run down the trouble. By this time we had wasted most of the morning and were nowhere. About noon another Sno-Cat with some fellows from McMurdo drove out to raze us. They were working on the ice near Scott Base a mile or so away and just had to say good-bye once more. We then decided, since it

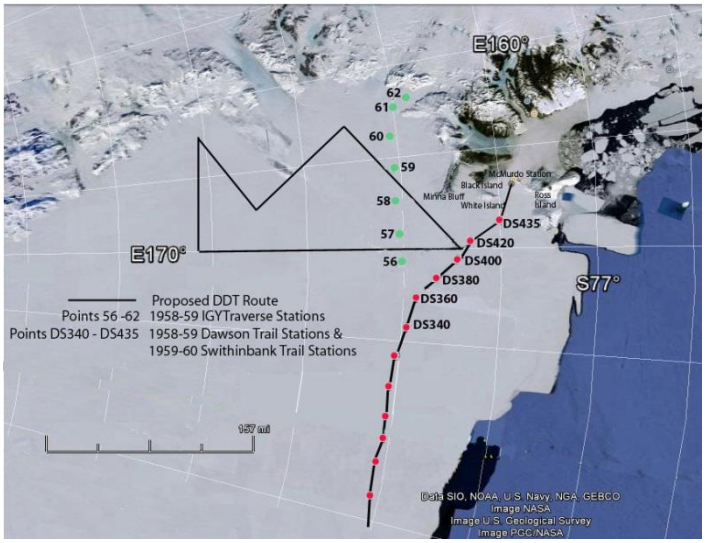
was a clear day, that the first Cat would go ahead three miles and turn sideways to indicate it was stopping. This worked fine and we managed to travel 18 miles this way then stopped to camp for the night. At each three mile stop we assigned a station number starting with station zero, station one, and so on through the traverse.

Pumping fuel

On February 28th we arose to another beautiful day and hoped to make good progress compared with the slow start we had had so far. While breakfast was being prepared, a couple of us checked the SnoCat fuel tanks, then got a barrel of diesel off the sled and filled each tank using a hand-cranked barrel pump.

After breakfast we turned on the radios and Jack and Sven left. They called us by radio every few hundred yards and we found for some unknown reason that reception was now very good and our radio troubles were at least temporarily over. About nine o'clock Jack and Sven reached the three mile point and called us. After taking our instrument readings I started the Sno-Cat and made ready to leave. But I found the sled was frozen in the soft snow and wouldn't break loose. First I tried pulling it with no success, then driving around behind where we hitched up a cable to pull it out backwards. Again I almost burned out the clutch and couldn't budge the sled. So then the only recourse was to unload some of the fuel. Marty and I rolled off seven 55 gallon barrels of diesel. With this extra load off the Sno-Cat was barely able to break the sled loose. Then came the back-breaking job of reloading the 350 lb. barrels. By making an inclined plane with some planks we were able to roll the drums back on. Meanwhile Jack had gone on another 3 miles and waited for us.

The route into McMurdo Station from the ice shelf was first driven by Col. Dawson in 1958-59. He led a tractor journey of more than 400 miles across the ice shelf from Little America. Approaching Ross Island not far beyond Mile 435 he lost a D-8 tractor and sled in a large crevasse. Other trail parties led by Crary and van der Hoeven also followed this route coming in between Ross Island and White Island. They had no serious crevasse difficulty. In 1959 Swithinbank's field party followed Dawson's trail from Little America to Mile 435. From there they headed directly for Observation Hill, detouring around the crevasse zone where Dawson had trouble. This detour covers the last 30 miles or so into McMurdo. Since no crevasses had yet been encountered along this route, our plan for starting out from McMurdo Station was to more or less follow it to where it joined Dawson's trail at Mile 435. We would then continue along Dawson's trail to longitude 170 E where we would head due south.



A few miles before reaching Dawson's Mile 435 we stopped for some readings when Marty almost fell into a hole in the snow. He called me, and sure enough it was a small crevasse. Completely bridged except where the sled runners had broken through, it showed no surface indication except this break. It was small enough that the vehicle and sled easily drove over it. So I radioed Jack to warn him to be very careful. But this small crack was the only one we saw in the area. Now we weren't quite sure how far it was to Mile 435, and how far along Dawson's trail we must go. So after passing this point in the trail we turned around and returned to it to make navigation observations for calculation of our position. After about an hour we had lunch and established our position. Travel that afternoon was without incident, and we made camp on Dawson's trail at our station 15. Our position was 78 deg 07 min S, 169 deg 20 min E.

We had to stop by 7:00 PM to make the radio schedule with McMurdo. We made a successful contact this evening after failing for the first two evenings. So now all our radio equipment was working properly. The day's travel amounted to 17 nautical miles, again disappointing since we hoped to average nearer to 30 miles a day.


Jack Long on the short wave radio

But spirits were good and we cooked our supper of traverse soup and Boulton rations. Traverse soup is made up of anything that will go into soup, usually a mixture of onion soup, pea soup, sausage pieces etc. and a liberal amount of powdered potatoes to thicken it into a real hoosh. Everyone prided himself in preparing an especially thick tasty soup, but for the first part of the trip anyway Jack was the champion. Hot soup is very good food for a field party. The rest of the meal consisted of Boulton rations, which are balanced meals of canned and dried food packages in two-man portions, each box being either breakfast, lunch, or supper complete for two men. There were five menus of each meal and it was cook's choice as to what goodies we had at each meal. Being cook amounted to dropping the cans into boiling water until they were hot. We took turns cooking supper, lunch was eaten in the SnoCat while driving, and for a while Jack and Sven took turns with breakfast since the kitchen was in their SnoCat.

The sky had been cloudy part of the day but cleared sufficiently by evening for me to get a round of navigation measurements to find our position. Evenings were usually spent around the supper table cleaning up and talking about any number of things, daring exploits and exciting women.


SnoCat track repair

We had now been travelling for only three days when mechanical breakdowns began to delay us. We got up in the morning of Feb. 29 and were ready to be off by eight o'clock. I then noticed that one of the SnoCat tracks was about to come apart. Jack got out the special tools for fixing it and we were soon repaired. Then he found the battery in the glaciology SnoCat wasn't charging properly. So we proceeded to tear apart the electrical system of that SnoCat. After testing things all morning, we found that the alternator was burned out due to a short circuit. Since this so rarely happens, we failed to bring a spare. So the radio was cranked up and in went our first distress call to McMurdo for a replacement part.

While waiting for the flight with the part, Marty and I greased the SnoCat tracks. Trying to fill and operate a grease gun in sub-zero temperatures is certainly a most irritating job. The tracks have to be warmed up by a large heater, and also the can of grease and the grease gun. But soon everything gets cold and stiff again. So by the time we finished I was so covered with grease that one windbreaker and pair of pants were ruined. Hopefully this wouldn't have to be done again.

The next day the airplane came out with the spare alternator, and also some beer and a great quantity of leaflets which they dropped. The leaflets were a cartoon drawn by one of the pilots, Ben Hooper, depicting our sorry situation, only three days gone and already calling on valiant pilots of VX-6 squadron to save us. The rest of the day was spent repairing the vehicle. We were held up for two days and not yet even off Dawson's trail. We figured we already had had our share of trouble.

According to my navigation we should travel along Dawson's trail another 12 miles and then turn south along meridian 170 deg E. We got started by 8:00AM and travelled about 9 miles, then had to stop to get the gyro-compass running. There was trouble with some plug, and after repairing it Jack drove up and down the trail to calibrate the compass. We then continued on to the turning point and headed south. After going about three miles we stopped to make the scientific measurements, then couldn't get the cat started again. Jack drove back to us and found the trouble to be the starting switch which had burned out. Grease in the switch got so stiff from the cold that it held the button in contact and the high current burned the contact so it wouldn't work. The repair took about an hour to put in a new switch. We also took time to repair a radio microphone which was frozen. We then

continued on to station 22 where we made camp. Again progress was only 18 nautical miles which was disappointing.

The heaters in the seismic cat were beginning to go bad. One wouldn't work but the other produced enough heat to make up for it. The scientific instruments were all working well so far and the data looked good, so we were all in good spirits despite other troubles. Outside temperature was about 0 deg F most of the time, and we had no heat in the SnoCats at night. But sleeping bags were warm and comfortable. Only getting up in the morning was hard.

On March 3rd we continued south. Since the sky was overcast we had only the gyro to steer by. But we proceeded without trouble to station 26 where the starting switch in the glaciology cat burned out. Since we again had no spares Jack wired-up a more durable starting cable which worked well for the rest of the traverse. We then continued on to station 30 where we made camp, having travelled 22 miles for the day. The sky cleared enough in the evening to set up the theodolite and find our position from sightings on mountain peaks.

The next day the weather was very bad so we could not travel. We couldn't get the heaters to work very well so spent the day attempting repairs. No spare parts had been sent down so all we could do was dismantle two smaller heaters and use the parts to repair the larger ones. So by the end of the day Jack had two heaters, one in each cat, in working order.

Waiting out a blizzard

During the day I took several gravity readings which could be used to calculate the tide in the ocean beneath the floating ice shelf. Sven worked on his glaciology data. He had been digging a shallow pit every three miles to study snow stratification, and had been running hardness tests. He placed a measured stake at each station which we hope to visit next season so as to measure the amount of snow fall for the year. Sven's English was improving but we still had to speak slowly and repeat for him to understand. But he makes a very good traverse companion being a hard worker and of calm cheerful disposition.

A few days ago we had rescheduled the radio time for 8:30 PM which would give us a longer travel day. So on March 5 we travelled with some difficulty for 28 miles to station 40. The first 15 miles we headed south, and then headed on the southwest course which would take us into Discovery Deep. However, all day the sky was overcast, so we had a complete whiteout. This is a condition which occurs where the ground is completely and perfectly white and the sky is uniformly overcast, so that there are no visible shadows and no visible horizon. The air is clear, but in every direction you see only unchanging milky white. With this featureless background a black SnoCat a mile away and a small black box lying 10 feet away are indistinguishable from one another. It is almost impossible to see SnoCat tracks in the snow, so a driver cannot follow the trail of the SnoCat that is travelling 3 miles ahead.

At one point Marty and I almost lost the trail because of the whiteout. Having turned off the Dawson Trail we were now breaking a new trail with Jack and Sven going on ahead and Marty and I following up in the seismic cat. It was very important to stay in their tracks so we wouldn't become separated from one another. After finally reaching station 40 we made camp, at last having made a good day's travel.

Every evening Marty had been working on his project which was to test different radio equipment. After the regular evening schedule he would continue talking with McMurdo using a different radio on various frequencies and with different kinds of antennae. After having some difficulties at first he had now been getting good results for the past week. He was also working on a Navy weather project, testing a "Grasshopper". This is a device which was designed to be dropped by parachute from an airplane some distance from a camp. It would set itself up automatically and would periodically transmit weather data from its remote location. So far there had been transmission problems which Marty had been working on during the past summer season. Now he wanted someone to set up a Grasshopper at McMurdo Station so he could test how well he could receive its radio signal as we journeyed south. So far he hadn't gotten much cooperation from those back at McMurdo, but they promised to set one up soon.

When Marty started out on the traverse he declared he was going to quit smoking. So he brought only half a pack of cigarettes and two pipes. According to him pipe smoking didn't count, because he didn't inhale. I also had left my pipe behind. His cigarettes were gone within a few days and he began on the pipes during the time we were driving. It wasn't long before I had adopted his extra pipe, which remained my companion for the rest of the

trip. After his cigarettes were gone he still figured he was entitled to one a day for good behavior, and this one was bummed from Sven. I must say he made a valiant try, but after Sven ran out he discovered that a few packs were placed in the boxes of emergency food rations. So old Mart would try to convince us we should try these emergency rations for variety. So all I can say about this "stop smoking campaign" was it provided a topic for conversation.

March 6th was again cloudy and partial whiteout. After the good progress of the day before we were determined we should now start making more distance. We got off early, and it looked like another good day, as we made our way without incident until 5:30 PM. We pulled into station 47 while Jack and Sven were three miles ahead at station 48. Jack called on the radio and said he had forgotten to read the altimeter at station 47. We decided I should drive back to station 46 while he remained at station 48 and we would read together at these stations and would not worry about his returning to station 47. So Marty and I turned around and started back.

SnoCat tie rod repair

We had gone only a few yards when I heard a snap underneath the cat. It didn't take us long to find out we had broken a tie rod end. This is the part which holds one of the heavy tie rods which steer the vehicle. There was nothing to do but call Jack to come on back with the tools and spare parts. Try as we might it still took half an hour to raise them on the radio and another hour for them to get back. We then had supper and Jack finished the radio "sked" before we set out in earnest on the repair job.

By this time of year the sun sets about supper time and the temperatures run about -20 deg F. The repair job consisted of working with heavy wrenches on our backs in the snow under the cat with only a small flashlight to remove the broken part. Also, we had to remove the heavy A-frame on the front of the SnoCat so that the other cat could get in to position to hoist up with its winch. After this was done we put on the new tie rod end and heaved and shoved the pontoons around until everything fit back together again. The job kept us up until past midnight, and after finishing we warmed up with a cup of coffee and turned in.

We slept in next morning until about 8:00 AM. This morning we again had heater difficulty. Since it is miserable trying to drive an unheated SnoCat at temperatures around -20 deg F, having to sit still in the seat without much chance to move about to keep warm we decided to stay put and fix the heaters. For the past few days the seismic cat heater was running so poorly that we had to keep warm by the small flame of a Coleman camp stove. So Jack and Marty worked on the heaters while Sven and I again climbed under the SnoCats to tighten all the tie rods and grease some joints.


Theodolite used for navigation

That day clouds obscured all the mountains but the sun was visible. I hadn't been able to get a good fix on our location for the past few days, so I decided to shoot the sun for position. This time of year the sun is so low that an accurate fix is difficult, but during the middle part of the day it is high enough to get some good theodolite observations. The theodolite is a particularly high quality surveying transit, which I used to measure angles between sightings on various geographical features such a mountain peaks, and also the vertical angle of the sun above the horizon. So I worked in a biting wind to get four shots at two hour intervals. At the same time I measured magnetic declination using the sun and a Brunton compass. I was also taking gravity readings every two hours for tidal changes. Jack was busy with the heaters most all day and we all helped when we could. He and Marty finally pieced together two working units. The troubles were caused mainly by poor quality parts in the heater. The seismic cat heater would now start only after holding a blow torch in the exhaust until the combustion chamber was hot enough to keep the fuel burning on its own.


Herman Nelson heater

For repair jobs it is often necessary to heat the parts and melt off the accumulated ice. For such repair work we had

brought along a “Herman Nelson” heater. It is a unit about four feet long and two feet high and wide. A small gasoline engine drives a fan and a burner puts out warm air which is blown out a long flexible duct about a foot in diameter. The Herman Nelson is used for pre-heating aircraft and vehicle engines in extreme cold. We had brought along one 55 gal drum of gasoline for the Herman Nelson, and by this time we had nearly used up all that fuel. So Jack put out another radio call for 4 more drums to be flown out. The folks at McMurdo promised to send out more food for hungry Herman as soon as weather permitted.

That night we feasted on steak again. We had brought along a case of frozen steak and whenever we were held up for a day we had time to thaw out the meat for supper. Marty was the best steak cook and he always had a good way of preparing the frozen vegetables that we included with the steak dinner.

The next morning all the broken things appeared to be working. Marty got our heater going with the blow torch and I got the engine started. We were about ready to leave when Marty noticed some oil leaking out from the SnoCat exhaust pipe. I called Jack over and for the first time he really looked concerned. He thought we were looking at a blown head gasket! So we should get settled for another couple of days for engine repair. We began to tear the engine apart. By afternoon it was pretty well disassembled, and parts were lying all over the SnoCat. I spent most of the afternoon cleaning the different parts in white gas. Meanwhile Jack found out it wasn’t a blown head gasket but a broken oil seal in the turbocharger. We had one spare turbocharger which wasn’t too difficult to install, but still had the rest of the engine to put back together.

After supper we were back reassembling the engine using a flashlight to see what we were doing. Jack put in a new head gasket even though the old one was not broken. Then we set about to put the cylinder head back on the engine block. Marty, Jack, and I could all have used an extra arm to hold all the little rocker arms in place while lowering the heavy head down on the block. After much foul language, bruised hands and pinched fingers we got it back in place, and only with light from a flashlight. By this time it was near midnight so we put off putting the rest of the engine back together until the next day.

March 9 was spent reassembling the engine. It was greasy, meticulous work and at times heavy, especially tightening the head bolts, all of them to 450 pounds of torque. This took Jack and I pulling on the wench as hard as we could on each of ten bolts. Finally after working all day and a little after supper everything was put back together and the valves all adjusted and the engine was running smoothly. While working we had kept the cat reasonably warn by sparing use of the Herman Nelson heater and by the SnoCat heater. On the more strenuous work we worked up quite a sweat. I certainly have to give Jack credit for managing this major repair. This traverse was really putting his mechanical ingenuity to test but he was good for anything that came up.

It was arranged by radio that night that a helicopter would bring out the Herman Nelson fuel next morning. During the day the clouds had cleared away so I was able to get some theodolite bearings on mountains to supplement my sun shot position. The next morning the helicopter arrived about 10:00 AM. They brought 4 barrels of food for “Hungry Hermie”. They also had a second chapter in the adventures of the Mañana Traverse in the form of another cartoon. Ben Hooper, the chopper pilot, made these up, but we had a laugh on him when the chopper started acting up. They took off for McMurdo about 11:00AM but we saw them land about ten miles away from us. Soon they were up again and coming back to the traverse party. An oil line in the chopper engine was frozen, and they needed some of Herman’s heat to try and fix it. So we came to the rescue. They left again and the problem still wasn’t solved, so they had to land about every 10 minutes for the entire flight back. It took them all day to reach McMurdo. By this time we figured there wasn’t much else that could go wrong with the cats. After this it appeared that the built-in pre-heaters weren’t able to get the diesel engines warm enough to start without taking a chance in breaking more oil seals. So Jack decided that the engines needed to be heated by the Herman Nelson each morning for about an hour.

US Navy helicopter

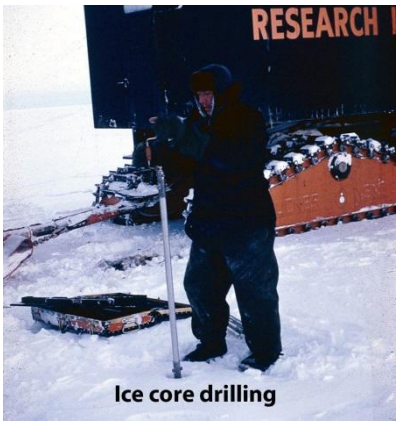
After lunch on March 10 we fired up the engines and moved on after a 3 ½ day delay. The temperature was now running about -25 deg F. We drove about 16 miles and made camp at station 53. That evening it was cold work taking my theodolite observations to find our position. I found we were a little off course because of those previous days of travel in whiteout. And the shots at station 47 weren’t as accurate as I would have liked. But at

this station I got a good position, since the sky was clear. We were now on a good travelling surface, the sastrugi not being too high so the vehicles rode fairly smoothly. The first 30 miles out from McMurdo were over an excellent surface, but all the way going around Minna Bluff the surface was very rough and the SnoCats rocked and bumped quite wildly at times, throwing things all over the floor.

On clear days the rugged coastal mountains stand out very sharp and white. The sky often is quite beautiful during the day with various cloud formations, and in the evening as the sun sets it becomes beautifully colored. The vast extent of the white snow and the crisp cold air make everything seem clean and refreshing. But by this time everyone is getting quite grubby since we have no facilities for washing anything but our hands, and them not very often.

It took us longer to get started on the morning of March 11 because of the time needed to preheat the SnoCat engines. But we left station 53 by 9:45 and travelled without difficulty except for a short delay when our sled hitch on the seismic cat pulled loose after having become bent from hauling the heavy sled. But a longer hitching pin solved the problem and we were soon on our way. The weather was clear and getting colder, temperatures now approaching -30 deg F.

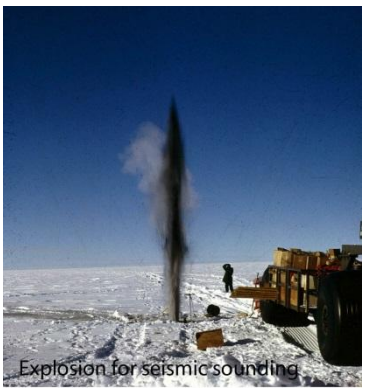
I decided to put in our first major scientific station at our next camping place since I believed we were getting into the region of Discovery Deep if it existed. We reached station 63 that night having travelled 28 miles during the day. When Marty and I pulled in, Sven was already hard at work on his deep pit. Jack was busy with the radio schedule.

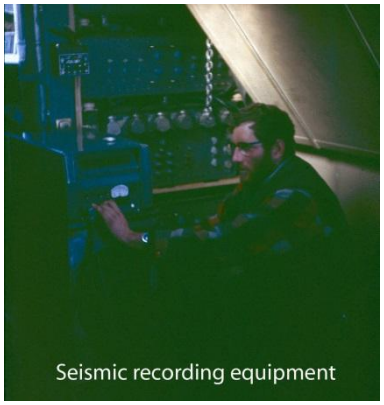


Ice core drilling

I set about to survey our position since the sky was so clear. The temperature was down to -35 deg F and I froze my fingers more than once while working the theodolite. My old landmarks of Mts. Erebus and Terror, Black and White Islands, and other points I had been shooting on were now lost from view. So I had to locate some new mountain peaks for turning angles. We were close enough to the coast that the high ranges offered a multitude of peaks. But my maps did not show good positions on all of these so I had to experiment with several before finding the combination which would give the most accurate position. By the time I finished plotting our position and calculating magnetic declination Marty had supper ready. We all turned in soon after finishing our Boulton goodies.

The program I had planned for this station consisted of taking gravity observations every few hours, and recording a seismic reflection to determine ice thickness and depth to ocean bottom. Sven planned to dig a pit 2 meters deep for detailed study of the snow, and to core drill to a depth of 11 meters to get a continuous snow sample, and to measure temperature variation with depth in the snow. He planned on doing as much as possible in the field but would take snow blocks and cores back to McMurdo for a very detailed laboratory study.


Explosion for seismic sounding


Seismic recording equipment

Soon after breakfast Marty and I set about the seismic work. This amounted to stretching two 1200 foot cables with detectors every 100 feet, then drilling a 5 meter hole in which we would set off the charges of explosive. The electronic apparatus of the seismic equipment would record on a photographic record the time taken for the energy from the explosive to echo off the bottom of the ocean and back to the surface thus allowing calculation of the depth. In some areas such echoes are difficult or impossible to obtain but in most areas of the Ross Ice Shelf good reflections were possible. I was happy to find my recordings were successful. Marty and I spent all day getting reflections with various detector spreads and charge sizes. Sven was busy all day with his pit and we all took turns helping him from time to time. The scientific program was finished by supper time. Again we had time to thaw some steak and so had a tasty dinner. Since the vehicles were in need of some routine maintenance Jack wanted to stay another day at station

63. The following day was spent greasing and changing oil and other jobs that had been neglected up to now because we had been forced to spend so much time just repairing the vehicles.

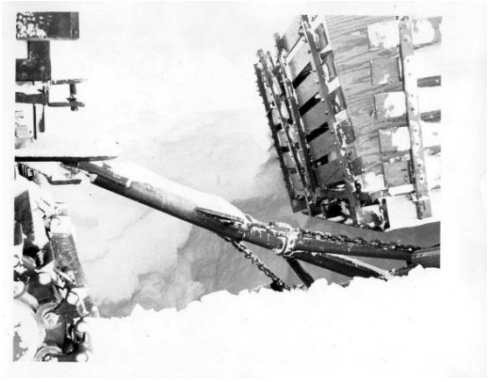
I planned to travel two more days before putting in another scientific station. On March 14 we continued southwest for another 28 miles. This put us at 79 deg 56' S, 164 deg 00' E. The gravity data taken during the day's travel showed us to be well over Discovery Deep with the ocean bottom getting deeper all the time. So I decided it would be best to put in another scientific station at this position which was station 73. So when we arrived that evening Sven was already working on his pit. The temperature dropped below -40 deg F this evening making my theodolite work quite unpleasant.


Another blizzard

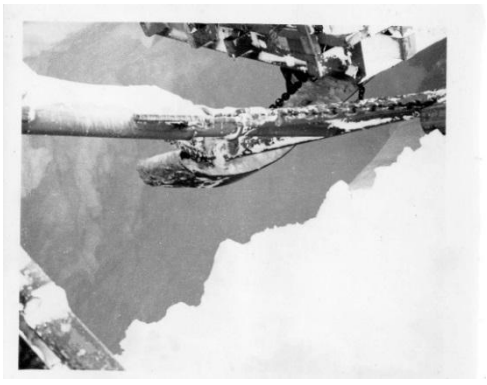
March 15 was spent doing the seismic and glaciological work. The weather turned bad and by afternoon a blizzard was howling. But we continued to finish the seismic work, and again had successfully measured ice thickness and ocean depth. By then the weather was so bad we couldn't see more than 20 or 30 yards ahead. Sven had a canvass cover over his pit to keep the snow from drifting inside. I have never been so saturated with snow as while working in this storm. The wind was blowing about 40 miles per hour with gusts up past 50 mph.

This was as close to the coast that I wanted to go because of crevasse danger near the Barne Inlet and other glaciers. So we planned to head southeast the next day, away from the coast for about 30 miles. The blizzard continued in full force on March 16 so we were forced to stay put. We spent the day on various inside jobs, taking care of those little items that are always being put off until later. I was beginning to get worried about how slow our progress was. We had been gone nearly three weeks and were only about 1/3 of the way along on the proposed route. But we always rationalized by saying not much more could go wrong to hold us up and the rest of the trip would go quickly.

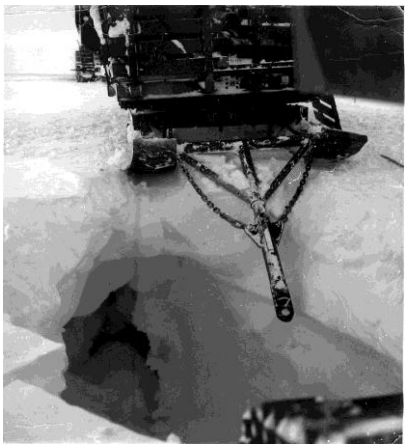
On March 17 the weather was still whiteout with about 15 mph of wind. But it was possible to travel so we dug ourselves out of the snow drifts and roared off by 8:30 in the morning. It was very difficult to see the trail of the other SnoCat driving ahead of us, but we managed to travel along without any holdups until mid-afternoon. My gravity readings showed a very rapid increase indicating that we were beyond Discovery Deep, and the ocean was becoming shallow. The weather began to clear about 3:00 PM as Marty and I pulled into station 79 and awaited the radio call from Jack 3 miles ahead. He came on a little sooner than expected with really scary news. The sled he was towing had broken into a crevasse! We must proceed ahead with extreme caution! This really stunned me. We were 50 miles off the coast and although we were in line with the Barne Inlet we were, I thought, well out of the range of the disturbed ice. However, the gravity measurements I had just been making did indicate that the ice might be grounded farther ahead which could cause crevassing.



We continued on very carefully to within 100 yards of the other SnoCat, then got out to look over the situation. The SnoCat had not fallen in, but the entire front of the sled had dropped in a crevasse about 8 feet wide and was hanging by the tongue and one rear runner. By the time Marty and I got there Jack had the situation pretty well sized up so we proceeded to probe out a safe area around the cat by using 10 foot probing rods. Then we brought the seismic cat up behind the sled. After another hour of heavy work we got the A-frame from the front of the glaciology cat re-mounted on



the rear brackets so the winch cable could be hooked onto the runner cross bar of the sled. I climbed into the glaciology SnoCat to operate the winch. By ever so gently reeling in the winch cable the dangling front-end of the sled was lifted so the tongue could be unhooked. The glaciology cat was sitting partly over the crevasse bridge, and every time I reeled up on the winch the cat slumped down a little. Meanwhile Jack hooked up the winch cable from the other SnoCat to the back of the sled. Then, fingers crossed, by pre-arranged signals I would raise the front of the sled with my winch and Jack would draw the sled back with his winch. After several very tense minutes we had the sled pulled out, and I ever so slowly edged my SnoCat off the crumbling bridge on to the firm surface. Whew! The relief I felt was tremendous and the others felt the same way.



Actually the escape went smoothly once all the equipment was hooked up. And we didn't even have to unload the sled. On previous traverses where we had no winches, extracting sleds and vehicles from crevasses was a long back breaking job. Upon further investigation of this crevasse we found it to widen to about 15 feet a little farther along. It was completely bridged over by a thin layer of snow which gave no surface indication whatsoever of its presence. What a forunate thing the crevasse bridge didn't collapse under the weight of the SnoCat, plunging it and the sled into the maw. The accident could well have lost us both vehicle and sled. It was just too easy to remember the fatal accident of the New Zealand party last November when an entire SnoCat plunged 50 feet into a crevasse killing the driver and permanently injuring another. But we couldn't allow ourselves too much time for worry. And so we soon set about getting the sled straightened out and hitched up again.

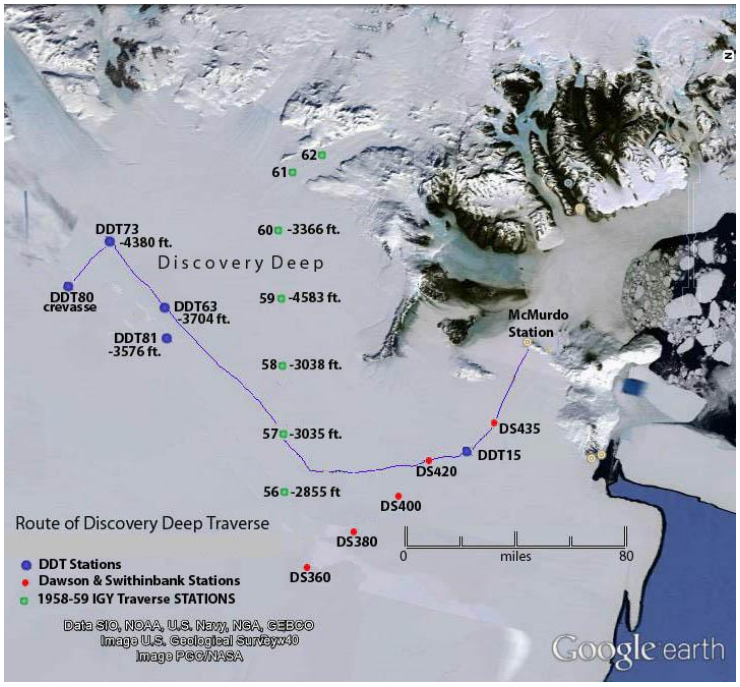
We decided to camp there for an additional day so that Sven could go down into the crevasse for glaciological observations, and we could do some seismic sounding. We named this campsite Station 80. That evening we were all in good spirits at having been so lucky to escape a crevasse disaster. Another bit of good cheer came in the form of a message over the radio for Sven. His wife had given birth to a girl. The new papa was elated and started dancing in the SnoCat.

The question came up of what route we should now follow. The rapid rise of the gravity and the presence of the crevasse made me feel the ice was grounded shortly ahead with lots more crevasses. So I wanted to backtrack over the old trail about 10 miles then head south again. Jack wanted to keep going ahead at least until we hit another crevasse. We argued it out and finally decided to go back over the old trail and head south from a point about 10 miles back

The next morning Marty and I got off some seismic shots but were not successful in getting a reflection. This didn't surprise me as I expected poor results in this area of bad ice. Last October we had tried seismic sounding somewhere near here on an air-lifted geophysical surveying trip, also without success. This further confirmed my suspicions that the ice might be grounded nearby.

That afternoon shortly after lunch we heard an aircraft overhead. Apparently they got a little worried back at McMurdo upon hearing we dropped in a hole, and decided to fly out even though we had made no request for a flight. After dropping off Chapter 3 of the Mañana Traverse cartoon they set about reconnoitering the ice over which we planned to travel. We tuned into their radio and listened as they described the surface to us as they flew along. It turned out that the route I had proposed looked bad with some collapsed crevasse bridges showing in various places. However the surface to the southeast looked safer with no surface indication of crevassing. So we decided that the best would be to continue another 20 miles in the direction we had been travelling and then head southwest. The sky was clear now, so after the airplane left I set up the theodolite, got bearings on some mountain peaks, and found our location.

Then Marty and I drove back along the trail about 3 miles to the last gravity station. It was necessary to reset the meter because it had gone off scale between station 79 and station 80. We got back to station 80 in time



for supper and then tuned in for the radio schedule. There was a long message from Wisconsin instructing us with utmost urgency to return at once to McMurdo. After getting this message and looking over the condition of the vehicles we decided it would be safest and fastest to travel back over our outgoing trail to McMurdo. At this point the total distance along our route from McMurdo Station was 225 miles. We now faced a return journey of that same distance.

The message from Wisconsin stated that they had received Jack's messages concerning the troubles we were having with the vehicles. They then consulted the factory and were told that the engines were in danger of severe damage if they were driven with faulty turbochargers, and that the best thing would be to get the vehicles back to McMurdo Station as soon as possible. The turbocharger in the glaciology cat had gone bad in the same way as the other, but since there were no spares we had just driven on with it as it was. So there were instructions from the factory for rebuilding certain parts and care that must be taken of the engine.

Jack was hard at work for the next two days rebuilding part of the exhaust system so the engine could run without the turbocharger. He made use of almost all the special tools which were brought along only for emergency including cutting torch, arc welder, electric drill, etc. The rest of us helped when we could. On one day I set up the theodolite for a series of sun observations to add to my mountain top bearings for navigation. Even at mid-day the sun has only about 10 degrees of vertical angle elevation above the horizon which is barely enough for accurate work. Later that day we lowered Sven into the crevasse to study ice structures and to collect ice samples.

We had a lot of wind and blowing snow around station 80. We were right in line with the Barne Inlet so we received much cold air coming down off the plateau. Recent temperatures were quite variable, sometimes as warm as -15 deg F and other times falling to -40 degrees. The long delay necessary for modification of the engine ate deeply into the Herman Nelson fuel supply so it became necessary to conserve gas in every way possible.

Starting return trip to McMurdo Station

By the evening of March 20th the SnoCats were ready to go. We decided to travel around the clock in a continuous drive until we reached McMurdo. This would save Herman Nelson fuel since we wouldn't have to heat the engines each morning. I was disappointed at having the field work cut short but decided I was lucky to have as much data as I now had considering all our troubles. I had found Discovery Deep to continue as far as 80 deg south latitude and had found it to be nearer the coast than before expected. I would have to be satisfied with what I had and hope more could be done by some later expedition. On the return trip I hoped to continue driving at a three mile interval so as to continue altimeter and gravity readings as a check with the outgoing observations.

We left station 80 the morning of March 21. The day was bright and clear as we headed back over the old tracks. We were making good progress for about 20 miles when Jack radioed for us to come up and join him

because he had a breakdown. We drove up and found he had a broken universal joint where the driveshaft from the transmission goes into the transfer case. Also the gears in transfer case were grinding badly.

So again we unloaded the Herman Nelson and the big canvasses to shelter us from the biting wind. This was a heavy cold job. We had brought a replacement transfer case with us. It is a large gear box which connects the main drive shaft from the engine with two other drive shafts going to the front and rear pontoon axles. It weighed about 150 pounds and was awkward to handle. Together three of us made several efforts to lift it into position and bolted in place. All of the work was done outside in the dark of night by flashlight, crawling around in the snow under the SnoCat. The job took about 8 hours. By this time the wind had picked up and we had a lot of blowing snow. Finally it was installed. We took a little time for dinner and then continued driving. Marty now relieved me and I climbed in my sleeping bag to try for a few hours of rest while the SnoCat bumped and rocked along the trail.

By this time heaters in both SnoCats were working intermittently and not putting out much heat. I got up at midnight for a gravity reading and then back in the bag. Apparently Jack lost the old trail because of very poor visibility somewhere after reaching station 73. We continued until about 4:00 AM when he decided to stop and wait for daylight in the hopes of picking up the trail again. So we all bedded down but left the engines running. I got up about 7:00 AM and prepared breakfast, then awoke the others. The heater in the seismic cat was completely gone now, and the one in the glaciology cat was barely operating.

The sky had turned cloudy, producing a whiteout, so we couldn't see any features of the snow surface. Still, we looked around for half an hour without success, hoping to find the old trail which we knew couldn't be far off. We started again travelling by compass direction. I took over driving while Marty continued sleeping. It was terrible. The temperature was well below zero and inside the SnoCat the engine gave off virtually no heat. The windows frosted so badly I couldn't see through them, so I wrapped up in a blanket with my head out the window to see where I was going. I tried lighting the little Coleman cookstove to cut some of the chill. But it seemed impossible to keep warm while just sitting in the driver's seat with my head out the window.

Stopped for repairs

About mid-day the clouds started to clear which always picks up our spirits. I was just getting used to the cold about 1:00PM when I heard the familiar snap of a tie rod breaking. I stopped and got out to find the broken end hanging in the snow. A radio call to Jack got him headed back to us. Then Marty and I got to work taking off the broken parts. Jack and Sven were soon back and we set about on another repair job consisting of pulling off the old tie rod, hoisting up the back of the SnoCat and prying the pontoons in position to fit the new one in place. The job took about 4 hours after which we cooked up supper.

I figured we should forget altimetry now and travel with the SnoCats together. Jack was of the same opinion as were the others. If both cats were to break down simultaneously several miles apart we would really be in trouble because we always needed one to fix the other. So we set out together hoping this would be the end of breakdowns. The glaciology cat heater burned out completely, so neither cat had any heat. Herman Nelson fuel was all but gone so we couldn't afford another long stop.

We all continued to keep in fairly good spirits but this was certainly wearing on the nerves. We were getting pretty philosophical about it. Now, with each breakdown the first thing to do was stamp and swear and cuss like the devil, then settle down to the work at hand. There was just nothing to do but fix it if we hoped to get these crumbling, fragile vehicles back to McMurdo Station.

We continued driving until 2:00 AM when again I heard a strange sound from beneath. The SnoCat just wouldn't go so I called Jack and we had a look. The universal where the drive shaft goes into the transmission was broken. This finished us! No spares, so we had to call for help. Jack and I worked the radio for about a half an hour but couldn't raise McMurdo. So we turned in for some sleep.

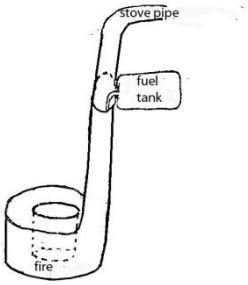
We slept in the morning of March 23 and arose about 10:00 AM for a large breakfast of bacon and French toast which Jack prepared. Shortly after Jack got McMurdo by radio and told them our situation. We needed a new universal joint, fuel for Herman Nelson, and Southwind vehicle heaters. We had been without heat for two days. They promised to fly out as soon as the parts were rounded up and the weather cleared.

The sky cleared long enough for me to get a round of navigation observations. Our position was 166 deg 45' E, 79 deg 39' S, which put us several miles east of our old trail. I decided to do a seismic sounding while we waited for the airplane. So that afternoon Marty and I got off a series of reflection and refraction shots and got a good bottom reflection. Sven put in a glaciology pit. About 6:00 PM we heard the airplane coming. Just about then a cloud bank moved in, and keeping with our run of luck, the airplane was unable to land. So they flew back and promised to try again in the morning.

Pilot Lcdr. Dale and his trusty R4D crew bring the replacement parts to get DDT back on the road

March 24 was a clear day and the airplane was landed about mid-morning. They had all the requested supplies along with chapter 4 of the Mañana Traverse. They brought us six drums of gasoline for the Herman Nelson, and a drum of white gas for the stoves. After much picture taking and well wishes they left us.

While we were camped in this place we contrived to jury rig a heater of sorts. It was an old plumbers' stove designed to be used in a snow melter. The odd shape is sketched below. It burned diesel oil which dripped from the fuel tank down into the doughnut-shaped base. The stove pipe went out the top hatch of the SnoCat. It either gave off too little heat to spread very far or it burned with a roaring blaze which heated the bottom of the stove red hot until we thought it would blow-up. We made a metal base to set it on so it wouldn't burn through the engine hood. Awkward as it looks it was a welcome friend for a few cold days.



With the new parts in hand we set to work that afternoon. Jack began installing the new heaters. The old ones burned diesel oil coming from the main fuel tank of the vehicle. The new ones were of similar design but burned gasoline. They were the type used on previous traverses where the SnoCat engines burned gasoline rather that diesel oil. So the problem was to install them and provide a fuel supply. Jack worked until about midnight on the 24th, and all morning of the 25th getting these going. He made new fuel lines which fitted into 5 gallon plastic bottles holding the fuel. When finished these worked very well for the rest of the trip. Working on cranky vehicles may be miserable at times but it is never quite so bad when there is a place to warm your hands from time to time.

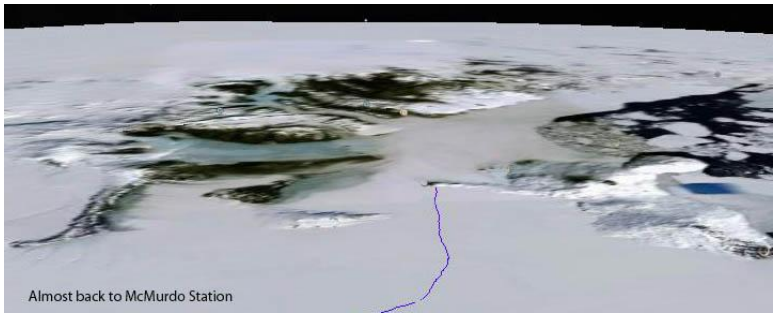
Marty and I began installing the new universal under the SnoCat. It was a real test of our patience since we couldn't fit it in place until we had completely removed the drive shaft and universal joint from the other end. We worked bare handed much of the time to get at small bolts in hidden places. Jack had to come out and help us from time to time when we couldn't get something to fit right. We all quit about midnight and resumed work in the morning when we had more light. The repairs were finished by noon.

After lunch a fog bank moved in. We fired up the engines and moved on in a whiteout after lunch. I was having difficulty with the seismic cat clutch slipping, but managed to get going finally. We drove most of the afternoon covering about 20 miles before the next breakdown. This time it was the rear tie rod on the seismic cat. By now we were resigned to making only 20 or 30 miles at a time then stopping for repairs. We now had only one remaining replacement tie rod end. So Jack decided to weld the rear pontoons in position and completely remove the rear tie rod from the system. This would give us twice the steering radius but would eliminate 50% of the chance of tie rod breakage. Again the job took about four hours. It was after dark before we finally had everything put back together.

By this time the clutch was slipping so badly that there was a chance of burning it out. So Jack set about to tighten it. The only way to do this was to remove several little spacers on the clutch plate. It was a terrible job especially by flashlight lying in the snow. By midnight everyone was ready for a little sleep. Work was resumed in the morning, and in a few cold hours everything was ready. After a quick lunch we hitched up the sled and started off again.

I was at my nerves end by now. Every strange noise put me on edge, and every few miles I would stop and jump out to see if anything was broken. After about 20 miles I was calmed down again believing we were making normal progress, and then braced up for the inevitable. But…. the machines just kept running along and by evening we were approaching Minna Bluff. We still hadn't picked up the old trail. We kept changing the compass course hoping to cross it at one place or another. Darkness made it almost impossible to see anything that was not directly ahead. We stopped every three miles to take a compass bearing. At 8:30 PM we stopped for the radio schedule and supper, then I turned the driving over to Marty and went to bed.

The morning of March 27 was clear and sunny. Our position was 170 deg 40' E longitude and abreast of Minna Bluff. This put us eight miles east of the old trail, so course was set to intercept it at station 30. This time our luck changed and we came dead onto station 30 early in the afternoon. Barring further breakdowns we would be back to McMurdo Station in another day, following the visible trail marked by flags at three mile intervals. Our travel routine was now simple. Just drive until you fell asleep and then turn the driving over to the other fellow. Sleep and eat without stopping. As long as the vehicles were running don't chance luck by stopping. From station 30 to Dawson's trail we placed bamboo poles every ½ mile to mark the trail for next season.


Almost back to McMurdo Station

I took over from Marty about 11:30 PM and continued driving until we reached Dawson's trail. All along the oil pressure was falling so finally I stopped and had Jack look at it. He found a clogged overflow pressure outlet which caused the engine oil to be forced up through the dip stick hole. He soon had if fixed and went back to bed. Meanwhile I warmed up the oil bottle and filled the engine before proceeding on.

On the morning of the 28th the sky was cloudy and the resulting whiteout made the trail very difficult to follow, but the flags every few hundred yards eased the problem somewhat. Later in the morning we arrived at mile 435 where we left Dawson's trail and headed straight in for McMurdo. I stopped briefly to make an occasional gravity reading from place to place along the old trail to check with the outgoing data. Otherwise we just made a bee line for home.

We passed the crevasse which had been opened on the outgoing trip and flagged it well. Otherwise we had no trouble with crevasses. I was worried that we might encounter some in this area since earlier expeditions have had trouble around here in the past. As the day wore on the sky cleared and all the familiar landmarks were around us. There was a strange optical effect called "polar looming" all around which magnified all the mountains making them appear much higher and nearer than was actually so. Early in the afternoon a helicopter came out and landed to wish us well for the last few miles. They brought chapter 5 of the Mañana Traverse series.

The last few miles were wonderful, but only when we were off the barrier and up in the pass overlooking McMurdo Station did I really feel full relief. We drove into McMurdo at 5:30 PM on March 28th after a nightmare of 31 days in the field. Some folks were on hand to greet us and take pictures. Then, after a good supper we all made for the showers. And then clean clothes, clean bed and relaxation. I think the first few days after coming in from such an experience is the nearest thing to heaven we will experience here. The relief from worry and work make it seem to be worth all the effort. Thus ended the Discovery Deep Traverse.

After a few days in camp we leisurely unloaded the supplies and equipment from the sleds and SnoCats. During the winter months ahead we can analyze some of the scientific data and work on the SnoCats. Thinking about DDT I feel lucky we had found the weak points in the vehicles now, so that spare parts can be ordered and in some cases redesigned for next season. It is better to know what is wrong now than to get in a bad situation up on the plateau next year where help by airplane will be much more difficult. I'm optimistic about the South Pole Traverse. But it scares me to think about what if we were to start on that journey without knowing what we learned about the SnoCats on the Discovery Deep Traverse.