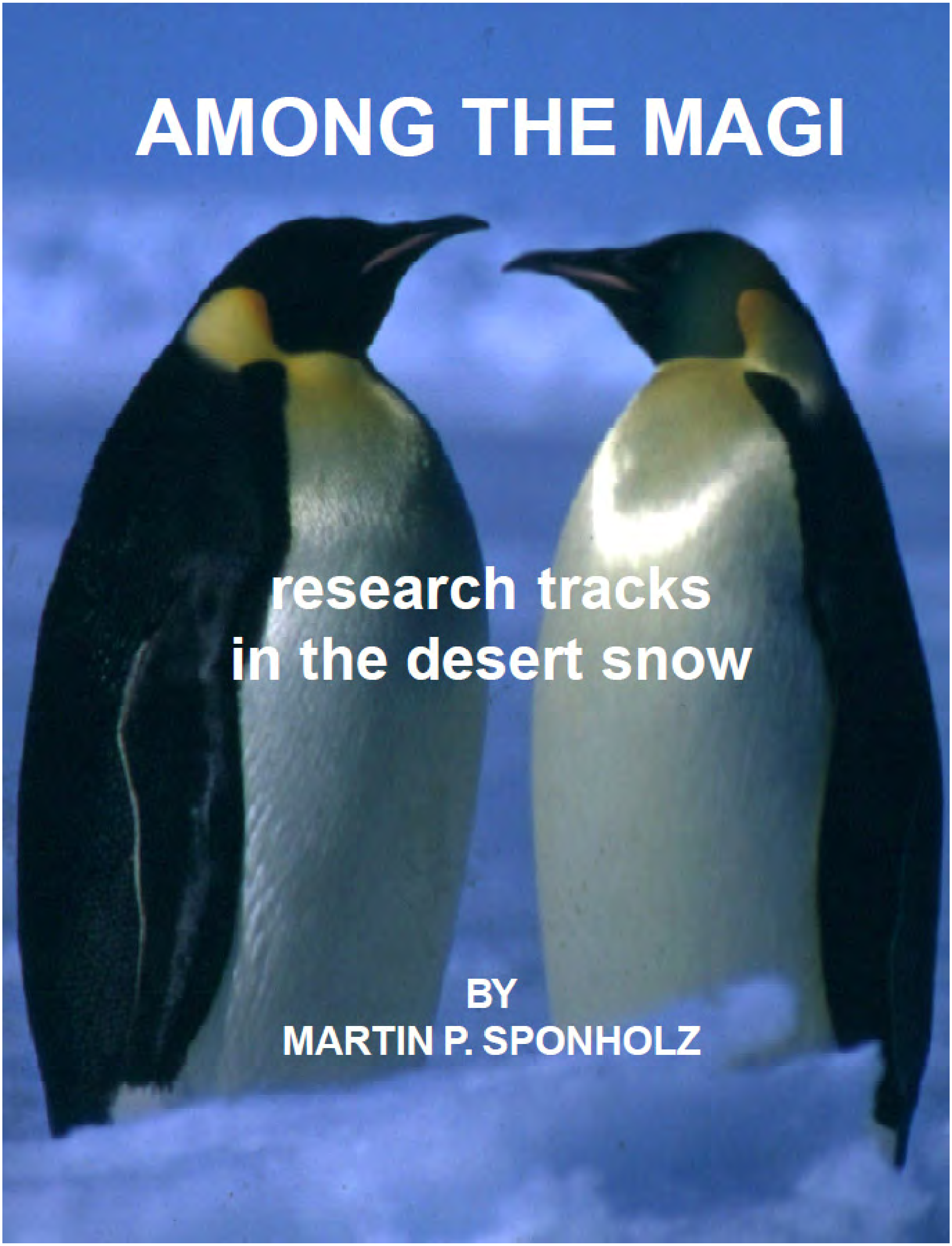
AMONG THE MAGI
research tracks
in the desert snow
BY
MARTIN P. SPONHOLZ

This book was originally written for my family (1994). Then, while cruising the internet for sites on Antarctica I ran into *The New South Polar Times* and found there an invitation for Antarctic contributions for Virginia's K-12 public school children. I submitted to Katie Wallet, founder and editor of *The New South Polar Times*, a digital copy of *Among the Magi* which she published on-line the descriptive text in its entirety (1997).

Editing for the on-line version of *Among the Magi* removed several inserts from *The Pentagon Papers,* (1971) which probably gave no contribution to the Antarctic experience. However, the shock to me as a wintering over scientist at a time of complete isolation from politics and news, *The Pentagon Papers* did show what was happening while I sat on the ice.

Also edited out of the original book were the equations. This is also accepted considering the audience of *The New South Polar Times* was K-12 and the travelog, polar life, and science methods are the greatest value of this account. The mathematical work is documented in the list of published works at the end of *Among the Magi* and by today has become dated as scientific discovery and reinterpretation has moved on.

Some graphics were also lost, perhaps because of the limits of desktop publishing at the time of the original establishment of *The New South Polar Times*. Whereas some of the complex mathematical models were left out, some of the original graphics along with a small number of equations have been restored in this new-old edition of the on-line book.

Whereas the negative copy on the war in Vietnam may be politically incorrect, the inserts of *The Pentagon Papers* reflect the denial of "victory" at the highest government levels. They add to my personal struggle of how one supports our men and women in uniform willing to sacrifice their very lives and at the same time be critical, as required of voters in a democracy, of the actions of our government? Several military personnel did make that supreme sacrifice in Antarctica for me, for the scientific effort they did not always understand, and for their country's presence in Antarctica. In the news vacuum of isolation on the ice these inserts also display a lost time and explain the confusion of those of us who wintered over. These inserts are restored in this edition.

Special thanks will always be granted to Katie Wallet and *The New South Polar Times* having provided a world wide exposure to *Among the Magi*. The full text of my experiences with polar research remained on *The New South Polar Times* from 1997 to 2007 as posted by Katie Wallet.

Among the Magi, related 35 mm slides taken at Plateau Station and with the Japanese Antarctic Research Expedition and reports by Martin P. Sponholz have been given to the Byrd Polar Research Center Archival Program in Columbus, Ohio currently under the care of Laura J. Kissel, Polar Curator, <kissel.4@osu.edu> <http://library.osu.edu/sites/archives/polar/staff.php>.

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MARTY SPONHOLZ ON PLATEAU AND BEYOND. The New South Polar Times website [http://205.174.118.254/nspt/home.htm] has its first-ever on-line book, AMONG THE MAGI: RESEARCH TRACKS IN THE DESERT SNOW, one by a former colleague of mine, Marty Sponholz, who wintered over as the first meteorologist at Plateau Station in 1966.

I don't think the book was ever published in either hard-back or paper back, a loss. But at least it is available on line and many of our members, namely Rob Flint, Tom Frostman, Mike Kuhn, Walt Seelig, Phil Smith, Charlie Bentley, Chuck Stearns, and perhaps one or two others creep into the book. Marty wears his heart on his sleeve, and was outspoken, and let the chips fall where they may, even though you may not agree with him. No holds are barred, as he even dissects the shirt worn by one of the chief Antarctic scientists. He seemed to be successful in his scientific career, although at the same time he always seemed to be reaching for something he could not obtain. When push came to shove, he passed up a promising career as a research meteorologist to seek personal satisfaction and happiness while serving the Lord as a secondary school teacher.

Marty was a graduate student in the German-rich University of Wisconsin Meteorology Department, featuring such well known professors as Heinz Lettau and Wemer Schwerdtfeger, under whom Marty studied, and Eberhard Wahl and John Kutzbach. Also on campus was Kirby Hanson who was the meteorologist-in-charge at the South Pole in 1958. Kirby was instrumental in talking Marty into applying for an Antarctic assignment, and Lettau the Elder threw his weight behind Marty's application. This was tantamount to his being on a plane to the ice, as Washington always listened to Lettau. Out of the blue one day, Marty was told by Kirby, "One last thing, comb your hair, and wear a suit!" Besides his two backing professors and Kirby, a senior meteorologist from Washington by the name of Mort Rubin who had wintered over with the Russians at Mirny, and I were there. It was fait accompli and for the rest of us it was more a celebration of finding another red-hot body for the ice. But for Marty, he thought he was being interviewed!

Marty was to be serving two masters, conducting a program in radiometry for my office, the Quartermaster Corps Research and Development Laboratory, and also being the station meteorologist under the United States Weather Bureau. And indirectly, he was also working for our current Society president, John Spiettstoesser, who was an administrator at the Institute of Polar Studies at The Ohio State University. The only way I could get NSF money was to have it laundered through Ohio State, who bought the instrumentation that Marty was to use. Confusing, maybe, but it worked. So I saw Marty several times in conjunction with our program. He was young, looked even younger, was still wet behind the ears, and worried about why his instrumentation was still at our office. I had an ace up my sleeve in Lee Stroschein, who was an expert on instrumentation and recording systems, and he was going to Plateau Station for three consecutive summers!

Marty touches base on another interesting deal involving me. I had hired a red-blooded Mexican mathematician by the name of George de la Borbolla. My original selection was washed out by the head shrinks at the last minute, and George had been recommended by another government agency. But he and the Navy clashed wickedly, and every time the micromet system would get up and running, the Navy would foul up the generators so George would not get any good data. After the season, George demanded a hearing at NSF, and a bunch of us were called to Washington. The head of the Office of Polar Programs was a nice guy, but rather naive, who was in over his head, (Louie Quam), and he innocently came to the meeting and said that he never realized that there ever had been any problems between the Navy and the civilians. Anyway, Marty wrote about this Hearing in his book. In retrospect, I think it may have been the first stepping stone towards civilian contractors replacing Navy as support in the Antarctic.

There are many great sentences in Marty's book. One is a dandy — "I know many of the modern taverns where new scientific ideas were derived." Several things bothered Marty, such as the power struggles going on. He mentioned that Uwe Radok and the University of Melbourne wanted to confiscate his data. Radok, who later worked for a while in the Office of Polar Programs, made a move on me at the end of our first year at Plateau to take over our whole program. After two years involvement, I was not ready for an intruder from the Outback to take over. Marty also felt another power struggle between Washington and the University of Wisconsin. I think any of us who have been on the ice can sympathize with Marty's feelings, as who wants to devote a year of their life to turn over their data to another? This all led up to his deep-rooted feelings about his religion. He wrote "I was stunned at the almost complete lack of interest in religion of any kind by so many of these scientists who now were my friends by virtue of the camaraderie established through frost bite, risk, and survival." We hope you read this book, appearing on the South Polar Times Website in its entirety, as it has a lot of good stuff which you will never find elsewhere, and it is INTERESTING.

A book review by Dr. Paul C. Dalrymple,
The Antarctican Society Newsletter,
April 2003, pp. 4-5.

A PRELUDE
by Robert B. Flint, Jr.

When I was very young, my parents sent me for piano lessons to the organist at our church. While I have never become very proficient at the piano, I generally enjoyed the lessons because of the personality of my teacher, Mr. Paul Terry. He was an energetic, humorous and inspiring white-haired old gentleman, who knew well about how to deal with kids, because he also had the job of shaping a bunch of unruly boys into a boy's choir of which I was later a member. But, like all kids sent for music lessons, there were days when my attention and interest decidedly flagged, and on a couple of these occasions, Mr. Terry would get out the set of photos taken by his son-in-law when the latter was an inspector for the International Whaling Commission aboard a whaling fleet in the seas surrounding Antarctica. These photos of whales, icebergs, and dark seas were my first contact with a part of the world that would later become an important part of my life.

I had not thought of the whaling photos until I was in graduate school at Stanford University, and once again my interest was flagging, this time in the pursuit of a graduate degree in electrical engineering. Then, on a bulletin board in the electrical engineering department, I saw a notice which read, "Wanted: electrical engineers with extensive experience in the design and maintenance of complex electromechanical systems to spend the winter in Antarctica maintaining equipment used in geophysical and geomagnetic research." Having not much experience in *anything*, especially "complex electromechanical systems," but with the brashness of youth, I presented myself to the associate professor of electrical engineering, John Katsufrakis, who was responsible for hiring engineers to run Stanford's geophysical program in Antarctica. I am still not sure what John was thinking when he hired me, but his decision was a pivotal turning point in my life. I was hired along with another engineer, Ron Sefton, to operate the "whistler recorders" and other research equipment at Byrd Station, Antarctica during the austral winter of 1964. Ron had spent the austral winter of 1962 at Byrd Station and was therefore an "Old Antarctic Explorer" (an "OAE" is defined as one who has spent at least one microsecond more than you have in Antarctica). He was also an active radio ham: it was a great comfort to me to have a colleague who was not only experienced in Antarctica, but also knew his way around practical electronics, which I, at that time, did not.

The prospect of being physically cut off from the outside world for nine months was scary, but, in fact, the entire experience turned out to be a very positive one. Byrd Station had been set on the surface of the Antarctic ice sheet during 1958 as part of the International Geophysical Year. However, being set in a windy place, it quickly became buried by drifting snow and was replaced in 1962 with a new station, intentionally buried to minimize drifting. This station was quite spacious: at one time the Navy had planned to install a small nuclear power plant as an energy source; energy efficiency was not a high priority. But more important than physical comfort at a small isolated situation is the station morale. The station military leader was also the station doctor, who had a low key leadership style and an able enlisted crew. All of us on the civilian side got along very well. The result was a harmonious and productive year. Ron and I became good friends and collected mountains of data which contributed to knowledge of the dynamics of the earth's magnetosphere - it's area of magnetic influence.

Upon my return to Stanford in 1965, I was asked to consult, as someone who had wintered in Antarctica, on the design of a proposed small portable research station that was to be built in airtransportable modules. The Navy, which at that time had overall logistic responsibility for the U. S. effort in Antarctica, would contract for the building of the station with the ATCO Company in Calgary, Alberta. The plan was to place the station at a site on the high plateau of the interior of Antarctica, occupy it for a couple of years, then move it to another site. This station would be manned by a total of eight people, including four scientific personnel and four support people and would be known as Plateau Station. And thus I found myself sent to Calgary to discuss this proposed station. (One of my contributions to the design of the station was to request extra-length bunks. I know that several of my shorter colleagues, including the author of the present book, later wished that they could have traded a little of the extra bunk length for more closet space!) When I returned to Stanford from Calgary, my boss John Katsufrakis asked if I would like to be the Stanford engineer at the new station. Somehow, I had never thought of going back to Antarctica, but I guess that, having been involved in its design, I was curious to see how this proposed station was actually going to work. Also, my previous year in Antarctica HAD been rewarding. Thirdly, it seemed a great opportunity to be on the edge of new scientific and geographic exploration. (Finally, I suppose, it was an opportunity to avoid real life for a while longer, and besides which, having wintered at an inland station, I still hadn't seen a penguin!) And so I surprised my parents, friends, and myself by agreeing to spend a second year in Antarctica. My Byrd colleague, Ron Sefton was just then agreeing to go back to Byrd for his third winter.

Thus it was that at the tender age of twenty-five I found myself as Station Scientific Leader at perhaps the most remote outpost in the world. In addition to Marty and myself, there were two others in the scientific complement: Bob Geissel was to collect geomagnetic data for the U. S. Coast and Geodetic Survey, and Hugh Muir was to collect data on the aurora for the Arctic Institute of North America. For support, the Navy assigned a doctor, a mechanic, a radio operator, and a cook. The reader will meet all these people in this book. Reading this book and in looking back at my own life, what most amazes me is with how much we, as very young and naive adults, were *entrusted*. In our hands was not only an extremely expensive small experimental scientific facility, but also a great investment in thought, hopes, and faith of the scientific community who conceived and designed the experiments that we were to carry out, and who would analyze the data that we gathered. Over the years many papers using Plateau Station data have been published, and it always gives me pride to be reminded of our contribution to science.

Meteorological science was one of our chief objectives. Although over the course of our year there, Marty explained much of the research that he was doing, it is not until I read this book that I realized the depth of his own background and what a *qualified* scientist that he is. The scientific community and the country were fortunate in having him pioneer the meteorological program at Plateau Station.

It is impossible to spend the winter in isolation without being personally affected: the fellowship that comes from sharing a great deal of time and the rigors of an extreme climate with a small group of people is like no other fellowship. The year at Plateau was not so harmonious as my previous year at Byrd, nor as a later year I spent with the Russians at Vostok Station. The station doctor was clearly unprepared for the psychological challenges of isolated living. But we managed, and the personal relationships that came from the year at Plateau are among the most important and lasting of my life. Bob's general good humor and contributions to late night bull sessions are among my favorite memories. Hugh shared a lab with me, wrote a paper with me later at Stanford, and he and his wife Hillary have become lifelong friends, though we live on opposite sides of the Atlantic. Marty was my roommate and my counselor, and he and his wife Nancy are likewise lifelong friends. I am delighted that he has undertaken to write this book for his children about our year. It will serve as an inspiration not only to them, but to my own family and, indeed, to all who are given opportunities and are faced with scientific and personal challenges.

The late T.O. Jones, former head of the Department of Polar Programs of the National Science Foundation, used to begin his annual speech to those who would be working in Antarctica during the succeeding season by saying "The Antarctic is a strange mistress..." He was describing the fascination that took so many of us away from family, friends, and the comforts of civilization. Indeed, many of us were drawn time and time again. The seventh continent did and does have a great pull: the exotic climate, the opportunities for discovery, the purity of the air and terrain, the physical beauty of the mountains and sky, the simplicity of life, of politics, the fellowship and comradeship, the physical and intellectual challenges... In this book my good friend Martin P. Sponholz has eloquently elicited the fascination of that "strange mistress."

CHAPTER 1
The Initial Meeting

"You'd better get your ass down here in a hurry, good buddy. Lettau's been lookin' for ya. He's stopped in twice this morning."

That was the big, calm, certain voice of Capt. Robert Fox, an Air Force student on leave to the University of Wisconsin at Madison. He was completing his Masters degree on optical RADAR detection of scattering layers in the atmosphere under the guidance of Prof. Stig A. Rossby. Bob and I shared a graduate research office in what we all affectionately called Bull Hall above a dentist's office next to a flower shop on the corner of Park Street and University Avenue.

For all of my research and teaching years since meeting Bob Fox, I have been grateful for his guidance. In the research world, the most detrimental gift was time. A graduate student was given incredible quantities of time to search out and digest all the available literature on his or her project and then develop a question worthy of being answered. After receiving the degrees, the same life turned into a "publish or perish" world and the same question, "What should be discovered next?" remained, for me, a haunting one. Bob never appeared troubled. With the forward certainty of his military training he suggested putting all of one's problems in a two-pocket folder marked "Problems Already Solved by Time" and "Problems That Will be Solved by Time." It works!

Much time vanished struggling with the foreign languages needed to show that your scientific literature search truly covered the global market place of science. My language nemeses were Russian and French. Endless hours passed with data crunchers, the IBM 1620 and the CDC 1604. One could never master enough mathematics, the chief language of science, or the art of numerically approximating the unsolvable partial differential equations.

I was learning what undergraduate science never teaches, the artistry in science: what should be done with data, what shouldn't be done, what couldn't be done, and finally what could be gotten away with. All was part of beating the data, taken from nature, into submission to our understanding of science. Such strange pressures led some to drink, others to pursue beautiful women, and still others to sing. The spring of 1965 was for me an excellent time for all three. There was Schlitz and Southern Comfort, Rita and Judy and Marie, and the earnest songs of the civil rights marches.

Crashing through the fog of a deep sleep, the persistent ring of the telephone and the concern of a good buddy had aroused me at 11:00 A. M. What could Prof. Lettau want? He was my thesis adviser, and of course the first draft was long overdue. Some delay was not entirely my fault. I was convinced that my project was exceptionally difficult, and I sought exceedingly complex answers requiring the coordination of many people across great distances.

Some of this was true. The project I started with was supported by the National Institute of Health. It sought to understand atmospheric turbulence over a city using wind and temperature data measured from instruments mounted at many levels on a 720 foot television tower, KSTP-TV, on the boundary of Minneapolis and St. Paul in Minnesota. Dr. Raymond J. Deland of Australia began the research, but by this spring of 1965, in the mobile world of academia, he had moved to New York University. Dr. Harlord Paulis and Dr. Alton Hollenbeck of the Department of Public Health of the University of Minnesota were also involved. With the departure of Dr. Deland, my master's work took a year setback. I had greatly appreciated the mathematical insights on global circulation that Dr. Deland had given. I truly missed him.

Now Prof. Heinz H. Lettau, a full professor in both the Department of Civil Engineering and the Department of Meteorology, consented to permit my research to continue under his direction. The prestige, the wisdom, the dedication that Lettau gave his students turned out for me a great gain. Lettau was the world's foremost authority on micrometeorology. He was an initiator and co-director of the Great Plains Turbulence Field Program and co-author of *The Atmosphere's First Mile*. He authored over one hundred scientific contributions written in either German or English. He invented the idea of the stability length-scale in boundary layer dynamics that permitted methods of comparisons and groupings of data of the atmosphere made of many interdependent variables continually changing.

His pioneer work in turbulent transfer, climatonomy, and microscale surface modification gave his students a world-class understanding of the complexities of nature. He showed his students the artistic freedom the scientist had in constructing a mathematical model of nature and insisted on constraints of first principles given generally by nature. I remember Lettau carefully explaining that ten new mathematical models of atmospheric turbulence were generated by scientists every year. Most of them were not worth anything. The mathematical model or the part of it that was worthy of continued study and closest to nature was the algorithm built on the first principles given by nature, such as conservation of energy, turbulent eddies generated from laminar smooth flow and the expected averages and fluctuations from those averages. Methods had to be developed to find the natural varying length-scales within nature as opposed to arbitrary rigid standardized measurements based on human demands.

Why was Lettau so earnestly pursuing me? I knew I was behind submitting the first draft of my Master's thesis. Perhaps he was getting impatient. Maybe he was checking on the utilization of office space by his graduate students, and now I was caught sleeping in. At least this day I had an excuse. I had worked all night from 2:00 A. M. to 6:30 A. M. at the Earth and Space Laboratory Computing Center dividing nearly 300,000 observational items into groups of atmospheric stability and according to anticipated frictional roughness by sectors of wind fetch over the Twin Cities.

I also was guilty of missing a meeting with Lettau on my independent reading study of polar expeditions. Independent reading was a wide open library review on a topic mutually agreed upon by student and faculty adviser. Many times such library searches lead to new research grants for a department and the University of Wisconsin had been a leader in glacial studies since the legendary Prof. Thomas Crowder Chamberlin taught at Madison and established the presence of the Ice Age in the Mississippi River Valley nearly a century ago. It was a natural thing to do - read about Antarctica together with such an expert as Lettau and receive credit besides.

I had delayed setting up such an appointment in an effort to find a book he had not read before I did. I was not very good at independent study; at least I never felt a good grasp of developing a successful literary search of the polar literature. I would outline the works of Nansen and Amundsen, and Lettau would reply, “But did you find an article on Vestspitzbergen or data from the nineteenth century polar years?”


Kirby Hanson

I had always been interested in the exploration of the polar regions and the related contributions to basic research. Many knew Prof. Lettau had just taken an interest in this topic as well. This turned out not to be true for it became obvious that Lettau was interested in polar work a long time but thatgrant money and research opportunities just had not materialized. I believe he had read every book in print and in every language on the subject. I would search out several books, digest them, report to him, and if they were popular or of common interest, he would shrug and say he had read them and ask if I had read anything else. The rare books or those loaded with data he took special interest in, especially if an author had identified a problem or expressed some uncertainty. I know of no one else who was as successful at using other data already in print and worked over by others. Lettau was always capable of seeing new and more interesting results.

I planned to dash straight to campus to try to catch Prof. Lettau before he went to lunch. At least the impression I might leave would not show I wasted all the morning. As I walked out of my apartment door down the hall to jump on my forty-eight Schwinn I was interrupted by a second phone call. I hastened back into the room. Kirby Hanson was on the phone.

Kirby was my idol as a graduate student. Actually he was much more than a mere student. He was on leave from the U. S. Weather Bureau pursuing a graduate degree and coordinating several research projects of joint interest between the University of Wisconsin and the Weather Bureau. He had been on the second team to winterover at the South Pole during the International Geophysical Year (1 July 1957 - 31 December 1958). He pioneered work on temperature inversion and thermal radiation studies at the South Pole. His radiosonde data from the South Pole correlated with other international scientific stations gave an initial picture of the unexpected movement of weather systems across the high ice dome of the Antarctic. Now as both a government scientist and a graduate student, he was involved with initial design work of the first weather satellite.

Kirby married a beautiful woman and had two wonderful children. He still had all the ideals of a young person but his family life seemed to temper dreams and hopes into realistic goals and achievements. There was much I learned from the Hanson family. Viewing him as my “big brother” I had gone to him with my crazy interest that I had in Antarctica since I read as a child a grade school *Weekly Reader* about Admiral Byrd and Operation High Jump of the late nineteen-forties. I never was able to talk to friends or relatives about my serious interest in Antarctica without ridicule. Now, as a graduate student, I was studying the findings of IGY and Kirby was a part of that IGY in 1958.

Not only did Kirby listen to my wild ideas and dreams, he also had given me the address of government people with the National Science Foundation. At Kirby's urging I had applied about six months earlier for a position in the U. S. Antarctic Research Program but nothing affirmative had developed. With my own graduate studies bogged down, I had lost concern over that application as an observer. Things like earning a living, doing useful things for society, or even just providing for oneself did not trouble me. My life on a research fellowship was easy after a childhood in the slums.That there was a life after graduate school had not occurred to me.

Now, on the phone, Kirby informed me that Prof. Lettau, Prof. Schwerdtfeger, and two visitors to the University were planning lunch in the Memorial Union. Kirby relayed that Lettau wanted to invite me to this important lunch meeting but could not find me. Kirby also thought it was important. He could not give me any more details. He would be at the meeting. "One last thing, comb your hair and wear a suit!" Thank you, Kirby. I guess this was no time to be a hippie.

As I showered and shaved, I wondered why Schwerdtfeger was to be at this meeting. My first impressions of Prof. Werner Schwerdtfeger were made in a three credit twelve hour Synoptic Meteorology lab. He was tough and demanding. Two things stood out. The only name from my class that he could remember was that of my good lifelong friend, Donald Panzenhagen. The second was Prof. Schwerdtfeger's absolutely wild excitement while interpreting the processes of weather systems. His English was excellent but with a heavy German accent sprinkled with Spanish.

The student generated rumor mill identified Prof. Schwerdtfeger as a general in the German Luftwaffe during the Second World War. I do know he flew in aircraft a lot during the war and he spoke of collecting correct wind data over the North Sea when the British falsified their weather broadcasts. His wind measuring device often was a machine gun and a stop watch to time the motions of salt spray raised by the bullets. After the war, Prof. Schwerdtfeger served the government of Argentina, and again the rumor mill had this tall colorful teacher in several revolutions in South America. The long hours of laboratory work, weather map analysis, and endless mathematical analysis led us all to understand and appreciate this famous world renowned expert in Southern Hemisphere meteorology.

Being a hemisphere dominated by water, with a polar cap mounted on a plateau high above sea level, the Southern Hemisphere weather was distinctively different from the Northern Hemisphere. Before the routine use of weather satellites that now see all things, I enjoyed his subtle jokes about how much more accurate the theories were in the Southern Hemisphere oceans where observations didn't cloud the imaginative theoretical models. With the University of Wisconsin becoming the best atmospheric physics school in the world, Schwerdtfeger's presence on campus gave us all a global understanding of the weather. I had not had a class with Schwerdtfeger for nearly two years since my undergraduate days. I had no idea why he was involved in this lunch meeting. And more puzzling, why me?

Time was running out! Relearning to tie a tie took more time than expected. Down the elevator in Hasse Towers, a shot along Gorman Street, through a red light at Wisconsin Avenue with a wide skidding turn to slide over to Langdon Street and then mostly down hill needing to slow only a little as the pedestrian traffic clogged the approaches to the Union I raced to lunch with my profs on my trusty Schwinn. Rolling in sweat, dressed in suit and tie, I presented a rather strange view of a scholarly-minded, adventurous graduate student.

Insert: 18 February 1965. "Policy on Viet-Nam adopted today calls for the following: Joint program with GVN of continuing air and naval action against North Viet-Nam whenever and wherever necessary." (Cablegram from State Department to heads of nine United States diplomatic missions in the Far East.) [*The Pentagon Papers* as published by the New York Times, 1971, no copyright is claimed in official Government documents quoted]

Not needing to lock up a forty-eight Schwinn I saved time and arrived at the Memorial Union early to apprehensively pace back and forth in the main lounge. I faked an interest in the art show ondisplay by examining paintings and sculpture without seeing them. Then the mob came. Five men arrived, all together, dressed obviously different from the prevailing dress code of the campus in the sixties. In this Union everything and anything was permissible, from the formal Military Ball to the Anti-military Ball.

As they approached, I could see a distinct difference in the men. The professors had coat and tie, but also chalk-dusted sweaters and coat pockets stuffed with things like pipe, chalk, note cards, thermistors, and whatnot. The two government men also had coat and tie, but no sweater, no bulging pockets, only the look of sharp and slick.

Kirby Hanson introduced me to Morton Rubin and Paul Dalrymple. Immediately after a short exchange of pleasantries the very tall and physical Paul Dalrymple in clipped New England speech asked, "Why are you so short? I don't know any short polar heroes." What could I have said?

I still didn't know what this meeting was all about. I smiled, said nothing, and kept listening. We had a fine dinner in the Rose Room, but I don't remember the food. I do remember some attention paid to me. The two government scientists inquired of my experience in the Weather Bureau.

I was a Trainee and Observer at the Weather Bureau Airport Station in General Billy Mitchell Field in Milwaukee the summer of 1962. My duties included the hourly observations and routine pilot briefings. I also was assigned a research project by Bill Harms to analyze and describe the sea breeze phenomenon over Lake Michigan.

After graduating from the University of Wisconsin with a Bachelor of Science degree, I returned to the U. S. Weather Bureau with the rank of Meteorologist and continued this lake breeze research from the Forecast Center in Chicago, then located on the University of Chicago campus.

It was this experience and the encouragement of the Chief Research Meteorologist, Larry Hughes, that pointed my life in the direction of basic research and back to graduate school.

I enjoyed the exposure to RADAR analysis and the crisis work of following severe weather such as tornadoes and the storm seiche along the Chicago beaches. There was intense and exacting forecast work developing wind trajectories and temperature profiles for long distance aircraft flights out of O'Hare International Airport. My assignments for these international flights usually covered the air space between Chicago and Newfoundland. While at the Forecast Center in Chicago, I also gained experience and understanding of the mesoscale of meteorology formulated by Dr. Fujita. I enjoyed watching the thermal disc tank experiments of Dr. Fultz that gave insights to global wind circulation. Both these researchers were professors with the University of Chicago.

Awed by the struggle endured daily in the discussions, or rather heated debates at the Chicago Forecast Center, I listened and questioned all things as each of the professional forecasters took turns leading the weather analysis for the day. I took my turn with great trembling and quickly learned how much more rapidly a person gained knowledge by experience rather than from school. One grave error still sticks in my mind. While orally developing my picture of the weather for the northeast quarter of the contiguous states from Illinois to New York for one of these debates, I had used the expression "in my opinion." An instant explosion erupted from John Hovde, the District Forecast Supervisor. "I don't give a damn about your opinion! What is going to happen?" He was the roughest on me. He turned me into a very good forecaster.

Hovde correctly taught more than forecasting. Oracles forecast. They have opinions that some times seem correct and many times are wrong. Science sought the created order in nature. Although the atmosphere contains so many variables that lead to false interpretations and many mistakes, thescience of atmospheric physics is an exact science, as exact as any other aspect of physics, and therefore its models and algorithms give predictions, forecasts without opinions. The degree of certainty leads to the blessings of warning, preparedness, and general progress of understanding. The degree of uncertainty leads to mistakes and a lure to research the unknown. That lure, instilled by Hovde and Hughes, is why I was back at school and probably why I was at this lunch.

Mort Rubin inquired of me what my interest was in the Antarctic. "What did micrometeorology or mesometeorology have to do with the Antarctic?" Was it a bated question? How did these men know of my interest in Antarctica? I really didn't have any reason to go to Antarctica other than just to go - a childhood adventurous dream. The awe inspiring account of *Little America* and *Discovery* by Admiral Richard E. Byrd, the saga of *The Home of the Blizzard* by Sir Douglas Mawson, and the tragic account of Sir Robert Falcon Scott would excite anyone to a passionate desire to see Antarctica without reason.

Quick, I told myself, fabricate a reason. Why were Lettau and Schwerdtfeger suddenly silent? Kirby had returned from the South Pole. Why did he go? I remembered the trouble all of us had with stability in the equations generated from Navier Stokes' starting equations for atmospheric flow and raised issues about the many terms that were time dependent. Time and space changes were not independent in most meteorological phenomena. The Antarctic, with its polar twenty-four hour day in summer and twenty-four hour night during winter would be an ideal laboratory to test some of the mathematical systems otherwise not capable of testing without the added complexity of the sun's daily rising and setting. If we could understand some of the simple ideal systems of change in nature, the persistent hope in all of science is then to graduate to more and more complex systems adding new terms to the equations.

Paul Dalrymple asked if I played any physical contact sport? No! He thought so. Did I play any sport? I used to follow the Milwaukee Braves. He had no sympathy for a Milwaukee boy who stole the Braves from Boston and then he laughed that they were on the road to Atlanta. Paul Dalrymple was a baseball fanatic. He spoke of his own contribution to the Cooperstown Baseball Hall of Fame. His picture and an orange painted baseball were in the Hall of Fame for playing the first baseball game at the South Pole. That story started a long session of reminiscence of the polar exploits of these three government men whom I had no idea were so closely bonded. Rubin, Dalrymple, and Hanson all had penguin tie clips and all wore the frost weathered faces of men who had seen -100 ° F. This was amazing! I had confessed to Kirby many months ago that I had this foolish dream and now at the same dinner table with me three men roared in laughter remembering some of their antics while there. I also sat in respect at the perfect silence of the two professors. I joined them with intent listening.

At the completion of dinner we drifted off to regroup in the Rathskeller, a beer tavern of German decor in the basement of the Student Union. I cornered Kirby to inquire of him what was going on? Who were these men? Why were we all together? Mort Rubin was with the U. S. Weather Bureau in the chief administration office serving on frequent international exchanges. He had been a U. S. Observer at the major Soviet Antarctic station, Mirny, and frequently served for our country on the international Scientific Committee on Antarctic Research (SCAR). Originally, twelve Antarctic Treaty signature nations, and now also many other nations acceding to the treaty, carry out the planning of scientific programs of intensive interest and ensure a prompt and accurate exchange of all discoveries at these SCAR meetings. The statesmanship and the high degree of theoretical concern for basic research were very evident in all that Mort Rubin said.

Paul Dalrymple may have been a poker player but not a statesman. He spoke his mind plainly and bluntly. He spent one austral winter at Little America V, the chief support base for the building of Byrd Station by tractor trains. That first year of the IGY Paul established a micrometeorology programat Little America. His instruments provided detailed data on temperature and wind profiles over the Ross Ice Shelf as well as basic net radiation measurements of heat flux between the snow and ice interface.

Normally one winter season is all that one man is permitted at a time, but Paul sent two hamgrams from the Antarctic announcing first to his wife that he was going to stay one more winter at the South Pole and second to inform the Governor of Massachusetts he would be back a year later to cheer the Boston Celtics and pay his taxes. His wife went to Bermuda.

Paul repeated his micromet program at the South Pole and became a firm believer in doing things second, letting the unknown hazards be found by the adventurous and developing a better program of study on the basis of some experience. He was with the second team to winterover at the South Pole along with Kirby. He was now head of the Polar and Mountain Laboratory of the U. S. Army Natick Laboratories in Massachusetts.

The experience of these three men, Dalrymple, Hanson, and Rubin, was inspiring to me as a scientific hopeful. They had gone to the source of the unknown for their studies. Paul Siple, a close friend of these three and author of *90 ° South*, in an account of the construction and survival during the first winterover at the South Pole, described science in the spirit of IGY as using to the fullest the modern technology of global communication and high speed transport and modern designed living comforts in order to bring scientists to the edge of adventure and exploration. To remain in the library and laboratory alone was not enough. These men had remained dedicated to that ideal spirit for all this time since IGY.

Then I learned why I was at their meeting. Kirby informed me they had just finished my interview. I would be invited to listen to their conversation after dinner but for the most part Dalrymple and Rubin were finished with questions of me. Gulp. I suddenly felt unprepared. I had no idea. I probably said all the wrong things. I was just a graduate student. I had no experience. It probably was a good thing that I did not know what was going on, but now it all made sense. Lettau had some new interest in polar studies, particularly in Dalrymple's field programs. Schwerdtfeger was the Southern Hemisphere expert. Kirby had been to the Pole. And I wanted to go.

I could see I would never make it. I simply was too nonathletic. The only games I played in my youth were ball tag with a hockey puck and for show I was good at sharpening a switch blade until some police officer confiscated it. Sometimes, being the runt of the neighborhood, I was compelled to sweep the glass out of the alley for the tough big boys so that they could play buckets against a wall using a wire coat hanger for a basketball hoop.

Accompanied by the consumption of several pitchers of beer, the discussion centered on details of proposed polar work. I meditated intently on every detail, missing a lot due to the rapid pace of the conversation. How can you take notes in a tavern? Through these discussions I learned the United States started an extensive traverse program in Antarctica the past austral summer beginning in November of 1964 exploring between the South Pole and Queen Maud Land. This was the last large unexplored area of the Antarctic continent.

The plan for the traverse was to make a zig zag path maximizing travel distance to enhance exploration of the region. The plan contained the objective that this traverse, crawling over the icecap, over the highest and coldest region of the Antarctic, would reach Princess Ragnhild Coast in four years. At several places along the planned route the traverse vehicles would be cached. The scientists would then be airlifted out of the region at the end of each summer and returned to continue their exploration as early each successive summer as the severe cold weather would permit.

A letter dated 16 October 1964, from Albert P. Crary, Chief Scientist, Office of Antarctic Programs, National Science Foundation, calling for research proposals announced, "A plan is also under study to locate an austere wintering-over station at the terminal point of the second year's traverse, 80 ° South, 25 ° East, from the period January 1966 to February 1968. The objectives will be to take advantage of the unique location for research studies that may be of interest in meteorology, micrometeorology, glaciology and upper atmospheric physics. Work will be possible during the winter of 1966, the summer of 1966-67, the winter of 1967 and the summer of 1967-68."

"The purpose of this letter is to bring this research opportunity to your attention. For your information, the elevation will probably be about 3,500 meters above sea level and it is expected that snow accumulation will be very small. The temperatures should be very much like those at Vostok, where the average is about 5 C° colder than at the South Pole station. The station will be modeled after Eights Station though probably somewhat smaller, with accommodations for four or five scientists."

The super theoreticians, the university men, were full of ideas of what might be done on the high Polar Plateau. However, they both were about ten years from retirement and not interested in learning the problems related with the establishment of a field site in such a hostile environment. The government men had the experience for establishing the station, its supply line and anticipatory knowledge of what to expect at 11,000 feet and -115 ° F. The possibility that I might be one of those scientists to winterover at this extreme camp to gather valuable data began to swell within me.

Lettau and Schwerdtfeger previously submitted suggestions concerning a study of the Great Antarctic Inversion in a letter to the National Science Foundation. It was a letter of suggestions of what might be done, not a proposal. They did not want the logistics responsibility. They might have been over cautious since the University of Wisconsin's Geology and Geophysics Department jointly with the Polar Institute of Ohio State University were already extensively involved with the traverses.

An overview of the Great Antarctic Temperature Inversion was known from work by Kirby Hanson and Paul Dalrymple. First of all, a temperature inversion is a common evening phenomenon, especially during a winter evening, anywhere in the world. The heat radiation cooling of the ground surface sends heat by way of long wave radiation out to space. With not much heat returning to the surface from the moisture, clouds, and air, the net radiation, that heat energy remaining from losses compensated by gains, algebraically adds to a net loss. The ground temperature cools rapidly and the air just above the ground also loses heat and cools but each successive layer above is warmer until the cooling versus warming reaches zero. The resulting temperature inversion is just that, a layer of air where the temperature rises with height above the ground inverse from the normal daytime solar heating pattern.

In the Antarctic on the High Plateau, Lettau and Schwerdtfeger named this layer of air the Great Antarctic Inversion. Kirby and Paul's data showed this inversion over the South Pole to stand some 2000 feet above the snow surface with the temperature at that level to be a warm maximum of -40 ° F and the snow surface measuring a minimum between -80 ° F and -100 ° F.

The Lettau and Schwerdtfeger letter praised the standard radiosonde and RADAR measurement techniques used for normal observation as quite sufficient to arrive at a general picture of the temperature and wind structure over the polar cap at a number of international stations. However, the two professors pointed out several difficulties. The routine aerological radio soundings were launched with large balloons that pass very quickly through the lower layers of the atmosphere. Never seen was the fine structure of the great inversion. The details needed for physical and mathematical analysis were unobtainable in this fashion.

Routine balloon radio soundings were launched every day at twelve hour intervals. That time span "is so large that characteristic temporal variations of the great inversion and their relation to changes in cloudiness, wind shear, and net radiation remain unknown. Almost completely lacking is direct information on the spatial variations of the inversion structure on the Antarctic continent." Such a thorough study of the changing features of the great inversion and its spatial variation and extent over the high Polar Plateau would certainly improve the general understanding of the behavior of inversions everywhere in the world. In the Antarctic all things were also so well defined and the extreme conditions such as the clear sky, the high altitude, the long night, and the isolation from contributing sociological intrusions would enhance observation of the complicated features not visible to mankind before.

Other features such as mirages, the propagation of sound, light, and other electromagnetic disturbances remained somewhat unexplained in detail and this type of study would have potential toward such an understanding. I remember from Lettau's micrometeorology class stories of World War II accounts that explosions were heard from the war front many miles away causing terror in towns when the fearful immediacy of military action was not so eminent and actually far away. A person standing in a barnyard on cold nights often can hear sounds clearer from farther away. A temperature inversion very definitely is related to this phenomenon.

Lettau and Schwerdtfeger proposed specialized radiosondes monitoring temperature and humidity with fast revolving, mechanical microbarographs and attached Soumi-Kuhn net-radiometers. Special slow rising balloons would carry the instrument package aloft at a rate not to exceed one hundred metres per minute. The normal lift velocities of such balloons were between 350 and 1000 metres per minute. The desire was to keep the inversion monitoring system within the inversion as long as forty minutes before reaching the altitude of 3000 metres. Daily routine observations were to be eliminated in favor of successive serial ascents on specially picked days. The chief meteorologists in the field would be expected to understand the theory thoroughly and know what they were looking for.

"Sound wave recordings of explosions 'ad hoc' released at the surface and at adequately chosen heights" were proposed as an original method of obtaining more information about the structure of the great inversion. A pilot study of the great inversion at South Pole using routine data already in possession at the Department of Meteorology at Wisconsin was suggested. They also suggested that the design and preliminary testing of a radiosonde system to be used could be done at the University. Finally Lettau and Schwerdtfeger wrote, "Needless to say that the two undersigned are willing, and anxious, to take charge of the evaluation and further elaboration of the results of the special inversion soundings, if and when an observational program of the proposed kind becomes reality."

Hard decisions followed. RADAR was out. The small station planned for the terminus point of the second year of the Queen Maud Land traverse could not count on the power necessary to operatea sensitive RADAR unit. An additional building also would be required. Heat to outlying buildings was not possible. The need for a separate heating plant and additional oil supplies all contributed to the cancellation of RADAR. That was a major loss before a scientist even went into the field. The sounding system for the inversion study had to keep the aneroid barometer as a check for the height of the balloon and provide necessary data for the triangulation of balloon movement needed for the determination of the wind's speed and direction. An immediate theoretical conflict emerged from these constraints. In an inversion the interrelationships of pressure, temperature, and density of air were to be studied, not used to determine other parameters.

An old fashioned manual system of triangulation suddenly looked pretty effective and independent. Two theodolites manned by the two meteorologists proposed for this assignment could do the task while leaving all other observations for automatic recorders. Each scientist would measure elevation (the angle from the horizon up to the balloon package) and azimuth (the horizontal angle swept clockwise from a preestablished base line to the position of the radiosonde) every thirty seconds. These data with needed trigonometric calculations could give independent heights and distances, the spatial positions, of the balloon carrying the instruments floating in the moving air. The change in the spatial position would yield the wind speed and direction.

All three polar-experienced men expressed concern for both the instruments' abilities to function in the anticipated air temperature of -100 ° F and possibly even colder as well as the ability of the human observers to remain unfrozen long enough to obtain the necessary data. Each balloon flight was expected to last thirty to forty minutes. Preliminary work before a balloon watch was also required. The expected rapid repeat of all outdoor work with little or no warmup time demanded by the study that required serial launches spelled too much frostbite for the men and thermal fatigue of metal parts of the instruments. Metal would become brittle and break like glass at the expected temperatures. Paul Dalrymple, a pioneer of wind chill studies for the U. S. Army, rattled off a considerable number of devastating facts with regard to the exposure of humans and their uncontrollable severe heat losses. Perhaps observation shelters could be developed permitting the observer to remain in warm comfort or at least remain out of the wind. Mort Rubin would look into it.

The base line between the two theodolites should be as far apart as possible. If the balloons were tracked for 3000 metres (nearly 10,000 feet), a base line of nearly two miles was desirable. That distance was too far away to walk back and forth in the severe cold. The greatest fear was for the loss of direction or personal orientation should a sudden change of wind occur and cause visibility in the polar night to suddenly reduce even in the slightest because of ice crystals or snow in the air. The greatest loss of life in the polar regions had occurred when a person lost his way, even a short distance from the door of the main camp building, and froze to death. Kirby, Paul, and Mort, all with polar experience, encouraged the shortest possible distance between theodolites.

Objection! This idea was striking at the very heart of the great inversion experiment. The most exciting and valuable discoveries were anticipated from the wind data. How the wind changed its speed and direction with respect to height and correlated with the temperature at each exact measured altitude demanded a base line of maximum length. The wind displayed the mechanical exchanges of energy with the snow surface. The wind showed the movement of sensible heat across the Polar Plateau. The wind moved the moisture, the ice crystals, the snow. The wind had to be measured as accurately as possible. Without a proper baseline, the University professors pleaded, the study would not be able to formulate worthwhile theory and never would be able to confront old misleading theories.

Paul Dalrymple spoke of his plans to place a one hundred foot micromet tower that would give the detailed temperature and wind structure to that height. He desired to be the chief meteorologist on the first year of this expedition for the balloon project and remain to establish the tower. All men here believed the Great Antarctic Inversion was considerably higher than Dalrymple's proposed tower. He strongly lobbied for the longest base line possible but not at the expense of the observers.

Struggling to preserve the longest possible base line, Prof. Lettau suggested a small hut with its own heating system such as Admiral Byrd used at Advanced Base on his 1934 expedition. Such an isolated hut could be maintained by one scientist. By living at a mile or more distance, communication could easily be maintained. During good weather, isolation could be broken with visits back to the main camp. I thought to myself, "I can do that." Dalrymple stared at me as if he read my youthful enthusiasm and abruptly interrupted, "Byrd almost died!"

This was the method of science, an endless struggle between the artistic brush strokes of theoretical science, the ideal sought, and the limiting frame, the reality that accepts what cannot be done. In the Second Byrd Antarctic Expedition (1933-1935) this same tension was most prevalent. In its day it was the most elaborate technologically equipped expedition with the highest scientific goals. It was the first expedition to adopt seismic soundings as a method for a large scale systematic mapping of the sub-ice topography. Special techniques maintained sensitive, delicate, complicated instruments that elevated the entire observational scope for all time in the Antarctic. Tracked vehicles, used for the first time, enabled research teams to extend the field of their studies and probe in more remote areas than ever before. Aerial reconnaissance established the boundaries of the Ross Ice Shelf and confirmed that the Ross Sea and Weddell Sea were not connected.

On this Second Byrd Expedition meteorology received major attention. The desire to establish an inland substation, Advanced Base, at the foot of the Queen Maud Mountains some four hundred miles south of Little America II was vital to meteorological research. However, the hardships of establishing Little America II, the struggle of Misery Trail, the severe weather, and frequent equipment failures caused delays and put the entire plan for a substation inland in jeopardy. With it the hopes and dreams of all meteorologists were also jeopardized. A station that distance away would have given significant pressure differences to establish cyclonic and anticyclonic activity as it developed while it slid down or scaled the icecap. Polar dominance of global weather was believed starting with the establishment of the Polar Front theory by the original Norwegian theorists, Vilhelm Bjerknes, Jacob Bjerknes, and Halvor Solberg.

Events forced Admiral Byrd to settle for the Advanced Base only one hundred twenty miles from Little America. This little station could only support one man. Byrd chose himself for the arduous task in isolation and solitary confinement. He wintered alone from March until mid August. A life supporting heater produced excess carbon monoxide gas under poor ventilation and the vital radio needed to correlate meteorological changes between Advanced Base and Little America added to the carbon monoxide poisoning. The meteorological task he bravely set out to achieve by bearing all physical and psychological hardship for the sake of science nearly killed him.

A compromise over the base line for the Great Antarctic Inversion study set the distance at one thousand feet. At all stations one hut was always set aside as emergency quarters with a year's supply of food and fuel, it's own electrical and heat generator and room for all party members, albeit cramped. The fear always was the loss of the main camp to fire. At one hundred below zero flexible fire hoses and liquid water supplies would be inadequate to fight a fire. Now proposed was such an emergency camp built one thousand feet from the main camp. It would house the needed observational dome for the second theodolite. A small electric heating system would operate through an electric cable from the main camp. Such a cable would also carry needed communication between the camps. The electric heating system would be independent of the emergency heating system. That would preserve that system as well as save fuel. Heavy liquid diesel fuel was relatively easy to bring via a ship with an icebreaker escort to McMurdo Base, but to airlift absolutely every item including that fuel and every weather balloon from McMurdo to the high Antarctic Plateau was incredibly costly.

I sat in awe listening to the give and take between the ideal and the real. In a sense, everything about the Antarctic was ideal. No immediate urgent national need demanded a presence in the Antarctic and for the Archie Bunkers, the Great Antarctic Inversion had a low priority. Such is the work of basic research. Industry rarely touches it. Little of it is practical. The discoverers rarely see the practical use of their own work. The inventors of the cathode ray tube searching for the connection between electricity and light had no knowledge that their invention gave the economical fluorescent light. The men who bent that cathode ray in a magnetic field discovered the mass of the electron, and later used it to measure the mass of many atomic particles, but they never dreamed that their invention would be in everyone's home as a television set.

The cost of these proposed projects? I learned much later the price tag to the U. S. Navy was $200,000.00 per man to keep him alive for one year at Plateau Station. What is the reason for such basic research? Was it worth it? A little of the reason comes out in admiral Byrd's book *Alone*. Byrd wrote: "I am finding that life has become largely a life of the mind. Unhurried reflection is a sort of companion. Yes, solitude is greater than I anticipated. My sense of values is changing, and many things which before were in solution in my mind now seem to be crystallizing. I am better able to tell what in the world is wheat for me and what is chaff. . . . my views about man and his place in the cosmic sphere have begun to run something like this:"

"If I had never seen a watch and should see one for the first time, I should be sure its hands were moving according to some plan and not at random. Nor does it seem any more reasonable for me to conceive that the precision and order of the universe is the product of blind chance. This whole concept is summed up in the word harmony. For those who seek it, there is inexhaustible evidence of an all-pervading intelligence." (Richard E. Byrd, *Alone*, Ace Books, Inc., New York, 1938, p.108) And a hymn he played over and over again as a favorite during his isolation was, "Oh Holy Night, the stars are brightly shinning. Tis the night of our dear Savior's birth." (Byrd, *Alone*, p. 139) The reality of risk with the lure of polar research gripped me. Basic research had its value. But things of value came with a price. In paying that price I would grow as a human being. I would also grow as a child of my Lord, for He already paid the ultimate price.

Even with the proper caution, a great risk to human life was real. Real limitations did indeed curtail some of the hopes of Lettau and Schwerdtfeger. Still everyone was enthusiastic for this basic research project. Lettau and Schwerdtfeger hoped for the best available data on temperature inversions this earth could provide. Dalrymple, Rubin and Hanson gave all the practical advice experience could provide to achieve the best possible results safely. Dalrymple and I truly were excited to go get it. Paul's was an enthusiasm tempered with experience and knowledge. Mine was young and foolish. I had already learned in this initial meeting more about science than in any single science class. I also learned that every note taken in the classroom and every idea remembered would be invaluable.

Mort Rubin turned the discussion to inter station communication problems. Part of the Lettau-Schwerdtfeger Proposal called for a continual analysis of weather systems moving into, across, or out of the Antarctic continent. The rates of movement of these weather systems were to be plotted and communicated to the scientists at the new station to provide advisory information to assist them with their serial balloon launchings. Such inter station coordination was anticipated to be difficult.

Such specialized analysis of continental weather was not done except to provide the militarywith weather advisories for their supply operations during the summer months. It could be done but many of the stations were established by foreign nations and language would be a barrier. The Great Antarctic Inversion study would go into the field the very next austral summer. The temporary station on the high plateau would be in existence for only two years. Coordination would be difficult to organize in such a short time.

Men at the National Science Foundation didn't believe spatial variation of a microscale phenomenon such as an inversion would be important. The region was too near the geomagnetic pole, the position where the earth's magnetic field lines enter the earth's surface. Near the planned position of the new station, auroral phenomena were very active and interfered strongly with communications rendering them uncertain for the desired immediate data exchange. Scientific news releases would be given to all foreign governments active in Antarctica and perhaps on site extemporaneous exchanges might develop.

The position of the station became an issue. The terminal position of the second year of the Queen Maud Land traverse was not exactly fixed. Schwerdtfeger felt that a perfect laboratory condition for the Great Inversion Study would exist by placing the station on the ridge line of the High Plateau. With the station right on the ridge, which in this case is flat, down sloping cold heavy drainage winds would not be present to affect the study examining the development of the temperature inversion.

Cold drainage winds, called katabatic winds, cascaded down the slippery slopes of icecaps like Greenland or Antarctica. The strong katabatic winds of Antarctica received world wide attention through the famous writing of Douglas Mawson from Australia titled *Home of the Blizzard*.

For the Australian Antarctic Expedition, 1911-1914, Sir Douglas Mawson established a station at Cape Denison on the coast of Adelie Land. It was there, during the months of May and June, frequent hurricane force winds in excess of eighty miles per hour blew steadily. Sometimes these winds blew for several days at a time, always down the slope from the inland High Plateau and seemingly not related to cyclonic activity from the sea. In his book Mawson showed several pictures of men leaning into the steady wind at angles more than forty-five degrees turned down from the vertical with their feet riveted into wind driven snow polished surface ice by Swedish crampons with inch and a half teeth. These winds began suddenly and ended as suddenly as they began.

The textbook explanation of these katabatic winds originated with H. H. Hobbs and was part of anticyclonic circulation formations over polar icecaps. Warm air rose from the surrounding ocean waters. Then it moved upward and inward aloft over the polar cap, became cool, and sunk in the central region of the icecap. For Greenland and Antarctica that region is their respective glacier high plateau. Then this heavy cold sinking air surged outward and accelerated down the icy slopes and reached hurricane force as Mawson observed at Cape Denison. Similar recordings were made at other coastal stations since the Australian Expedition in 1911.

These outbursts of cold air in the Northern Hemisphere were believed to be the trigger that set off the main frontal cyclones of the Atlantic. This theory spawned the interest of meteorologists in the polar regions. Their belief followed reasoning like this: if one can understand polar weather, then weather everywhere might be predictable. The katabatic out flowing winds, based only on coastal observations, became the model for low level wind flow over all polar icecaps.

Prof. Lettau pointed out that although katabatic winds were a dominant feature along the Antarctic coast where ice slopes were steep, his own study recently presented for publication using some of the data collected by Dalrymple at South Pole Station in 1958 showed a wind flow not as simple as that presented by Hobbs. Katabatic winds were not so all dominating on the entire continent. He identified light katabatic winds existing only in the lowest twenty feet above the snow surface. These winds were directed down slope, steady, stronger than the prevailing winds, but shortlived. Larger scale weather systems easily disturbed these katabatic winds. In the interior of the Antarctic, these winds were weak due to the nearly level but slightly sloped ice dome at the South Pole. According to Lettau's findings, katabatic winds could not account for the general low level wind circulation over the polar ice dome. (Heinz H. Lettau, A Case Study of Katabatic Flow on the South Polar Plateau, pages 1-11 in Volume 9 of *Antarctic Research Series, Studies in Antarctic Meteorology*, Morton J. Rubin, Editor, American Geophysical Union, 1966)

Continuing the discussion in the Rathskeller, interrupted only when a pitcher of beer became empty, Lettau pointed to the contradictions within the Hobbs-katabatic theory for large scale polar air circulation. Sinking air is usually representative of anticyclonic circulation. Anticyclonic flow, the common wind pattern for a high pressure region, inhibited cloud formation and prevented precipitation from occurring. Also strong out flowing katabatic winds would transport surface snow away from the center of the ice dome and outward to melt in the sea. Together, the sinking air and the out flowing air would reduce the polar cap. The Hobbs-katabatic wind theory, accepted as a rule of law in the Compendium of Meteorology and likewise expressed as a law in almost every textbook of weather and geography, simply could not exist as a climatological feature for an icecap with the stability and longevity of either Greenland or Antarctica.

Other results, also generated from Dalrymple's micrometeorology data and taken at Amundsen-Scott Station, hinted at a new approach. Lettau spoke of thermal winds formed by the extremely stable and stratified inversion layer. The inversion phenomenon was widespread over the icecap. These thermal winds, caused by a horizontal temperature gradient, would alter the ambient or normal wind established by the pressure gradient and the earth's spin. Lettau and Schwerdtfeger expected that the wind speed and direction near the snow surface would be forced to turn around the ice dome according to the thermal wind hypothesis. These turning thermal winds of the inversion predicted only a minimum loss of snow and greatly increased the longevity of the icecap when compared with the Hobbs-katabatic simple down sloping and outward winds.

Schwerdtfeger further explained that this inversion wind, if it existed, would be locked to the slope and shape of the ice dome. These winds would create a low level anticyclonic circulation over the ice dome. As a cold core shallow high pressure region, the inversion winds would also establish a cyclonic circulation pattern aloft. A circumpolar cyclonic wind pattern aloft would enhance precipitation, continually adding to the polar cap.

This aspect of the Great Antarctica Temperature Inversion was revolutionary and Mort Rubin, with emotional excitement, recognized its value as a solution to many unsolved problems. On a global scale, it always was a mystery why, with the earth's strong green house heating, there still were the two major icecaps of Greenland and Antarctica.

This phenomenon, in the minds of Lettau and Schwerdtfeger, may have escaped detection because of current data analysis techniques. Instruments were designed to measure expected phenomena and no one ever looked for these inversion winds before. Balloons carried their instruments through the inversion so fast that details needed to identify the proposed wind effects were not visible even if looked for.

This grand finale of theoretical interpretation gave high purpose to future polar exploration at the proposed austere isolated small station in the center of the unexplored High Plateau of

Antarctica. Our meeting adjourned with Dalrymple saying to me: “You still want to go South? You’re too little.” I suggested my small surface area was easier to keep in thermal equilibrium. I bicycled back to my apartment at Hasse Towers with my head swimming over the awesome project planned for the deep south, over even the remotest possibility that I might personally be involved, and over too much beer!

CHAPTER 2
Application Forms

As a child I was infatuated with Antarctica but at the same time ridiculed when I suggested that, in fact, I desired to go there as an explorer. The children's newspaper, the *Weekly Reader*, followed the adventures of Admiral Richard E. Byrd as leader of the United States exploration of Antarctica in 1946 and 1947. I certainly did not recognize the scope of the exploration work when I was a child. Operation High Jump was sponsored by the United States Navy, involved 4000 men, and used thirteen ships in addition to two icebreakers, an aircraft carrier, two seaplane tenders, and a submarine. Six Navy R4D planes, four helicopters, and three light aircraft performed nearly continuously during the twenty-four hour sunlit summer days with exhaustive precision permitting the entire coast of the Antarctic to be mapped in a two year span of time. Much of the coast at that time had never been seen. Scientific objectives included many meteorological studies and gave for the first time weather maps of the entire south polar region.

Insert: 27 February 1946. "Ho Chi Minh handed me 2 letters addressed to President of USA, China, Russia, and Britain identical copies of which were stated to have been forwarded to other governments named. In 2 letters to Ho Chi Minh request USA as one of United Nations to support idea of Annamese independence according to Philippines example, to examine the case of the Annamese, and to take steps necessary to maintenance of world peace which is being endangered by French efforts to reconquer Indochina." (Cablegram from Landon, American diplomat in Hanoi, to U. S. State Department, Washington D.C.)

The black and white pictures in the *Weekly Reader* nonetheless captured my interest in adventure and exploration as it would for any child. Ice breakers smashed up against large amounts of snow. A huge wolf fur ruff of a parka surrounded Admiral Byrd's head, and although most children tried to avoid wearing mittens, the huge "bear claw" mittens connected to straps around Admiral Byrd's head were somehow different.

While most children left ideas of adventure and exploration behind along with other childhood tales, I never let go of my imaginative views of the Antarctic. In my third and fourth grade, Operation Windmill by the United States Navy continued aerial photography concentrating on newly discovered mountain ranges and coastlines. Adding to the grade school publications and science books, the "Green Sheet" of the *Milwaukee Journal* carried frequent articles on the Antarctic exploration. I discovered the travel section of the Sunday paper. And when Miss Dorothy Wolf suggested to my guardian, Tanna, that I might not be promoted to the fourth grade because of reading and missing too much school because of colds and fevers, my grandfather presented me with a library card that led me to many books about the Antarctic. Ernst Shackleton, James Ross, Robert Falcon Scott, Fridtjof Nansen (an Arctic diversion), Roald Amundsen, Hubert

Wilkins, Douglas Mawson, Lincoln Ellsworth, and Finn Ronne wrote to me directly in library books whetting my appetite for adventure, showing me the value of reading, and helping me pass fourth grade.

I turned every hill that I climbed into a major glacier traverse. Visits to my Uncle Edgar's farm near Ixonia, Wisconsin, were great in winter. The chance of being snowbound was real, just as if I was on Shackleton's ship and was locked in the ice. My cousin Dan Hahm and I every spring would try to march out to the Rock River, failing most times because of the flooded marsh and thin ice that interrupted our path. These walks always were imagined as man-hauling treks to the unobtainable pole. The pain of cold and wet became marks of endurance and survival. I loved it.

In the interim between Operation Windmill and IGY, American interests in Antarctica seemed nil. Antarctic news faded to only an occasional article on the pie shaped claims other nations had in Antarctica. My imagination ran wild inventing wars in the polar south. Two close friends and I divided the world and went to war for our respective countries. Paul Zedler, now a professor of botany at the University of Missouri, was the despot ruling the entire earth from an artificial island called Voltz. Leon Todd, now in the computer business in Milwaukee, held out in a nation called Boards that was mostly Borneo with all the waterways in Indonesia built over with wooden floors. I, of course, controlled Antarctica. The amount of time we spent drawing maps of cities in Antarctica, Boards, and Voltz connecting all land masses with international floating highways, moving large populations to resettle in cube cities in both polar regions, and conducting wars by mirror satellites, cannot be measured. Today I do not believe it was a waste. Paul and Leon and I demanded of each other correct maps, realistic data, and reasonable explanations to our imaginative inventions. I apologize to Mr. Vater, our seventh and eighth grade teacher, who had to endure our imaginative enthusiasm which spilled over into geography, history, and science classes. For one particular assignment, to draw a spring bird, Leon was drawing a dodo bird (but handed in a robin), Paul drew a vulture picking on a skeleton, and I handed in a penguin. I remember arguing at length with Mr. Vater, who knew we were smarting off, that Adelie penguins, as robins, laid their eggs in spring, albeit an austral spring. Always Antarctica was a real place for me to go someday.

I graduated to *Current Events*, the newspaper for the upper grades, and by my eighth grade, preparations for the International Geophysical Year erupted in the news. Before this became news worthy, James A. Van Allen, a scientist for the federal government in Washington D. C., invited several of his scientific friends and colleagues to his suburban home in Silver Spring, Maryland, in 1950. Dr. Lloyd Berkner of the U. S. National Academy of Science proposed to Van Allen's friends that a third international polar year should be launched that involved sharing all new polar discoveries with all participating nations. The idea of sharing polar knowledge at a time when the cold war between the U. S. A. and the U. S. S. R. was preparing for possible nuclear exchanges over the North Pole was more than bold. Little interest existed for such exchanges, but the idea of simultaneously studying rapid changes on the sun and the earth with emphasis on the unexplored south polar region aroused the interest of all men present.

In quiet conference rooms all over the world this idea expanded into the full working IGY for 1 July 1957 to 31 December 1958. In 1955 Laurence M. Gould, chief scientist on several Byrd expeditions and then President of Carthage College in Minnesota, was appointed by President Eisenhower as Head of the U. S. Antarctic IGY Committee. Weather observations were a major item for scientific research exchange and provided immediate data for all logistics operations of all nations involved in the Antarctic for IGY. Harry Wexler, an enthusiastic idea man who always was assigned to special research projects of the U. S. Weather Bureau, became the Chief Scientist for U. S. Antarctic Programs. He in turn chose Albert Crary, from the Air Force Cambridge Research Center, as his Deputy Chief Scientist for Antarctic Programs. Crary represented geophysical and geological interests which also could readily be exchanged. All operations were handled by the United States Navy with Admiral Dufek commanding Deep Freeze I Expedition for Task Force 43 during the austral summer of 1955-56.

Exploits of Deep Freeze I filled the science sections of the *Milwaukee Journal* and the *National Geographic Magazine*, which I read without skipping a word. All this activity in a previously quiet region of the globe raised all kinds of political questions for nations that held overlapping claims to territory of Antarctica. A few years earlier, in 1952, at Hope Bay, at the northernmost tip of the Palmer peninsula, Argentina attempted to prevent the reconstruction of a British base by not permitting the supplies to be taken off the British ship, *John Biscoe*, and repulsed the landing party with machine gun fire. Under the direction of the Governor of the British Falkland Island Dependency, the British returned with the *HMS Burghead Bay* and landed battle-dressed marines, drove the Argentines out, and provided naval protection for the reconstruction of the British base. The threat of spilling blood on the white snows of Antarctica over territorial claims during new explorations was a real fear.

Insert: 7 July 1954. “Thus since undoubtedly true that elections might eventually mean unification Vietnam under Ho Chi Minh this makes it all more important they should be only held as long after cease-fire agreement as possible and in conditions free from intimidation to give democratic elements best chance.” (Cable-gram by Secretary Dulles to United States Embassy in Paris.)

Any hope for international scientific studies depended on the success of the Antarctic Treaty called for by President Eisenhower that asked for a suspension of all national claims to Antarctic territories for thirty years, arranged for the exchange of all scientific findings in the Antarctic, and permitted free inspections of all stations established in the Antarctic. Eisenhower proposed such free inspections in disarmament attempts between the NATO alliance and communist countries during his presidency but always without acceptance. The signing of the Antarctic Treaty was an unprecedented success in international relations during the Cold War.

Deep Freeze I surveyed the Antarctic for potential placements of American stations for IGY. Deep Freeze II supported the first year of IGY and established those stations. Albert Crary established Byrd Station by overland (really over snow) tractor trains from Little America V. Morton Rubin was the head meteorologist for the Weather Center of Antarctica. Paul Dalrymple established a research project at Little America. Paul Siple was the Scientific Leader at the building of Amundsen-Scott Station exactly at the South Pole and stayed the full year over the cold dark six month winter. A meteorologist at Amundsen-Scott Station was Ed Flowers that first winterover year. The next year, Deep Freeze III, the second year of operations at Amundsen-Scott Station, Paul Dalrymple moved in and joined Kirby Hanson. These names were all part of the story I read, digested, and nearly memorized instead of doing homework when I was in high school and read *90 º South* by Paul Siple and *Operation Deep Freeze* by George Dufek. For me in college, in the Rathskeller that day that I was being interviewed for Antarctic service, these names, idols in my mind, became personified behind pitchers of beer.

Kirby Hanson had encouraged me to apply for a position in the Antarctic. My master's thesis was nearly complete. It was time to pursue a career. At Kirby's suggestion I wrote the personnel office of the Weather Bureau. I was still on their roster since I was on a leave of absence to pursue graduate work. I wrote to ask for an assignment in the Weather Bureau after graduation in June and then also indicated my interest in Antarctica. In the mail shortly before Christmas of 1964, I received a booklet titled "ASSIGNMENT: ANTARCTICA." My excitement could not be described. However, reading it scared me as well as gave me all sorts of reasons why most of my hecklers were probably right. I was not cut out for exploration.

"Any male citizen of the United States, who is 20 to 45 years old and in perfect physical health, may apply for a position in the Weather Bureau's Antarctic research program by writing to Chief, Personnel Management Division, U. S. Weather Bureau, Washington 25, D. C."

"It should be appreciated that applicants must be carefully selected on the basis of high technical skill. The program is conducted on a highly efficient level which can only be maintained by personnel whose professional ability is proven by experience."

"Polar assignments can justly be rated among the toughest government positions anywhere in the world today. Hardships are inevitable. According to a report made by a U. S. Navy doctor, the main difficulties stem from the monotony of life in Antarctica and continuous association with the same small group of men. Tolerance, cooperation and good sportsmanship become of extraordinary significance when the winter darkness sets in. Most of the dangerous pioneering of years gone by has been done away with through the use of radio, aircraft and other mechanical devices, but isolation, darkness, low temperatures bring out the best or the worst in a man's character. Once having embarked on this project no one should expect to change his mind and go home. A tremendous amount of money is spent on each individual for medical examinations, transportation and training and orientation. A cost of over $100,000.00 per person per year has been estimated." [The cost per man for Plateau Station, my eventual assignment, was more than double this amount.]

"An applicant should have an adventurous spirit which makes this undertaking of first importance to him personally and have a real desire to accomplish his duties and accept hardships and inconveniences with equanimity and in good spirits. He should be willing to work hard over long hours and be ready to give a hand in any work other than that which may be specifically assigned to him as his day-to-day job, including hard physical labor and K. P. The ability to work hard, to cooperate enthusiastically in the work of the station, and to keep on for a long period of time without relief, is essential to success of the program. Observations are made on an around-the-clock basis, therefore, hours of duty will vary in order to cover 24 hours."

"It is recognized that in many instances applicants may not have experience in a particular program planned for these Antarctic stations. For this reason an intensive training program designed to satisfy the needs of each individual is made available prior to departure for the Antarctic. Each individual will have the opportunity of discussing with specialists and previous participants in Antarctic programs the problems, procedures, techniques and theories applicable to each phase of the program to which he may be assigned. They will also have the opportunity of discussing related, but not planned, research aspects of the programs. Meteorologists will be encouraged to initiate projects in varied program areas."

"In addition to the regular per annum salaries, an allowance approximating $2800 will be paid for Antarctic assignment. Quarters, travel, subsistence and polar clothing are furnished free of charge."

The demand for experience and high professional ability sent shivers up and down my spine. Could I fit that requirement at all? My grade point averages in meteorology, physics, and mathematics were very high. I had finished a traineeship with the U. S. Weather Bureau in Milwaukee. I had an appointment as Meteorologist, GS-7, at the District Forecast Center in Chicago. I was in the process of finishing a two year analysis of the air flow over the Twin Cities in Minnesota where I was responsible for maintaining the data gathering system Dr. Deland and I mounted on KSTP-TV tower. Yet I never could get over the feelings of inadequacy, failure, and timidity. Someone else was stronger, wiser, and had more experience. Never me.

Advice from Bill Harms, Meteorologist in Charge at the Milwaukee Airport Station, comes to mind. Several years before my application for the Antarctic Bill Harms recommended me for my first professional position as a meteorologist in Chicago. I had just completed a Traineeship under him. In his den at his home, at a farewell so to speak, Bill, out of the blue with his back toward me said, "You think you're a damned Christian don't you."

As he whirled around to see my reaction he further explained that I had performed as an observer, as a pilot briefer, and as a forecaster at an outstanding level. He further told me that if I would accept the position he was recommending me for, at Chicago, I would be leaping fifteen years ahead in my professional career. I had one problem as he saw it. My gifts were so plenteous and I was ignoring them. He blamed it on my religious training, which he had also. Bill Harms was a member of the Missouri Lutheran Synod and I was a member of the Wisconsin Lutheran Synod. He knew the doctrines well. So much of Lutheran education stresses that we are all sinners worthy of eternal damnation and even though our Lord Jesus Christ has freed us and given us eternal life in Heaven, all the rules and all the training in school aimed at obedience and our own inadequacy.

Bill said I needed to recognize when my Lord had given me so much talent and I had refused to recognize it, or some teachers had not shown me the wondrous talents that I did have, how could I expect others to believe in my abilities, especially when they will really needed to, if I didn't. Unless I started acting as the redeemed child with many gifts that I really had, I would have failed His Church both inside and outside. Wow!

Bill was right. No teacher had ever told me I had gifts. I needed to know that I had an outstanding comprehension of the weather systems and was a very effective observer and forecaster. I had to believe that my Lord had given that talent to me through more than six years of university training. I had to convey to pilots my own confidence or else their need of my skills during times of emergency would be of no value.

I had studied hard. I knew my subject. I digested nearly everything possible about the Antarctic. Though never an athlete, I enjoyed things of endurance requirements such as canoeing, hiking, biking, and climbing. Were these not the stuff of Mawson, Byrd, and Amundsen? I wanted to go. I had the skills my government asked for. I would be accepted. I mailed in my application, still listening to my Christian teachers who said "unworthy" so often and remained unsure of my abilities. Harms understood.

Unknown known to me, that application went to the office of Overseas Operations Division of the U. S. Weather Bureau. The Polar Specialist was Charlie Roberts, a veteran of many expeditions to the Antarctic. Under the direction of Vaughn Rockney and Glenn Dyer, Overseas Operations (OOps) trained and sent to the Antarctic between eighteen and twenty-five meteorologists to four stations, Amundsen-Scott South Pole Station, Byrd Station, Eights Station, and Hallet Station. They also sent a similar staff to the Arctic. Many men working for OOps chose to be "polar rats" serving in the Arctic, returning to civilization at the end of the Arctic summer, wildly spending their high wages, and signing up for Antarctica at the start of the austral summer. Most of their work served the World Weather Watch that provided all nations with a global view requiring twenty-four hour data in the very remote polar regions. Acquiring precise quality standard data took dedication and sacrifice on the part of the men serving. I was most willing to be part of that routine.

Also unknown to me, Kirby Hanson had sent word of my interest to Paul Dalrymple of the Polar and Mountain Research Labs in Natick, Massachusetts, and to Bill Weyant, Head of the Polar Meteorology Branch of the Atmospheric Analysis Lab of the Office of Meteorological Research (OMR). As mentioned in chapter one, an opportunity for pure research was opening up at the planned terminus point of the overland traverse operation in East Antarctica on the High Plateau. Plans for the new station, Plateau Station, were already being drawn out in detail in the offices of the National Science Foundation. A man with my qualifications and experience was needed to serve in the Antarctic at this new station and return for a permanent assignment with OMR to serve both Bill Weyant's and Paul Dalrymple's research group. The job included publication opportunities and future grant supported work. OMR! This was the most prestigious research office in the minds of all my classmates. OMR! Wow! I would be lucky just to listen to one of these scientist's lectures.

The gigantic administrative services of the Federal Government, powerful as they are, move slowly. From the time I sent in my application until the luncheon in the Student Union on the University of Wisconsin campus in Madison I received nothing in the mail. That is one reason why the luncheon meeting with Lettau and company was so unexpected. Then a job offer came in the mail the end of March from OOps. I was ecstatic. Immediately I showed Kirby. I was stunned to hear him say that I should sit on it and wait. Why? All my life had dreamed of going to the Antarctic and now I should do nothing?

The next week I received a letter dated 1 April 1965 and a ton of federal forms from Bill Weyant. “Enclosed are numerous forms which have to be completed by anyone being considered for an Antarctic position. As Kirby Hanson has told you, your physical and psychiatric examination is scheduled for 8 a.m. on Wednesday, April 7, 1965. The ‘Medical History’ forms should be filled out by you before the examination. The form entitled ‘Personal Information for Antarctic Service’ is to be filled out and returned in the enclosed addressed envelope to NSF Office of Antarctic Programs. . . . After we have the results of the Navy physical, we can discuss the work we would like you to do for us, and send you a formal job offer. Best of luck with your examination next Wednesday, and please telephone me if there are any questions you have about the enclosed forms that Kirby can’t answer.”

U.S. DEPARTMENT OF COMMERCE
FORM CD-79a
Exception to SF-86
Approved by Bureau of the Budget
Personnel Security
Pres. by A.O. 207-4

“15a. Are you now or have you ever been a member of the Communist Party U.S.A, or any Communist organization?”

“15b. Are you now or have you ever been a member of a fascist organization?”

“15c. Are you now or have you ever been a member of any organization, association, movement, group or combination of persons which advocates the overthrow of our constitutional form of government, or of an organization, association, movement, group or combination of persons which has adopted the policy of advocating or approving the commission of acts of force or violence to deny other persons their rights under the Constitution of the United States or of seeking to alter the form of government of the United States by unconstitutional means? A list of organizations designated by the Attorney General pursuant to Executive Order 10450, is available through the Personnel Office or other office to which this form is to be submitted when completed.”

No job offer yet. Why didn’t I just go with OOps? Kirby advised that I could accept their offer if OMR fell through. My heart preferred research over routine so I accepted Kirby’s advice and traveled to Great Lakes Naval Base north of Chicago for several days of examinations.

Physical examinations are physical examinations. Other than spending many hours naked in a paper sheet, they are endurable. What I did not know and wish I had been told was that at some point the long line up of exams changed from required to background research. I learned many years later from Dr. Karl Johannessen, Associate Director, Meteorological Operations of the entire U. S. Weather Bureau that our eight man team of Plateau Station and the successive teams were forerunning models for similar eight man teams to occupy eventual space stations.

Memory is fuzzy but I remember at least two medical doctors each giving me complete physical exams. Eye exams and my personal sensitivity to ultraviolet radiation were monitored. Special eye glasses with strong filters for ultraviolet rays were ordered. I also had a complete dental exam and was given orders to have even the smallest cavity filled. There were no dentists in Antarctica and the risk of even a small cavity suddenly getting worse and becoming an abscessed tooth could not be taken. Small problems in civilization could become major problems in isolation. A good plus for my acceptance into the program was that I already had my appendix taken out when I was a freshman in college. An appendicitis attack in the Antarctic might mean death or worse, death to an aircraft crew trying to perform a rescue mission.

All the medical doctors paid a lot of attention to my lungs. I was afraid of being disqualified because of childhood pneumonia which I had twice before the age of six. The exact location of Plateau Station had not been determined but it was known that a similar Russian high plateau station, Vostok, was at an altitude more than 11,000 feet above sea level. In the polar regions, because of the earth's spin, the atmosphere was thinner than normal. Where a normal atmospheric pressure of 30.00 inches of mercury existed in my home town in Milwaukee, an atmospheric pressure of 18.00 inches of mercury was expected at the station in Antarctica. That meant there existed only 60% of the normal oxygen content to breathe and occupants of Plateau Station were expected to acclimatize to that thin air. Again the overwhelming consideration for selection to this polar team was the candidate's ability to survive in isolation. Once you were taken there and winter set in, no one would be able to come back. All through my training from this visit in April to Great Lakes Naval Base until I was entering the DC- 6 at Andrews Air Force Base for final take off for Antarctica in November, more and more tests of my lungs were performed. At each one I always suspected that this test would cancel my appointment to the Polar Meteorology Group.

In one test my nose was clamped shut and I was required to breathe through a hose that completely filled my mouth. Gradually the medical team monitoring me replaced the oxygen content with helium forcing me to breathe deeper and deeper until I nearly passed out for lack of oxygen. At another time and place I was put into a small room and strapped into a chair, somewhat like in a gas chamber used for execution. Suddenly all air in the room was allowed to expand into a large adjacent room that had been made into a near vacuum, a sudden decompression test. I was told not to eat beans the day before and I quickly learned why. The air within me suddenly evacuated from every body opening possible and I momentarily blacked out. Great Lakes Naval Hospital, Bunker Hill Air Force Base, The Naval Hospital in Bethesda, Maryland, and others were all part of the elaborate testing system concerned with each of the scientists and military personnel selected for such a rigorous polar assignment.

The psychiatric exams likewise seemed to go on without end. Why do you want to go to the Antarctic? Do you love your mother? When you dislike someone what factors lead to such a dislike? Do you love your father? Do you have black marbled bowel movements? Do you love your mother? Why are you going to Antarctica? Could you get along with an alcoholic? Have you ever been in a fight? Do you love your mother? Have you ever quit a job or project? Why must you go to Antarctica? If you discovered one of your polar party was a homosexual what would you do?

On and on went the questions. I was concerned with all the questions on family. I was virtually an orphan. My father died when I was one year old. My mother died before I attended kindergarten. My two brothers, both adopted, sailed off to war before I was four and were married shortly after their return from the Second World War. I was raised by a grandfather, now also dead, and by a maiden aunt, Tanna, whose home I still listed as my permanent address. This probably was not good for the psychiatric report. Several of these shrinks wanted to go to the Antarctic but they themselves could never pass their own tests for isolation. What would I do if I found one of our polar party was a homosexual? After the sixth psychiatric exam I simply blurted out, "Shit, I'd lock him up and keep him for myself." I never had another exam after that remark.

Standing at the railroad platform next to Great Lakes Naval Base waiting for the train to return to my home to tell unbelieving Tanna how the exams went, I talked to a sailor who expressed some disparaging remarks about not being able to learn anything useful for civilian life. He claimed he was excellent at putting a shell precisely down a smoke stack twelve miles away. He was going to reenlist.

Insert: 17 April 1965. "The JCS have reviewed the military resources which will be available in SVN by the end of 1965 and have concluded that even with an attainment of the highest feasible mobilization goals, ARVN will have insufficient forces to carry out the kind of successful campaign against the VC which is considered essential for the purposes discussed above. If the ground war is not to drag into 1966 and even beyond, they consider it necessary to reinforce GNV ground forces with about 23 battalion equivalents in addition to the forces now being recruited in SVN." (Cablegram from Ambassador Maxwell D. Taylor in Saigon to Secretary of State Dean Rusk.)

18 June 1965 a telephone call from Clyde L. Hughes, Head, Employment Branch, Personnel Division, confirmed my appointment as Meteorologist, GS-9, $7,710 [$27,789, 1993 equivalent civil service pay scale] per annum plus Antarctic bonus for a total of $10,510 [$37,881, 1993] with OMR. Unbelievable! Hallelujah! There was one glitch. "We have had no reply from Local Draft Board #44, Milwaukee County to our letter of June 8 in which we requested permission for you to leave the country. You should not begin travel until you have their clearance and approval of your Travel Request is received." I never knew we were prisoners in our own country. This should not have been a problem since we were at peace with no major military action occurring with American troops anywhere in the world, just military occupation forces in Korea and Germany.

"June 8, 1965"

"Milwaukee County Draft Board"
"Local Board #44"
"Selective Service System"
"135 West Wells Street"
"Milwaukee, Wisconsin 53203"

"Subject: Selective Service # 47-44-41-192"

“Dear Sir:”

“Mr. Martin P. Sponholz, 2535 N. 2nd Street, Milwaukee, Wisconsin has been selected for assignment as a Meteorologist to participate in the U. S. Weather Antarctic Expedition 1965-66. Mr. Sponholz will be assigned to Plateau Station, Antarctica.”

“The U. S. Government through the National Science Foundation and cooperating agencies such as the Weather Bureau is supporting an active national research program in Antarctica. This is an important part of the coordinated international scientific investigations of Antarctica, mainly in the geophysical sciences. The Weather Bureau conducts a meteorological measurement program and a program of Antarctic research using data from the measurement program.”

“Since we have experienced a great deal of difficulty finding qualified persons willing to accept this isolated assignment, we are most anxious for Mr. Sponholz to be able to participate in this program.”

“The duration of the tour in the Antarctic is approximately 18 months beginning July 1965, and terminating December 1966 or January 1967. We shall appreciate it very much if you will grant Mr. Sponholz permission to be absent from the United States for the period indicated above in order that he may accept this assignment.”

“Sincerely, Guy H. Dorsey,
Manager, Personnel,
U. S. Department of Commerce.”

I, as well as most American citizens, was unaware of the involvement of the United States and its armed forces in Vietnam. Required to get my draft board’s permission for accepting a job and travel was a sudden way to become aware of our international relations in the Far East.

“11 June 1965”

“PERMIT FOR REGISTRANT TO DEPART FROM THE UNITED STATES”

“IN HIS APPLICATION THE REGISTRANT GAVE THE FOLLOWING INFORMATION:”

“A. COUNTRIES TO BE VISITED, Antarctica.”

“B. ORGANIZATIONS OR INDIVIDUALS REPRESENTED, United States Department
of Commerce (Weather Bureau).”

"C. NATURE OF BUSINESS, U. S. Weather Antarctic Expedition 1965-66."

"The above-named registrant is hereby authorized to depart from the United States
and to remain absent therefrom until 11 June 1966."

None of us took note that in spite of the U. S. Department of Commerce request that I be granted an eighteen month deferment, each government agency has its own policy and the Milwaukee Draft Board did nothing beyond twelve months. Never mind that June 1966 would be the austral winter on the isolated high plateau of the south polar region inaccessible from the outside world. The all wise administrator of the great bureaucracy would figure it out. I was on my way SOUTH!

CHAPTER 3
Move East to go South

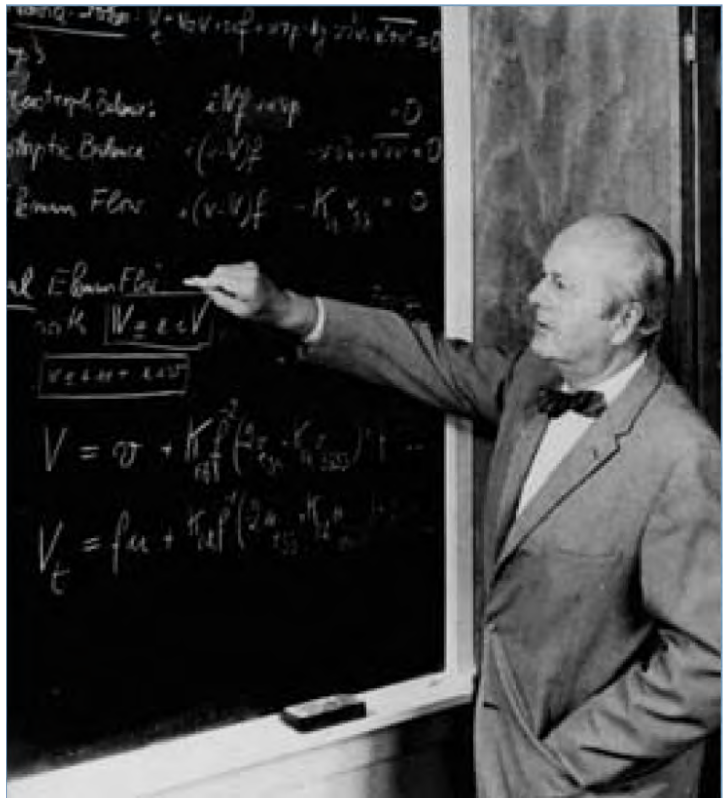
A job offer of $10,510 was more than adequate. I was even a little embarrassed at such promised riches. No one in my family earned wages at that level. In Admiral Byrd's day men either paid to get on to an expedition to the Antarctic or were paid a token $1.00 plus provisions while in the Antarctic. This was a position of high privilege. This appointment was a gift of adventure. Few positions for a new graduate held so much promise of discovery. Without question I was the envy of all my classmates. Granted, with privilege, adventure, and discovery come uncertainty, risk, and fear. Suddenly my life was filled with preparations for the great trip South. First I would have to go east.

One trivial matter- I needed to finish my master's thesis in a hurry. "Wind Structure 50 to 150 Meters Above an Urban Area" was accepted and signed by Prof. Lettau. The conclusions, to me, were very exciting. I learned that the greatest loss of energy by the wind, when passing over the Twin Cities of Minnesota, occurred over the low residential area where most of the trees grew. The expected high friction regions over downtowns of St. Paul and Minneapolis turned out to have less friction. Many of the findings of the micro climatic changes over the urban area might have been a series of first findings but by taking two years at my research, many of our findings were published first by researches in other cities.


Tanna

Graduating in June of 1965 with a Master's degree in meteorology was secondary to the need to plan for crash studies in polar meteorology. I did take one day off for that celebration. I felt the pride of reaching a great achievement. Tanna came to the ceremonies at Camp Randall Stadium. It was the only time she visited me at school and walked the paths of campus in the six years I attended the university. She raised me after I lost both parents in early childhood. She always encouraged me with my studies although she herself quit school in the fifth grade not seeing any value in it. It was Lettau who noticed her talking to me at the podium after the ceremonies and introduced himself to Tanna as my thesis adviser. I don't think she knew what a thesis adviser was, but the two of them talked for quite a while in German with me standing in my graduation gown with masters collar unable to understand what they were talking about. You tell me who was more educated? Tanna rarely spelled wrong, knew two languages, and provided for me without the benefit of a husband or provider. This was her gift to her dead sister. Whatever sacrifices she had made that I knew nothing about, she had raised me to this point of independence and now I was on my own with only a poor understanding of English. The master's degree was impossible without both of them- Tanna and Lettau.

In one meeting with Prof. Lettau, before I left for Washington D. C., he reviewed with me many of the things to look for in the Antarctic. In the anticipated extreme polar climate with snow surfaces very cold and with the sky very dark without a warming sun, stratified layers of air can produce very complex temperature profiles. The introduction of instrument probes influences these delicate profiles denying the observer proper analysis. Subtle measurement methods needed to be invented. Lettau suggested to me that I dream up some kind of target for a camera to record mirage events photographically. These targets could be used to document visual mirages in many different stages. Photographic recordings could monitor the undisturbed passage of light. From the refraction of the light perhaps the temperature profile could be determined. Jim Sparkman, an older previous PhD candidate of Lettau's, did much pioneer work with this method photographing a boat house door through a few miles of air just above Lake Mendota. This was not part of any previous proposed project. Lettau just never stopped coming up with new ideas. This idea, one of many, I took to Antarctica.



Prof. Heinz H. Lettau

Lettau also had a theory with which to predict the most probable lowest temperature of the austral winter on the High Plateau of Antarctica. A plot of the average daily temperature against the date for a full year at any place with normal sun rises and sets shows a cosine wave. In the interior of the Antarctic circle where the daily rising and setting of the sun are interrupted with periods of twenty-four hour sunshine defined as summer and a period of twenty-four hour darkness defined as winter, the temperature plot over a year's time displays a long flat winter curve. This truncated cosine wave was called a "kernlose" winter meaning that it was a winter without a cold core or that the seemingly lower and lower sweep of a cosine wave was cut off never getting to an expected minimum. At several interior stations in Antarctica the anticipated minimum never was reached. Many different theories emerged every year, some very simple, some incredibly complex. Lettau felt that the answer lay in the forcing function of the daily rising and falling of the sun in which its highest position in the sky mimicked the cosine wave. When the sun no longer was present the cosine wave was cut off. Once equilibrium was reached, perhaps after a few weeks of sunless days, further cooling should not be expected. That is exactly what a graph of the temperatures from a coreless winter displays. An answer about nature's puzzles should not be more complex than what nature displays, nor should the scientist look farther than the obvious.

Lettau told me the normal methods of establishing the expected temperature range for this unexplored region. I would be on the earliest exploration team. Most likely we would be landing at the unexplored site in the warmest part of summer. The air surface temperatures taken the first several days would be very near the maximum temperature. Next, by drilling a deep hole into the snow and monitoring the temperature of each core of snow I extracted, I could get a view of past winters. By drilling deeper and deeper until I noticed that the temperature did not change any more, that temperature theoretically was expected to be the average temperature for the year. Normally the difference between the highest temperature and the average temperature is the same as the temperature change between the average temperature for the year and the lowest temperature. The normal method to predict the lowest temperature was as follows. If +10.0 ° F was the maximum temperature and -50.0 ° F was the unchanging temperature at the bottom of a deep hole in the snow, then the temperature difference between the summer maximum and the predicted average annual temperature was 60.0 ° F. It simply follows that the coldest temperature would be 60.0 ° F lower than this predicted average of -50.0 ° F, giving -110.0 ° F. This type of prediction, experience showed, was repeatedly wrong. A kernlose winter for the same data I just used as an example would be closer to -90.0 ° F. Lettau wanted the opportunity to predict correctly the coldest temperature for Plateau Station. I promised to carry out these observations and send them to him.

I thought it odd that, as my teacher, he did not share the details of his theory for predicting. The essence of a teacher is to share everything and as my teacher, until this moment, Lettau did. I did not understand that now, as a professional meteorologist, particularly as a research meteorologist of the office of Meteorological Research (OMR) I was no longer a student of Lettau but a competitor. I never believed that! I don’t think Lettau did either. When I finally made these temperature measurements somewhere between the unexplored High Plateau and the research offices of the warm university this promised communication failed to get through.

With weeks flying past, time in Madison was running out. Lettau continued to outline for me what type of wind profile to look for with my balloon launches. I remember Lettau emphasizing the need to look for and document the existence of “S” shaped wind profiles. What he meant can be described with little arrows. Let us imagine the wind is at our back as we face a particular direction, say north. Let me draw a little arrow, say one inch long for a ten mile per hour wind speed, and point the arrow in the same direction as the real wind is blowing toward the North. For an “S” shaped wind profile I looked for a series of winds increasing with speed and arrows drawn longer but sweeping to my right for the lowest part of the wind profile as well as the lowest part of the “S”. The wind would sweep to my left and blow faster. The tip of my arrows, all drawn with their starting point or feathered end at the same point, would sweep out an “S” as the wind would slightly slow down at the higher levels and sweep back to the right. If such “S” shapes could be documented, a true discovery for meteorology would be made.

Many of these meetings Schwerdtfeger also attended. He insisted on the need to make the balloon ascents as slow as possible. The great temperature inversion was expected to be of a very large temperature difference, but only if the balloon ascents were in the inversion long enough could enough detail be achieved. If a thermistor, the device that recorded temperature, was moving too fast, it might still be cooling when it hit the warmer air above and give a false height for the inversion. Likewise, if moving too fast, it would not record the warmest and most important top of the inversion. A long acclimatizing of the instrument package on the ground would also be necessary to make sure the instrument recorded the true coldest temperature at the bottom of the inversion. Schwerdtfeger also stressed the need to take as many balloon soundings during the temperature inversion as possible. Since the inversion dominated the long polar night, the maximum useful data might be during the time of inversion changes while it is forming or while it is coming apart by some atmospheric mixing process. Kirby Hanson expected several storms to pass over the interior of Antarctica and disturb the inversion. Predicting these weather changes was nearly impossible without cooperation with other stations and communication with the weather center at McMurdo Station or the Russians at Mirny or Molodezhnaya.

Here both German professors enjoyed reminiscing about trying to predict the weather for the war effort in Europe for Hitler's army when the English and French falsified the data as much as possible. They gave me a crash course in predicting the weather for a single station using weather data only from that same single station. Although we all knew Germany was not Plateau Station and no means of forecasting had been established for the High Plateau, nevertheless pressure changes, wind shear, cloud directions and types, and behavior of smoke plumes all revealed useful knowledge about the detailed workings of the atmosphere. She was a friend but one needed to wait and watch her.

At one of my last meetings with Prof. Schwerdtfeger, he requested a favor of adding one more little thing to look for while I was on the High Plateau of Antarctica. Schwerdtfeger, struggling with the age-old dilemma of how did the icecap of the Antarctic get there in the first place, proposed, in addition to the thermal wind with the inversion, that ice crystals fell from a clear sky. Many explorers reported ice crystals continually in the air. Humidity measurements were worthy of taking, but Schwerdtfeger was not sure the Weather Bureau program included them. Certainly sinking cold air, if saturated and sinking into still colder air, would become super saturated with a strong probability of forming precipitation. Without clouds? Maybe. I promised to watch.

I still had to say good-bye to friends and relatives in Milwaukee. My friends, the Beertown Boosters, arranged a barbecue and beer party in my back yard at 2535 North Second Street. What once was a German lily white neighborhood when I was a toddler, changed into a multiracial neighborhood of both good and bad neighbors. A lady next door shot her husband eleven times for which two of the bullets entered the hall wall of my house. At times I needed to step over a neighbor passed out on alcohol or drugs lying between the ash box and the garage as I walked home from the Third Street bus stop through the alley and into our back yard. Mr. Stinger, a black man who was a renter living downstairs in Tanna's double flat, was a Muslim priest and took very good care of the near neighbors and especially Tanna herself.

All these friends of mine, mostly white and well educated, found it uncomfortable to visit me at my house but anything for beer and brats. We played badminton, sang a lot of songs, argued a lot and generally made a drunken scene and thereby attracted many lookers hanging over the fence. I never did much with my college friends at my home in Milwaukee. As I said, most were uncomfortable in my neighborhood, except of course Leon Todd who was also black and from the neighborhood. Gradually the catcalling from across the fences from the many black kids turned into ugly harassment. I became concerned but Mr. Stinger solved it all. He suddenly appeared on the back porch and raised his hand and without a word the neighborhood kids disappeared as suddenly. We had no further trouble. Our barbecue and beer party continued uninterrupted on into the night until all was consumed. Each said their good-bye without comprehension of where I would be going. Most said "see-you" as though we would. Many of them I never saw again.

My brother Ray was driving me to the airport for my flight to Washington D. C. Tanna came along. With two suit cases, one large and one small, I walked down the steps of Tanna's house and ran into Mr. Stinger on the porch. I thanked him for keeping the peace. He understood and assured me that Tanna was in good care. She would have no problems while he rented the downstairs flat. His promise could be counted on. Tanna was safe in an unsafe neighborhood. Our Lord truly provides and in this case He sent a black Muslim to be her guard. I believe it. Her angel had black skin.

Insert: 2 July 1965. "Rather, I think we should think in terms of the 44-battalion buildup by the end of 1965, with added forces—as required and as our capabilities permit—in 1966." (Memorandum from Assistant Secretary McNaughton to Lieut. Gen. Andrew J. Goodpaster, assistant to the Chairman of the Joint Chiefs of Staff.)

The neighbor to the north recognized me and hollered over, "Hey Slug, where you been?" It was an old childhood playmate, Larry. His brother, Charlie, was in and out of jail. Larry was on military leave. He was in the Army and about to be shipped out for Vietnam, so I asked, "What are you going to do over there?" He answered, "Give a little black advice!" We said little else. We had little in common other than the street on which we lived and the ability to make zip guns for killing rats in the alley. Military duty in Vietnam struck me as strange. What commitment did we have there?

Ray sped off to the airport. Conversation on the way to the airport was nil. Even at the airport we said little to each other. Good-byes were not in our tradition. Tanna moved once from 5th and Hadley to our present home at 2nd and Wright but that was in 1919. Ray remembered his departure with Dick, his twin brother, for their service in the U. S. Navy, and I think he understood my adventure in conjunction with the Navy's Operation Deep Freeze. At the airport I wanted to stop in at the U. S. Weather Bureau's Airport Station where I spent my traineeship but as time ran out on us, it seemed inappropriate. I felt bad that one more time I could not function without help from Tanna. Here I was about to start a job earning more than ten thousand dollars and I needed money from her for an apartment. She "loaned" me $300.00 and as time would tell she never let me pay it back. This departure gave me the real insight that she indeed was the mother who raised me although I never called her that. True parents never stop trying to provide and that was true of Tanna. I never gave nor received much affection from her but at this good-bye I was shocked by her tears which I had never seen her shed before. From Ray and Trudy came huge bear hugs and kisses and of course I had tears of a fountain.

The flight to Washington D. C., 8 July 1965, was uneventful. I landed at Washington National Airport and surprised at the crowds and the grime all around collected my luggage.

National was an old airport. Always there was repair, new access roads, a new lounge. I learned some time later that although Dulles International Airport was a model airport of the future with plenty of room and comfort, National was in immediate downtown Washington. It was just across the Potomac River from the White House. That convenience made it popular no matter how crowded or outdated.

I hailed a cab and was proud that I learned quickly or at least whatever I did seemed correct. The cab driver grabbed my two suitcases, threw them into the trunk and did some low level flying on the way out of National before he asked, "Where you headed?" I said proudly, "The Weather Bureau." "Suitland?" was the return response, but I had no idea what he was talking about. We were moving so fast in what seemed to be four or more lanes of traffic that by the time I dug out an address, 24th and M Street, Northwest, we were headed in the wrong direction. Without emotion the cabby jumped four lanes, started along one exit ramp and then without warning jumped a traffic control island and caused me to duck behind the seat as we rolled over what I thought were steel yellow and black posts. We were on the George Washington Memorial Parkway, squealed around a hair pin curve to cross 14th Street Bridge to Pennsylvania Ave., passed the White House, buzzed around Washington Circle, and came to a screeching halt in front of a very old fortress building (he said it was the old Mexican Embassy) that had a sign claiming it was the U. S. Weather Bureau.

The views were barely noticeable at the speed we were driving. I was in sheer panic over the intense driving, in and out of traffic lines, jumping lanes, slamming on the brakes on the congested streets, and roaring forward as soon as the light changed only to slam on them again in only a few car lengths of forward progress. Raised in Milwaukee and working in Chicago I should have been prepared for city traffic, but my first impressions of DC driving were filled with terror. I was glad that I neither owned a car nor had a driver's license.

The sights of our nation's Capitol were spectacular. How could one speed past it all? I learned the business of the nation had no time for sight seeing. Though I ended up living there for four years, there were only two occasions I took time off to see what there was to see. I was not a tourist but even though I wanted to study this fabulous city I was a resident with work to do. Indeed, the work started almost immediately when I entered the door of the old Mexican Embassy.

Ann Darby, the secretary of the Polar Meteorology Research Group offices, was my first contact with this new research place I would be calling home and pouring out my intellectual energies for. She gave a kind smile, found a place for my old scuffed outdated, non-stylish suitcases, and took me to the inner offices and the inner inner office of the Chief of Polar Research, William S. Weyant. Ann was a true dedicated civil servant and served her office well. There was no part of Polar Met that she did not know about. I learned very quickly, if you needed the name of someone in the government, anywhere in the government, Ann would have it. She would have the phone number, office hours, hours when that person really was prepared to take phone calls and even enough about that person to give you a needed advantage in conversation to achieve your purposes. Before any conference that I attended, she supplied me with a correct agenda, a list of important participants, and most important, the backgrounds of the individuals I needed to see, talk to, exchange information with, ask favors of, and play politics with. The more I would learn about the inadequacies of the professional research men as well as my own inadequacies, it became apparent that this office had its high reputation as a research office because of Ann Darby.

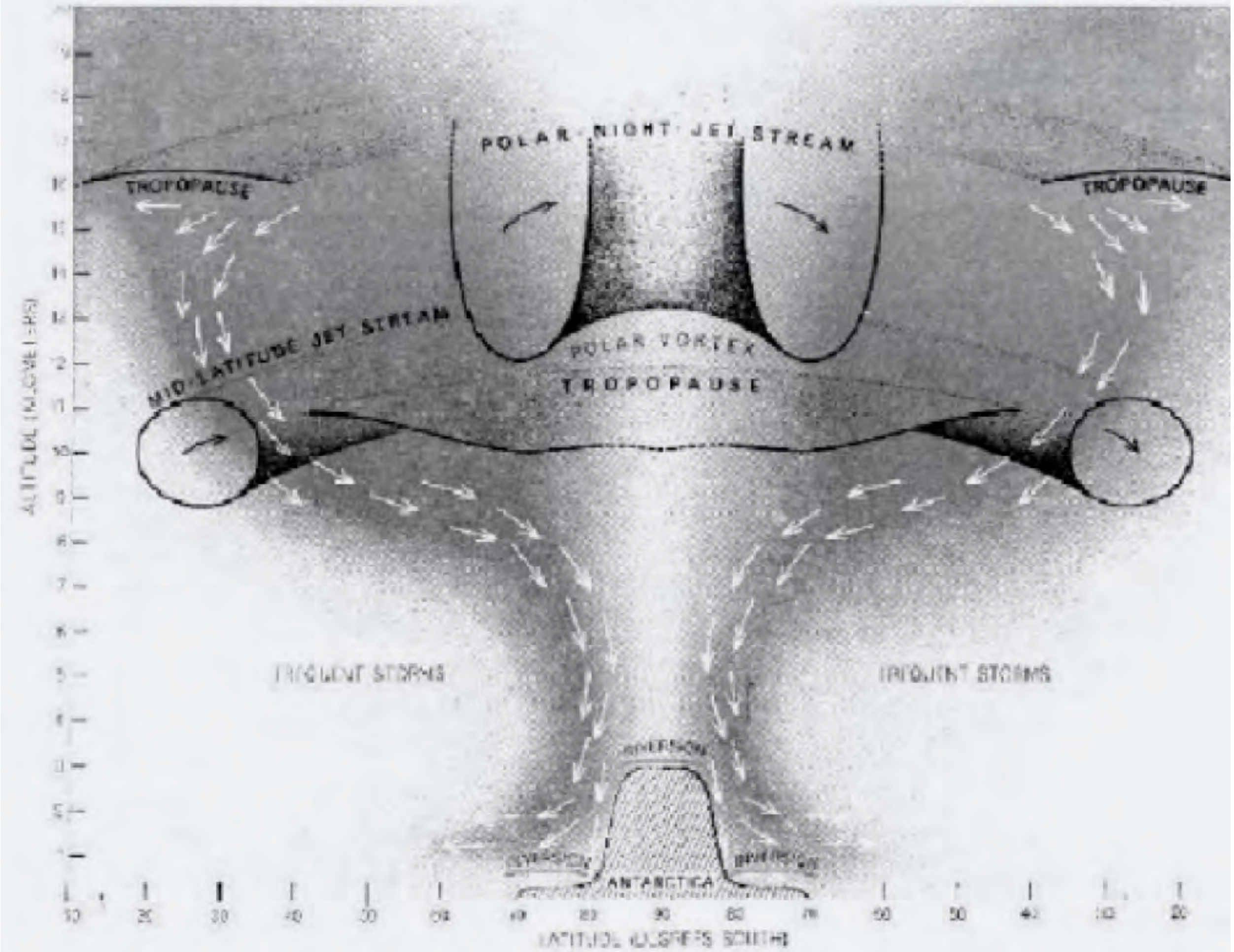
Meeting Bill Weyant was for me an extremely nervous moment filled with awe and the culminations of all of my childhood dreams of Antarctic exploration. For a trained meteorologist or atmospheric physicist, which I was, Bill Weyant was the leader and the living embodiment of polar discovery. Without a doubt he was a veteran of the Antarctic; his weather beaten face testified to that. He wore a penguin tie clasp. He was very friendly, but intense about his research and the research of the entire office. The only thing that had close to an equal captivation of his attention was the card game of bridge. I didn't play bridge. I sensed he felt that was a failure on my part. I should learn. Bill Weyant eventually retired early from government civil service and became head of running bridge tournaments up and down the east coast.

Bill Weyant was a frequent writer with the great Harry Wexler of IGY fame. Wexler and Weyant formulated the first complete and comprehensive model of the general circulation of air over the high ice dome of the Antarctic. From radiosondes launched daily for more than eight continuous years at the many IGY Stations now made permanent all around the Antarctic coast, as well as several interior stations such as Byrd Station, Amundsen-Scott Station, and Vostok, Wexler and Weyant discovered above the great polar ice dome a strong clockwise wind system in the troposphere.

This was a strong cold core low centered over the ice dome of the Antarctic and flowed exactly opposite the direction given in all the college geography textbooks. These winds were the strong winds from the west, and were very different from the supposed polar easterlies currently taught. In fact these west winds increased to form the very rapid moving polar vortex of the south polar stratosphere. This contradiction between the science of the "library", knowledge invented behind a desk, and what really happens in nature is quite common in science. Only when the scientist is willing to go out into nature and look to compare ideas with what really exists, can meaningful surprises occur. Oddly, polar easterlies are still (1993) being taught.

Further analysis of weather data by Wexler and Weyant showed, as expected, that the warm tropical troposphere (the layer of common weather changes and storms) was considerably thicker than the troposphere over the poles. The mid-latitude jet stream lies in that band of discontinuity where the tropical troposphere rides higher but not connected to the lower polar troposphere. The ozone, concentrated in the stratosphere (the layer of thin air over the troposphere, where the temperature of the air is either isothermal or rising with height), sinks into the troposphere through the discontinuity of the tropopause, and by the converging tropospheric westerly winds of Antarctica, concentrates over the ice dome. Weyant and Wexler reasoned that somehow the stratified air closest to the ice dome played a role in the surface concentration of ozone. Long before the modern concern over the ozone hole of today, Weyant and Wexler saw these global complex interactions and recognized the serious interplay of these atmospheric chemicals that are vital for the survival of life on this planet. Since Wexler's death, only a short time before my coming to Polar Met, Weyant discovered that ozone concentrations changed rapidly with seasons and that seemed to be a result of horizontal advection (wind acting as the carrier) and not so much by vertical advection.

Scientific American, September 1962, p. 94



Where Harry Wexler had been a dynamic human force in the Weather Bureau, establishing the American role for weather research in IGY in Antarctica and building the Polar Research Group as a special task force for struggling with the basic research of the fundamental problems of the atmosphere, now his research companion, Bill Weyant was chief of this special group and I was shaking Weyant's hand and more, I would be doing this very special research work of polar studies. WOW!

Bill took me to meet Herb Viebrock, the second in command at Polar Met. Viebrock was intensely interested for many years in theories of energy exchanges between the air and the ocean, pioneering these thoughts before others. Making his research interesting and complex were all the energy exchanges with the many phase changes of liquid water, ice, and vapor. The size of the Antarctic doubles in surface area during the winter when the surrounding ocean freezes. This changes the albedo or reflectivity of the entire planet, reflecting away at times as much as ninety percent of the solar energy reaching the ice and snow of the earth's surface. This sea-air-ice interaction in the polar regions was central to understanding the weather all over the globe, and Herb Viebrock was an intense researcher for the task.

Herb Viebrock also was jointly working with Ed Flowers studying an anomalous decrease in direct solar radiation due to influx of volcanic dust from Mt. Agung, Bali. They traced wind streams of the stratosphere from Bali to the Antarctic and confirmed such sensitive changes most prevalent in the pristine Antarctic air. Herb also developed national climatological maps of the polar regions putting together the research work of many researchers, not only from Polar Met but of scientists all over the world. This tended to be unsung heroic duty as much government research was. So many of these general, but massive projects, were published under the name of the Secretary of Commerce, or the cabinet post under whose office the work was funded.

The dust of Mt. Agung, having such a major influence on global weather and being part of the most up-to-date research that this office was doing, reminds me of ignorant denials by people of little or no understanding who refuse to honor knowledge and understanding that others may have. As a professor, the very first evening I moved to Dr. Martin Luther College with the moving vans still being emptied, I remember commenting to a new neighbor about the unusually brilliant sunset to the west on the flat prairie land. I quoted some of Viebrock's findings about the influence of volcanoes on the fundamental light rays reaching the earth. Mind you, it was not long since my research days with this top front line research office and I knew my subject. "Oh no. Definitely not! Volcanoes would not influence us here in New Ulm." I suppose! Truth you don't have to believe. If The Wisconsin Evangelical Lutheran Synod's worker training schools did not teach it in the past, such knowledge must either be wrong or simply nonexistent.

Bill and Herb took me around to meet all the professional scientists. First was my immediate office mate. Bob Becker, a connoisseur of pizza, was the resident synoptic meteorology expert. His immediate interest was concerned with the study of blocking highs in the South Pacific Ocean. High pressure weather systems became stagnant over the immense ocean. As tropical or sub tropical air expanded by solar energy over the warm and moist ocean, it formed a stationary air mass. Bob was looking for trigger events coming from the Antarctic that either would begin the movement or breakup the formation of such high pressure systems. His source of data was intensive case studies using data collected by people on research ships such as the *USNS Eltanin*. Bob eventually got married, helped his wife run a catering service in Washington D. C. and opened a pizza shop, all perhaps to avoid becoming sea sick on a polar tub.

Herb introduced me to Ed Flowers, his co-author on the Mt. Agung dust study. I recognized Ed Flowers as a veteran of the first winter at the South Pole under the leadership of Paul Siple from my high school readings on IGY. He also had a special interest in micrometeorology and turbulence. I had hoped to be able to grow professionally with an expert such as Flowers but he soon would join the research staff of the National Center for Air Pollution Control in Cincinnati, Ohio. He surprised me by quoting to me some of my own research on wind fetch over the Twin Cities of Minneapolis and St. Paul, the heat island I measured over Milwaukee, and the lake breeze studies for Milwaukee and Chicago I published in obscure government manuals.

Martin Predoehl performed pioneer work with the great technological advance of the age, the weather satellites. ESSA Three and ESSA Five data permitted Martin Predoehl to determine for the first time the mean cloud cover over the Antarctic region and the seasonal changes of the pack ice on the surrounding seas. The breakthrough for these studies came when Martin discovered ways to distinguish between ice and clouds.

These five men and I made up the research team called the Polar Meteorology Group. A seventh professional scientist, Janice Robinson joined our team about a month later. Janice was a pure mathematician. She was a new graduate as myself. Much of the work of the other researchers was becoming more and more mathematical. Energy balances, statistics governing three dimensional vectors, computer analysis of vast amounts of satellite data, all were demanding a greater more complex mathematical interpretation of nature. Janice would serve as a check on our mathematical work as well as do research projects of a more theoretical kind of her own. In addition, as the polar specific studies became known with more certainty, the demand to inculcate these theories into the working models of the Weather Bureau's global forecasts increased. Such linkage demanded much mathematical treatment.

Janice was married to a Marine serving our country in South Vietnam and, in fact, he served more than one tour. She understandably was very critical of my attitude toward the war in Vietnam. Actually in July or August of 1965 I had no opinion. It was my association with the University of Wisconsin at Madison, which was notably "pink" or of communistic leanings according to this mathematician from a southern university, that made her suspicious. That suspicion turned out to be prophetic but in summer of 1965 very few citizens knew the extent of the U. S. involvement in Vietnam. My neighbor in Milwaukee, Janice's husband, and a few former ROTC (Reserve Officers Training Corps) classmates from college were involved and this did begin to puzzle me. Why were so many of my acquaintances associated with Vietnam?

To round out the professional picture, while I was in the Antarctic, Ed Flowers left for Cincinnati. Replacing him was Professor Lettau's son, Bernard Lettau. His research interests included ice-air interface energy exchanges. He took hour by hour heat flux measurements going into the ice at the South Pole and found them to generally balance very close to convective heat loses of the air above and conductive heat losses given up by the snow. He wrote in the *Antarctic Journal of the United States*, "The sensible heat given up by the snow made up an appreciable fraction of the radiative heat loss at the surface." (Jan.-Feb.'67)

Remembering the lunch-interview I had with Prof. Lettau, Prof. Schwerdtfeger, Kirby Hanson, Paul Dalrymple, and Mort Rubin, I asked, "Where is Mort Rubin?" thinking he was part of Polar Met. I learned that he was president of the International Commission on Polar Meteorology in Geneva, Switzerland. He served the United Nations through the World Meteorological Organization and had an office in the main administrative center of The Environmental Science Services Administration (ESSA) in Rockville, Maryland.

I was beginning to learn the alphabet soup of the Federal Government. Every new politician, every new political appointee to head a government office, every new administrator automatically felt the need to make him or herself look important by restructuring all the offices below them. That meant new chains of command, new flow charts of office structure and of course, new names. New names meant new letters of the alphabet soup. Nothing new happened to productivity with such manipulations. Productivity had nothing to do with administration but with the hearts and love for work of the people doing the work. They needed to see a sense of purpose. Most administrators saw only their own need for power and to exercise that power they ordered change, many times without forethought or study and always without input from the workers.

The Chief of the Weather Bureau, F. W. Reichelderfer, retired and Robert M. White was appointed by President Johnson through the recommendation of the Secretary of Commerce. There was an incredible flurry of activity in the Weather Bureau as I entered it as a professional research scientist but it did little to improve the forecasts of the weather, or improve commerce, or increase safety of air traffic. These things did in fact improve, but they did because individual forecasters continued to study and analyze the duties for the sake of the men and women they served. The U. S. Coast and Geodetic Survey merged with the U. S. Weather Bureau and became USCGS and USWB as parts of ESSA. White's administrative offices greatly expanded and new coordinating offices were also added. Here my new office, headed by Weyant was the Polar Meteorology Group (PMG). We became part of the Air Resources Laboratory (ARL). ARL became only one of many laboratories all of which were headed by a cover group called the ESSA Research Laboratories. These served and were served by the Environmental Data Service (EDS) and the National Environmental Satellite Center (NESC). Theserectangles on the Government flow chart were the all important real stuff of administration and changed very frequently in my short tenure of government service. Some times these changes had an effect on the work down below; most of the time these changes had no effect at all.

The outstanding people below the research staff of Polar Met I was introduced to next. They occupied the outer office. They were the ones who did all the statistical work we ordered. Sometimes they knew the value of their work but most of the time the professional researcher never shared his goals or objectives with the technicians below him. I was complimented by Gertrude Sohns, who did most of the statistical work on my research projects, for keeping her informed of what my projects were supposed to prove or, even if I had no idea where it was going, she always was informed of that.

Sy Roman was a good confidant for me. I know he felt strange having me share troubles of the professionals above his rank. But for me, I never seemed to understand rank. Besides, Sy had a sharp eye for changes in the data and many times saw correlations the research staff missed. It was always worth sharing ideas. Sy knew every traffic light within the beltway and gave excellent advice on how to commute without stopping both in the morning and the afternoon. When our office was moved to the Grammax Building in Silver Spring, Maryland, Sy's advice was to race up Georgia Avenue 33 mph from Rhode Island Avenue to New Hampshire Avenue, slow to 21 mph until Kansas Avenue, then travel as fast as the traffic flow would bear, usually near 40 mph past the intersection with Piney Bridge Road and glide into Silver Spring at the posted speed limit of 25 mph. It worked. We'd even keep score on how many stops a person got stuck at.

The rest of the support staff was equally important but time and circumstance did not permit a comfortable growing together. I wish we had all realized how nevertheless we did grow together. Jim Monahan was the at the office earliest, first to make coffee, and in true government fashion, used his afternoon break to move his car closer to the front entrance of the office building for a quick getaway at quitting time. Mabel, concerned for all listened to everyone's problems and always had comforting things to say for all situations.

Sam, a dedicated federal worker, I got close to on only one event. When D. C. burned in the aftermath of the senseless killing of the American servant of peace in troubled times, Martin Luther King Jr., it was difficult to move around in the District. Sam needed to travel to see his wife and family every weekend and took a Greyhound bus. During the military occupation of D. C., access to the bus terminal became difficult. Sam and I tried to drive to the terminal after curfew and were chased by siren screeching jeeps and after we escaped the military I simply drove him home to Harrisburg, Pennsylvania. The deep feelings and the struggles of this young man to provide for his family "up north" added meaning to the needed struggle I was watching our nation work through.

Lanny Dimmick was a fast rising young man who started with educational disadvantages but seemed to overcome them. After a time with our office he moved on to another research office, Geophysical Fluid Dynamics Lab, and had strong ambitions to study and to achieve the professional level. Thinking I came from simple and poor roots, I had difficulty in accepting these strata in my work place and I never understood the privileged position I found myself in as a professional research meteorologist here at the Polar Meteorology Research Group.

That just about covers the introductions to the people of Polar Met. I was also taken to a different office building where I was introduced to Weyant's boss and to still another building across town to shake hands with Weyant's boss's boss and began to ponder the huge endless structure of the federal bureaucracy. This structure would change many times during my tenure in Washington D. C., sometimes for the better, sometimes for worse, and most of the time for politics. Dr. Lester Machta remained for the most part of my time with Polar Met as an overseer above Bill Weyant. Yet, because of our dependency on National Science Foundation grants, we maintained our independence.

Dr. Machta was an outstanding workaholic role model for the devoted scientist. He kept a sleeping cot in his inner office for the big research pushes that seemed to occur just before budget times. Nothing was better for research outfits as Polar Met than to make a discovery just before it was time to ask for more money. As Director of the Air Resources Laboratory he led all research teams with his publication pace. His most famous work was probably "Global Scale Dispersion by the Atmosphere", that he developed using knowledge measured in earlier works like, "Meteorological Factors Affecting Spread of Radioactivity from Nuclear Bombs." It was Machta's research leadership that showed the politicians of the world that we all were on the road to global suicide trying to build bigger and more deadly nuclear weapons and by testing them in the atmosphere. As a family of nations we were beginning to kill more by cancer through radiation and fallout than by any bomb dropped in anger. Yet it was Machta and his deputy, Donald Pack, whom I remember venting considerable verbal anger when a nuclear test ban treaty was signed because it meant an end to their ability to study global air circulation by means of nuclear trace material.

Sidney Teweles was another government leader who seemed to have influence over Polar Met even above Machta. He was Chief of the Data Acquisition Division of the Weather Bureau, and although his office did not remain in a direct line in the government organizational chart above us, working in the polar regions simply could not be done without a global data acquisition system and all the international diplomacy requirements behind such a system. When Lester Machta established a global air pollution monitoring station at the South Pole, it required every human effort for people down at our Polar Met level and the same effort all the way up to Teweles' office and much more over at the State Department. These little things that sent great vortexes of political turbulence throughout many government agencies made life on a simple polar meteorological problem exciting without end and required an understanding of the government structure for its proper manipulation.

Amazed at the special interest Sidney took in my appointment, I learned of the need for diversity. More than once he expressed gratitude that I was a graduate of the University of Wisconsin. It was a concern of his that the research sections were becoming too dominated by graduates of the eastern schools. He knew that coming from a Midwestern school my research ideas, most certainly following training from men as Lettau and Schwerdtfeger, would soon clash with the teachings of Ben Davidson of New York University and Hans Panofsky of Penn. State. This was the essence of science — debate. Ideas of imaginative thinkers were put into imaginative models and tested in the field of nature. More than one system of thought could always be "force-fit" onto nature. The contest of debate and necessary clash of ideas led to the best understanding and for the Weather Bureau, the best predictions. I couldn't wait!

It took several days for me to notice but then it dawned on me, there was an older guy sitting behind a desk off to the side in Polar Met that I never was introduced to. When I finally felt at home enough to ask "Who is that man over there?", I got the reply "that's Fred." Fred Fopay was a kind gentleman behind a large desk piled high with maps and thousands of microfilms. He eternally toted up statistics, relabeled the microfilms, cut some of the microfilm apart and spliced them back together again. For what reason and project I could never find out. Even during the few years when budgets were drastically cut, Fred's position seemed protected. The best answer I got was that he was associated with one of the last of Admiral Byrd's expeditions and somehow his position as a civil servant, not special service as all of our research positions were, was permanent. Until his retirement he went about his business of averaging data and classifying maps that were never used. He never spoke much and obviously ignored introductions.

Actually, before my research days came to an end, it was some of Fred's maps on microfilm that were beneficial and I don't want to leave the burden of bureaucracy all on Fred's desk. I eventually learned to respect him as a person. Unending projects were normal for the federal government. At one point of my stay in Washington D. C., to further my own position I became a self-taught student of the government's structure and stumbled onto a civil service position with the title of Director for the Interoceanic Canal Project. It was more than fifty years since the building of the Panama Canal and there really still existed an office where dedicated people still collected data and still planned alternative routes across Central America. I'm not making this up. I saw the offices with project maps from the floor to the ceiling showing canal routes across Nicaragua, Costa Rica, Panama, and Columbia. The project Director was Robert J. List who had his office on the third floor of the Grammax Building in Silver Spring, Maryland. Oddly enough it even became attached to Lester Machta's Air Resources Laboratory because during the Eisenhower Atoms for Peace Plan the "canal researchers" did many studies of turbulence and dispersion of nuclear fallout problems if a "clean" nuclear bomb was used to dig the new canal. That's our government.

My first rented apartment in this fabulous federal city of the District of Columbia was in the artistic, expensive, and prestigious Georgetown. I rented an efficiency apartment from Mrs. John Stahl at 3009 Que Street Northwest for $110.00 per month. It was very comfortable. Several other young people lived in the building adding to the enjoyment of apartment living, making it a touch of dormitory with the independent responsibilities of house keeping. For me keeping one room was more than enough.

Mrs. Stahl was a very interesting person. At one time I'm sure she used this fabulous building as her own townhouse. After the loss of her husband, she probably started to subdivide the building into its separate parts. Weird ideas filled the mind of this delightfully talkative old woman. She let me in on a secret since she knew I was a government man. She knew the earth was hollow. Inside the earth existed a vastly superior race of people and only government agents knew of it. These advanced people flew out of the center of the earth with flying saucers though a great gate at the Poles and Admiral Byrd was the first to discover these openings.

During my stay in her building I tried many times to assure her that no such gate to the center of the earth existed. I even brought to her documents and plans of the Amundsen-Scott Station at the South Pole. Then accidentally she saw a picture of a locked door at the South Pole Station that led to the snow mine. Paul Siple, the scientific leader at the South Pole Station the first winterover year started the snow mine for clean snow for drinking water as well as snow samples for glaciological studies. Ed Flowers, Paul Dalrymple, Kirby Hanson, and Mario Giovinetto, all close scientific acquaintances of mine had worked the snow mine as their diggings penetrated several hundred feet under the snow surface. The padlocked door was placed over the mine entrance to keep drunken scientists and Navy men out. Mrs. Stahl was convinced by this time that I had joined the government agency that was keeping the gateway to the hollow earth a secret.

The first days on the job my immediate task was to nearly memorize my job description and the grants covering my research work. These are now given in full:

COVER LETTER TO THE NATIONAL SCIENCE FOUNDATION

MR-4.2
Dr. T. O. Jones, Head
Office of Antarctic Programs
National Science Foundation
1800 G Street, N. W.
Washington, D. C., 20006

Dear Dr. Jones:

We are submitting herewith ten (10) copies of a proposal for a grant in the amount of $50,910 for fiscal year 1966 from the National Science Foundation entitled "Study of the Lower Atmosphere above the High Antarctic Plateau." This proposal is for the support of a study, including field investigations, to be conducted by the

Polar Meteorology Branch of the Atmospheric Analysis laboratory, U. S. Weather Bureau. The Polar Meteorology Branch is under the direct supervision of Mr. William S. Weyant, Head of the Branch, and under the overall direction of the Director, Meteorological Research. Dr. Sidney Teweles, Director, Atmospheric Analysis Laboratory, has been designated Principle Investigator. An estimate of the possible cost of the program beyond fiscal year 1966 is also included with the proposal.

Sincerely yours,
Jerome Spar, Director
Meteorological Research

cc: Dr. Crary, Dr. Teweles, Mr. Weyant

Draft Proposal for Grant from the National Science Foundation

A Name and Address of Institution

Office of Meteorological Research
U. S. Weather Bureau
Washington, D. C., 20025

Principal Investigator:
Dr. Sidney J. Teweles, Director
Atmospheric Analysis Laboratory

B Title of Proposed Research
Study of the Lower Atmosphere above the High Antarctic Plateau.

C. Desired Starting Date of the Research
1 July 1965

D. Time Period for which Support is Requested
1 July 1965 to 30 June 1969 (Two Operational Years)

E. Description of Proposed Research

1. The proposed research program encompasses two intimately related major investigations designed to provide detailed information on the vertical structure of the fields of wind, temperature and radiation flux in the first three kilometers of the atmosphere at the projected high plateau site at 80 ° S., 25 ° E. One portion of the program is an investigation of the "great Antarctic inversion" as suggested by Drs. Lettau and Schwerdtfeger of the University of Wisconsin. The purpose of this portion of the study is to delineate the detailed structure of the inversion and its temporal and spatial variations

in order to examine and outline the various causative factors and their relationships. This will involve sounding the first three kilometers of the atmosphere during the dark period using slowly rising balloons instrumented to obtain temperatures, radiative fluxes and, if possible, humidities from the levels through which they rise and, by theodolite tracking, winds from these levels. The other major portion of the program is a micrometeorological study to provide continuous information on winds, temperatures, and incoming and outgoing radiation, both long- and shortwave, from several levels on a suitably instrumented 100-ft. tower. A study will be made of the temperature and wind profiles in continuation of a study previously made at Little America V and Amundsen-Scott Station. This will be supplemented by a determination of the surface and low level radiation budgets. Besides carrying out these two major programs, the meteorological personnel would: take and record synoptic surface observations at six-hourly intervals, and transmit these observations for operational use: measure subsurface snow temperatures to obtain the amplitude, damping and phase shift with depth of the annual temperature wave in the upper layers of the snow and the magnitude of the heat storage term in the seasonal heat budget; and, if feasible, carry out a suitably designed experiment to determine evaporation (sublimation) rates from the snow surface at this unique site.

2. The "great Antarctic inversion" study. This study is based on suggestions contained in a memorandum from Drs. Lettau and Schwerdtfeger of the University of Wisconsin to Dr. Crary of the National Science Foundation. The field program consists of a series of 10 to 12 multiple balloon ascents at intervals through the dark season. Each group of soundings will cover a period of 12 hours, with five or six balloons released serially at intervals of about two hours. Each helium-filled balloon will bear aloft a radiometersonde-radiosonde instrument, requiring about 45 minutes to traverse the lower three kilometers of the atmosphere. Double-theodolite tracking of the balloons will provide information on the winds in this atmospheric layer, while temperature, pressure, radiative flux and possibly humidity will be transmitted to a surface recorder by the balloon-borne instrument.

3. The micrometeorological program. Data will be continuously recorded from wind, temperature and radiation sensors mounted at specific levels on a mast about 100 feet high. The temperature will be measured by shielded thermohms or thermocouples; the wind by vane-mounted anemometers; total global and net radiation by Funk radiometers; direct and reflected solar radiation, during the sunlit period only, by Kipp instruments (including filters). The Weather Bureau will furnish a meteorologist to carry out the field portion of this program during the first year only (1966).

4. Supplementary Programs. Snow temperature profiles to a depth of about 12

meters will be obtained from buried, continuously-recording thermocouples. These data will be used to determine the change with depth of the amplitude and phase of the annual temperature wave in the upper layers of the snow, and the seasonal heat storage in those layers. By measurement of the diminution (or augmentation) of mass with time of carefully weighed surface snow samples exposed to ambient conditions, an assessment of the amount of sublimation (or deposition) occurring at this site will be made.

F. Personnel

1. Field Staff

Position	Grade	1966	1967	1968	Total
Meteorologist	12	1	--	--	1
Meteorologist	9	1	1	—	2

2 Research Staff (Data Analysis)

Meteorologist	9	--	1	1	2
Totals		2	2	1	5

The overall control of the program will be vested in the Office of Meteorological Research, U. S. Weather Bureau. In 1966, one field meteorologist will have primary responsibility for the micrometeorology program; the second meteorologist will have primary responsibility for the inversion study, and conduct the supplementary studies. Both men will share the taking of the synoptic surface observations. Because of the small scientific staff winteringover at the station, it will be necessary for the meteorological personnel to assist in the work of other disciplines at times; by the same token, scientists from other disciplines will be called upon to help with the meteorology program when necessary.

G. Budget

Summary of Costs

Note 1: The budget does not include any expenditures for equipment or supplies in connection with the micrometeorological program.

Note 2: Costs listed under 1966 are those required for the first year's work; those listed under 1967 are funds required for expenditures during the second year and succeeding years.

a. Salaries - includes government contribution and allowances.

Field Staff	1966	1967	Total
1 GS-12 Meteorologist	$17,627	—	$17,627
1 GS-9 Meteorologist	13,592	—	13,592
1 GS-9 Meteorologis	—	13,592	13,592
Total	$31,219	13,592	44,811
Research Staff			
2 GS-9 Meteorologists	$—	16,626	16,626
Total salaries	$31,219	30,218	61,437

b. Permanent Equipment

Theodolites	$2,000	—	2,000
1 R/S receiver - recorder	2,800	—	2,800
Thermocouples and cable	1,000	—	1,000
Surface observational equipment not available as spares in Antarctica	250	—	250
Total equipment	$6,050	—	$6,050

c. Supplies and expendable

180 R/S including modification	$4,050	4,050	9,100
90 tanks helium (includes $20 per tank deposit)	1,575	1,575	3,150
180 600-gm. balloons	288	288	576
Balloon lights, chart paper, ink, etc.	300	300	300
Total expendable	$6,213	6,213	12,426

d. Data reduction and publication

$—	5,000	5,000

e. Travel - includes per diem, training, indoctrination, etc.

2,800	1,870	4,670

f.	Total direct costs	46,282	43,301	89,583
g.	Indirect costs			
	Support services	4,628	4,330	8,958
	Instrument inspection fee	43	43	86
h	Total costs	$50,953	47,674	98,627

End of NSF grant proposal from OMR.

The micrometeorology program was designed and directed by Paul Dalrymple. From Washington D. C. and in the field I would serve him for the establishment of his program on the high plateau of Antarctica. His grant proposal follows.

NAME AND ADDRESS OF INSTITUTION
U. S. Army Natick Laboratories
Natick, Massachusetts

NAME AND DEPARTMENT OF PRINCIPAL INVESTIGATOR
Paul C. Dalrymple
Head, Polar and Mountain Laboratory
Earth Sciences Division
U. S. Army Natick Laboratories
Natick, Massachusetts

ENDORSEMENTS [signed]

PAUL C. DALRYMPLE, Principal Investigator

PEVERIL MEIGS, Chief, Earth Sciences Division

WILLIAM C. F. MULLEN, Lt. Col., QMC, Comptroller

TITLE OF PROPOSED RESEARCH

East Antarctic Radiation Climatology

DESIRED STARTING DATE OF RESEARCH

1 October 1965

TIME PERIOD FOR WHICH SUPPORT IS REQUESTED

1 October 1965 - 30 September 1966

DESCRIPTION OF PROPOSED RESEARCH

Abstract

It is proposed that a radiation program be conducted on the austral summer traverse in East Antarctica from November 1965 through February 1966. This program will include measurements of direct solar, global short-wave, net, and total global radiation to be made on these days when the traverse has stopped for scientific measurements. The Chief Scientist, Office of Antarctic Programs, National Science Foundation, has indicated that approximately 25 such days will occur on the traverse. At the end of this traverse, the instrumentation used will be installed at the to-beconstructed camp in East Antarctica and will be left there for the duration of the camp. The principal investigator plans to conduct the radiation program on the traverse, return to the United States to analyze the summer data, and then make plans for a micrometeorological program at the new station for 1967.

Plan of the Work

The direct solar radiation (solar intensity) will be taken with a portable potentiometer and filters will be used to separate the radiant energy into reasonably well-defined spectral bands. The measurement of the solar intensity is well suited for instantaneous readings; all other measurements will be continuously recording. The instrumentation will be set up as soon as possible at each stop, and the data will be self-recording on three potentiometers equipped with mechanical integrators and readout tapes that will materially speed the data reduction program. The power for the instruments will be supplied by a portable generator. The portable generator proposed for use has a greater power output than is required by the instrumentation, but it is the smallest generator that has the characteristics (relatively stable cycling and good maintenance record) required for such a program.

Objective

Basically the main objective is to learn something about the summertime radiation climatology at the high elevations in East Antarctica. The proposed traverse is scheduled at the period of the year when the sun is at perihelion, and it is closer to the Antarctic at this time than to any other region. The route of the traverse is in the region of high elevation, and solar angles higher than those at the South Pole will be encountered at times. The insolation at the top of the atmosphere can be calculated, but the intensity at the surface of the earth has to be measured. Because of the large number of cloudless days expected in this “fair-weather” region, it is anticipated that there will be good opportunities to make detailed measurements of the turbidity of the atmosphere. It is possible that some solar constant work might be made.

The measurement of incoming solar radiation which is most generally useful is that of the total energy falling on a unit area of a horizontal surface. These measurements have been taken with some degree of accuracy in the Antarctic since the beginning of the IGY. However, the same cannot be said for measurements of net radiation. It is only in recent years that improved instrumentation for measuring net radiation has become available and has been tested satisfactorily in the polar regions. This instrumentation can also be adapted for measurements of the total global radiation. The measurements of these elements will aid in future computations of the heat budget of interior Antarctica and should help in the understanding of the energy exchanges at the snow-air interface. The computation of the albedo of the snow surfaces along the traverse will be computed for different meteorological conditions as well as for different solar angles. Comparison of these data will be made with measurements recently taken in a high mountainous region (Himalayas). One of the overall objectives of the summer traverse program is to determine the feasibility of conducting a radiation program on an oversnow traverse. All indications are that it can be done, and the results should show whether these measurements should be considered as standard measurements on future traverses.

Relation to Present State of Knowledge and Previous Work in the Field

There have been no known radiation measurements made between the Pole of Inaccessibility and the proposed site of the new station. Detailed observations have been taken over the past eight years at the South Pole station, which is approximately 1000 meters lower in elevation than most of the proposed traverse route. Additional radiation measurements have been taken at the U. S. S. R. stations of Vostok and Sovietskaya. However, these stations are several hundred miles from the closest point on the proposed traverse. The instrumentation proposed for use is considered to be not only good to excellent, but has also proven satisfactory in the Arctic. It is felt that this program will thus be a continuation of much of the fine work which the Weather Bureau, and particularly Mr. Kirby Hanson, has already initiated on the South Polar Plateau. The program has been modeled after one conducted at the Arctic Research Laboratory, Point Barrow, Alaska, by the University of Washington under Project HUSKY. The proposed instrumentation, for the most part, is an exact duplicate of that used so successfully by the University of Washington in its 1964 program.

FACILITIES

Modern electronic facilities, including a GE-225 digital computer and its peripheral equipment, are available in the Data Analysis office, U. S. Army Natick Laboratories (NLABS), where a complement of 15 people, including 5 mathematical programmers, provide data processing services and statistical advice. A broad program of environmental research is underway within the Earth Sciences Division by a 37- member staff which includes 19 physical geographers and 6 meteorologists. Polar studies in meteorology-micrometeorology and climatology are conducted by members of its Polar & Mountain Laboratory, of which the undersigned serves as head. Excellent facilities are available within the ESD Cartographic Laboratory for the preparation of maps and graphic material; reports are published in an NLABS reproduction unit using up-to-date photographic and printing techniques.

PERSONNEL

Dr. Paul C. Dalrymple, Meteorologist, Principal Investigator
Miss Sarah H. Wollaston, Micrometeorologist, Research Assistant
Mrs. Leonora Kundla, Statistical Clerk
Dr. Heinz H. Lettau, Micrometeorologist, Expert (consultant) to NLABS
Mr. A. J. Drummond, Radiation Specialist (NLABS contractor)

Biographical Sketches

The Principal Investigator, Dr. Paul C. Dalrymple, is Head, Polar and Mountain Laboratory, Earth Sciences Division, U. S. Army Natick Laboratories, Natick Massachusetts. He conducted micrometeorological programs of temperature and wind profiles at Little America V in 1957 and at the South Pole in 1958. In the fall of 1962 he was on the Greenland Icecap at Dye 2 where he conducted a program relating types of snow surfaces to different meteorological parameters. The summer of 1964 was spent on the airborne phase of the International Indian Ocean Expedition working in marine meteorology. He was formerly employed at Blue Hill Observatory, Mt. Washington Observatory, Woods Hole Oceanographic Institution, and by the U. S. Weather Bureau. He has a bachelor’s degree from Clark University, a master’s degree from Syracuse University, and a doctoral degree from Boston University; all degree work is in physical geography. He also studied meteorology and climatology at M. I. T.

Miss Sarah Wollaston has been associated with the Polar and Mountain Laboratory since 1960. She has worked on the analysis of the Little America V and South Pole micrometeorological data under the guidance of Dr. Heinz H. Lettau. Miss Wollaston formerly worked for Harvard University at Blue Hill Observatory for 16 years. Upon the death of its director, Dr. Charles F. Brooks, she returned to school and obtained her master’s degree at Penn State University. Her thesis was on the nocturnal temperature inversions at the Brookhaven national laboratories in Upton Long Island.

Dr. Heinz H. Lettau is one of the world’s leading micrometeorologists, and has become interested in polar meteorology-micrometeorology through his work on the IGY data. He has over one hundred publications in meteorology to his credit and has served recently as Chairman of the Meteorology Department, University of Wisconsin.

BUDGET

Salaries	
Paul C. Dalrymple, Principle Investigator,GS-13,	
9 months at $1111 per month	$9999
Sarah H. Wollaston, Research Assistant, GS-11,	
4 months at $795 per month	3180
Leonora Kundla, Statistical Clerk, GS-5,	
2 months at $430 per month	860
Heinz H. Lettau, Micrometeorological Expert,	
20 days at $75.00 per day	1500
Total Salaries	$15539
Permanent Equipment	
Kipp Actinometer	$1250
Kipp Solarimeter	260
SCIRO (Funk) Radiometer	750
SCIRO (Funk) Radiometer	750
Georgi Radiometer	1562
L&N Speedomax H Recording Potentiometer,	
Range -25 to +25 mv	1210
Range 0 to 10 mv	1210
Range -10 to +30 mv	1273
3 Mechanical GE Integrators for	
L&N Recorders ($414)	1242
Mervyn Recorder	983
Recording Millivoltmeter	745
Total	$11235
Expendable Equipment	
3 KW Generator	705
Spare parts for L&N’s	315
L&N Charts (2-year supply for 3 recorders)	120
GE Charts (2-year supply for 3 integrators)	46
Total	$1186
Total Equipment	12421

Travel

One round-trip, Madison, Wisc., to Natick, Mass	$175
One round-trip, Natick, Mass., to Skyview, Va	100
(per diem included in above)	
Total Travel	275
Publication Costs	0
Other Direct Costs	0
Indirect Costs (20% of Total Salaries)	3108
TOTAL COSTS	$31343

Other Sponsors - None

The budget submitted is for the radiation instrumentation for the 65-66 summer traverse program as well as for the 1966 and 1967 winters. Analysis time is submitted for the summer traverse program. Because of the uncertainty as to who will conduct the 1966 winteringover program, the budget for the analyses of these data is omitted from this proposal. It is anticipated that the principal investigator on this proposal may submit another proposal for a winteringover program in micrometeorology for 1967; at that time, any data analysis required for the 1966 data will be included.

End of NSF grant proposal from NLABS.

More personal, my job description:

Position Description - Research Meteorologist, GS-9

Research situation or assignment:

The incumbent conducts meteorological research on the causes, structure and variations of the temperature inversion in the lower three kilometers of the atmosphere over the central Antarctic plateau. This will include a minimum of twelve months with the observational field program in Antarctica to obtain the basic data required for the study. After the incumbent's return to the U. S. he will use this data and additional data from the U. S. Plateau Station as it becomes available. He may be required to assist other professional research meteorologists in the Polar Meteorology Group or perform other specific assigned tasks related to research investigations of the Antarctic atmosphere and its behavior. While in

Antarctica he may be required to assist the senior research meteorologist and other research scientists at the station in the performance of their programs.

Supervision received:

The incumbent will be under the direct supervision of the Supervisory Research Meteorologist and the general supervision of the Chief of the Polar Meteorology Research Group. In Antarctica he will be under the direct temporary supervision of the senior research meteorologist at the station. His work will be subject to review by senior research meteorologists of the Group in order to provide guidance and suggestions to further his research objectives and personal professional development.

Guidelines and Originality:

The incumbent must be capable of understanding and using the results of other research on or relating to his problem. He will be required to prepare a complete research plan which, in fulfillment, will lead to publication of the results of his investigations as a professional paper in a recognized professional journal.

Qualifications:

The incumbent performs responsible professional work of moderate difficulty requiring a thorough general knowledge of meteorology. He must be familiar with past work on the lower atmosphere in polar regions and have first-hand experience in obtaining data necessary for his research problem through conducting a field research program. He must have a Master's degree in meteorology and at least one year of experience.

Supervision over the work of others:

The incumbent will normally work alone or in cooperation with a meteorological technician assigned to assist him in his research work by the Supervising Meteorologist.

End of Job Description

A tavern near the corner of Wisconsin Avenue and "M" Street Northwest and the Bavarian Caverns- the soul home of soul jazz- on 13 th Street N. W. rounded out an initiation into a hectic and yet genteel and leisurely life of research.

Washington Monument, Washington D.C.

CHAPTER 4
Spring Training

Earning a living by doing research is the strangest kind of employment. I'm not sure growing up in a retired immigrant laborer's household in the slums of an industrial town provided the best image as to how to act, work, and behave in such a position. Although the University taught nothing but research and even seemed to ridicule the routine jobs like daily weather forecasting or pilot briefing, it likewise failed at training me for pure research as a way of life on my own. At school all graduate students simply followed their professor. Each of us was trained to believe our school, our professor, and our methods were the very best in the world at the time. Suddenly my task was to learn about everybody else besides Lettau and Schwerdtfeger. If I had been hired to give a noneastern view coming from a Midwestern university, the tables were reversed on me. I had an immense amount of reading to do about the research of the people from these eastern schools in order to reach the starting datum plane from which to begin my research.

Going to work every day to read and to argue was not physical, and my first pay check, incredibly too large, gave me a guilty conscience. I was paid to do what I loved - learning about the Antarctic and the weather over its icecap. I was paid for reading. So strange! Many days I went home with a headache, with confusion over someone's theory, and a stack of more journals to pore over the remaining night and into the dawning morning. But these were not heavy lifting, nor back breaking labor, nor boring pursuit of the pace of a machine. The pay was so much more than the hard workers, who earned their wages, who I knew from Second and Wright Street in Milwaukee.

A measure of the difficulty I had with accepting my new way of life as a research meteorologist was my inability to explain to relatives and friends what my new job was all about. To some extent that inability remains even to this day as I write this story to my children nearly thirty years after the story. The research story I, in fact, learned. The many people with whom I mingle and serve today have that same inability to listen and understand the awesome councils of science into which I drifted into and out of. The single icon understandable to all is the fact that this research job took me to ANTARCTICA. The great white continent indeed was the ever present lure, the nearly insurmountable threat to achievement, the inspiration to new thoughts, and the fulfilled dream of my childhood.

In all three documents - my job description, the grant proposal of OMR, and the grant proposal of NLABS - the overwhelming purpose was to make a human appearance on top of the unexplored ice dome of Antarctica. This was not of the same scope as the expedition of Columbus. For Antarctica, Capt. James Cook's circumnavigation of the Antarctic region or Capt. Charles Wilkes' continent confirming expedition would be equivalent to such an exploring adventure. The exploration of the high plateau of Antarctica was perhaps equivalent to Francisco Vasquez De

Coronado's expedition that penetrated onto the prairie of central Kansas in 1541.

Exploration and all the adventure that goes with it is a lure just about anyone with a touch of historical interest can understand. But that shallow understanding of what I attempted to do, over the years has become almost hurtful. I cringe in mental anguish when someone introduces me as one who has gone to Antarctica. It is the discovery of the inversion winds that took more than five years of research that is the achievement of my life. This lure of scientific discovery is a bit more difficult to grasp. And so many of my friends and colleagues over the years never did. To seek out those special conditions that form the Great Temperature Inversion and discover new insight as to its structure and formation was my assignment. This was what the high monetary reward was all about. Discovery demanded the development of special equipment or the finding of new ways to use standard equipment. Finally mathematical models needed development with computer animations for the best human interpretation of these very complex structures.

The grant proposals followed quite exactly the requests of Prof. Lettau and Prof. Schwerdtfeger. A temperature inversion occurs routinely over cold ground on a clear night just about anywhere in the world. Antarctica, as a test tube for meteorological theories, provided a twenty-four hour night, uniform terrain, and extremes of the inversion. Scientific exploration works best with extremes. Extremes give views scientists' otherwise do not see. This is why going to a place so far away was so important in spite of the great cost of travel and the cost of exposure to the severe elements of the polar winter. The biggest problem was going to be the severity of the cold on the equipment more than on the observer who had the opportunity to seek shelter in the camp.

I was surprised at the planned involvement for me with Paul Dalrymple's research from the Natick Army Labs. I never expected to be involved in this beginning work on the most elaborate, comprehensive, and precise polar study of solar radiation and micrometeorology since the IGY. I would be at the critical starting point of the development of this program. As soon as my preliminary studies were complete I needed to hit the road to coordinate the three principle research offices, OMR, NLABS, and UW-Madison.

By pondering all this, my thoughts drew to fear. These programs no longer were about getting an "A" or a "B". These programs had no answer to look up in a book. If successful, these programs would give pictures of polar weather and maybe even pictures of weather extending to many other places. That thought was so exciting that for many weeks I went nearly sleepless, reading journals, eating waffles at an all night restaurant on Wisconsin Ave. in Georgetown, and reading more.

There seemed to be no end to the required reading. Readings about inversions. Readings about solar radiation exchanges with many surfaces. Readings about instruments, errors of instruments, modification of instruments and designs of innovative instruments. Readings about the Arctic, the Antarctic, and even about the polar cap of Mars. Some of the authors on whom I took notes included:

Aamot, Angell, Anisimov, Armendariz, Arnold, Artemyev, Astapenko, Bardin, Barkov, Barnett, Becker, Bellamy, Bilello, Blackadar, Bonn, Brockamp, Bryson, Budyko, Bull, Businger, Butler, Buttenberg, Cadle, Camnitz, Campbell, Carmein, Cartwright, Cave, Chelchowski, Clarkson, Colson, Cox, Crozaz, Dalrymple, Darkow, Davidson, Davitaia, DeBreuck, DeJong, Deland, Dergach, Deryapa, Dines, Dobosi, Dobryshman, Dolganov, Dolgin, Drummond, Dubovskoy, Dubrovin, Dukhanin, Duncan, Dyer, Emmanuel, Engler, Federer, Federov, Fichtl, Fiore, Fischer, Fletcher, Flowers, Fogle, Frank, Frankenberger, Franssila, Frost, Frostman, Galtsov, Garnier, Gentry, Gilchrist, Giles, Giovinetto, Goltsberg, Gotaas, Gow, Grigoryev, Gutman, Gwendolyn, Hanson, Haraguchi, Harrison, Henry, Hickey, Hirling, Hoeber, Hogue, Hoinkes, Holdsworth, Islitzer, Ivanov, James, Jex, Johnson, Kangos, Kapitsa, Knapp, Koblents, Korotkevich, Koshelenko, Kotlyakov, Kovrova, Kreem, Kruchinin, Ku, Kucherov, M. Kuhn, P. Kuhn, Kupetskiy, Kutzbach, Laikhtman, Landon, Lansberg, Laptev, Law, Lazarev, Lea, Ledenev, Lenschow, Leontyev, B. Lettau, H. Lettau, Lhermitte, Lipovka, Lodge, Loewe, Losev, Ludlam, Ludwig, Luers, MacCready, Mahrt, Maksimov, Martin, Mather, McCloskey, McFadden, McVehil, Meroney, Miller, Morachevskii, Moreland, Morris, Müller, Murayama, Murrow, Nagata, Nagel, Newstein, Nikandrov, Nitzschke, Obukhov, Ohmura, Orlenko, Orvig, Ostapoff, Paddock, Panofsky, Pavlov, Peters, Petrov, Picciotto, Popham, Predoehl, Radok, Rakipova, Raynor, Reifferscheid, Rider, Roberts, Robin, Robinson, Rogers, Rubin, Rubinstein, Rush, Rusin, Sanders, Sauer, Savonichev, Schaefer, Scholes, Schwerdtfeger, Semenov, Sergeyeva, Shamis, Shen, Sherr, Shmidt, Shnaidman, Singer, Slade, Smirnov, Smith, Sokolov, Spano, Sparkman, Spohn, Staley, Stearns, Steiger, Sterns, Sternzat, Stonehouse, Stremikis, Stroschein, Suomi, Taft, Taljaard, Tanner, Tarakanov, Tauber, Thyer, Timofeev, Tkachenko, Treshnikov, Tseltin, VanLoon, Venkateswaran, Viebrock, Villmann, Vinje, Vittozzi, Vonderhaar, Vorontsov, Vowinckel, Wahl, Wait, Walford, Wark, Weertman, Weller, Weyant, White, Wollaston, Yeh, Zabrodskii, Zhdanov, Zigrossi, and Zverenka.

Many journals specific to my research topic had to be digested. Among them were:

Antarctic Journal of the United States
Antarctic Record
Arctic Scientific Research Institute Publications
Bulletin of the American Meteorological Society
Canadian Geophysical Bulletin
Climatological Data for Antarctic Stations
Climatological Data for Arctic Stations
Japan Meteorological Agency Reports
Journal of Applied Meteorology
Journal of Meteorology
Journal of the Atmospheric Sciences
Polar News-Japan Polar Research Association
Polar Record, Journal of the Scott Polar Research Institute
Reports of the National Center for Air Pollution Control
Soviet Antarctic Expedition Reports
U. S. Antarctic Research Program

And maps had to be nearly committed to memory. My old reliables included:

Australian Map of Antarctica
USAF Antarctic Navigation and Planning Chart
USSR Map of Antarctica.

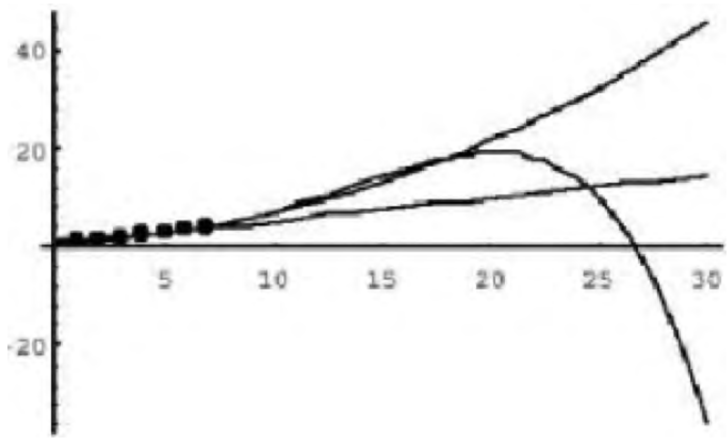
I quickly learned that by working for Polar Met I was one of only six professional meteorologists directly responsible for polar studies for and under the control of the Weather Bureau and later ESSA. That meant serving in an informational capacity where I was expected to provide detailed information to any and all who might ask. Even though my research dealt primarily with the temperature inversion, requests came for information and I was expected to provide advice for all aspects of the polar regions and weather information from energies penetrating deep into the ice core or the frozen ocean to observations of polar noctilucent clouds high above the stratosphere. The U. S. Navy would request emergency information about the capability to land on the sea ice of an uncharted region of the polar ocean. NASA was vitally interested in our view of how we believed ice crystals on Mars might be forming. Many of these minor research projects, unfunded, regularly took a person away from the assigned task. Yet, when we answered these questions, a payoff came in unprecedented cooperation between the many agencies for years to come. I also discovered that during the interruptions the most tantalizing and unexpected explanations of nature were found through the interdisciplinary exchange.

Through this literature survey I noted the large number of Soviet scientists active in the Antarctic. The works of Astapenko and Rusin had to be digested. Mort Rubin continually maintained communication with the Soviet scientists and frequently brought significant publications to our attention at Polar Met. My college Russian came in handy. Even though I considered the study of this difficult language a real burden, to be able to read the technical jargon and interpret formulas and graphs was easier having had those eight credits of Russian.

By reading and translating on my own I could beat the Israeli translating teams serving our government by as much as a year from the publication date. In the publish or perish world that I was now a part of that year was important lest a competitive researcher achieved publication before I did. Not being very aggressive, I was beaten to publication more than once. It’s like losing a championship game. Indeed to play at the championship levels is an honor, but . . . ! If you’re beaten to publication all that is left for you to do is to write that you also can confirm what someone else has discovered.

After six years of facing college classroom demands and using textbooks, this immersion in the journals and written reports I found to be a very disconnected way to learn. Articles on the inversion that I read in preparation to establish this program of research on the high plateau of the Antarctic included articles about inversions in the tropics as well as in the polar regions. Wind under the canopy of trees in the rain forests was of value. Some reading came from in-house publications of the many government agencies, military publications such as a report from the White Sands Missile Range, reports of an unclassified nature as well as secret documents. Some material could be acquired only by interviewing a military scientist with information given out only on a need to know basis.

What were simple or at least straight forward equations now all had to be revised for computer applications. Again the military led the way. Where the Weather Bureau scientists used, as an example, the Smithsonian Meteorological Tables, all such tables had to be reduced to computer usable formulas. At the forefront of discovery and research, where there were no answers, many of the tables were strictly empirical and derived equations based on theory had not yet been discovered. This fudging by forcing equations to fit, after being so carefully trained by Prof. Lettau, who cautioned about mere empirical connections, I found to be most unsettling. It turned out that Prof. Lettau used such empirical tricks as well, but as a student of his I never knew it.

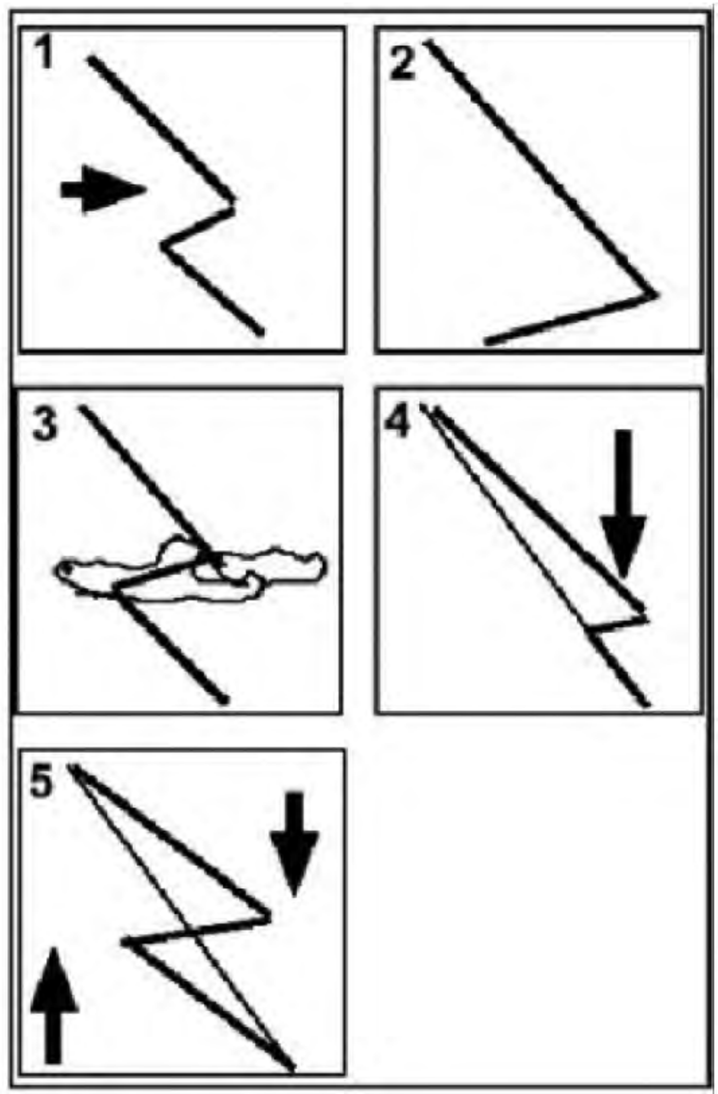


His warning still has a powerful imprint. “Ten new theories about any given subject are generated every year. Only the one that is connected to nature theoretically derived from first principles of nature such as the laws of conservation of energy has the potential of correctly describing nature.” In a briefing I had at Langley by a science expert from the CIA on Soviet science, I learned Soviet science was primarily little more than this empirical curve fitting. In the cold war race to lead in any and everything the Soviets believed correlations emerged most rapidly by these empirical methods. The little graph displayed here shows this problem. The dots display real data. Three different “laws” in equation form as graphed exactly fit. Nevertheless if a scientist followed either one he or she would arrive at very different predictions.

Reading several hundred authors, many of whom wrote multiple papers on the same topics, all disconnected as each scientist sought in academic freedom what alone interested him, was simply overwhelming. Concerning temperature inversions, I learned that there were at least five different kinds. I had to begin with the normal atmosphere in its simplified form. Yet nothing about the atmosphere was simple. It was a gas, a mixture of gases. Some of these gases were interacting in very complex chemical ways that included energy exchanges. I would ignore these. One of the gases, being water vapor, underwent several phase changes frequently, giving very large energy changes that simply could not be ignored. Once on the Ice, I realized these energies had to be ignored anyway.

As a child I learned that gases filled their container. The atmosphere had no cover to its container but is held by gravity on a spinning globe. As a result very complex relationships developed between height and the density of air as well as its pressure and temperature as the air thinned to nearly nothing at the top of the atmosphere. In fact, all the undergraduate laws for gases learned in chemistry were inadequate in this open beaker of air without laboratory thermostats. Instead, in its simplest adiabatic (non-heating) state, which is not simple in the least, the interrelationships between temperature, pressure, volume, and the amount of molecular mixture present yield a lapse rate (change of temperature with height) of about -5.4 Fahrenheit degrees per one thousand feet (-9.8 C°/Km). This means at normal mid-latitudes near sea level the temperature is 5.4 F ° cooler one thousand feet above the observer on the ground. This cooling with height above the ground is normal.

An inversion is the opposite. In a temperature inversion the air becomes warmer with height for a myriad of reasons. I will list five here. Each square represents a graph showing the relationship of temperature with height where temperature is the horizontal axis and height is the vertical axis. The first square shows an inversion aloft caused by the horizontal advection of warm air. This might occur when a faster moving warm air mass moves from behind a cold air mass and rides over it slightly.



The second square shows an inversion on the surface of the ground. The ground and the air immediately above the ground loses much heat through radiative cooling as happens most frequently during clear cold nights. The infrared radiation or heat at and near the surface escapes the atmosphere without being reabsorbed by clouds or moisture. The result is that the surface layer is losing heat faster than it is gaining it and it gets colder than the air above it. One would be tempted to say that the warm air above it is hotter and since hot air rises it stays there but what is correct in a beaker in the closed laboratory is not true in the open atmosphere. The warmer air through the complex interplay between temperature, density, and pressure is at equilibrium and without heat loss so it stays put.

The third square shows an inversion caused by clouds. Most often the heat given up by the condensation of water vapor to form the cloud is considerably large and warms the air above the cloud. The interface between the two masses of air, air below and air above the cloud, shows the discontinuity as an inversion.

When air aloft is forced to sink, such as air moving over a mountain range sinks on the leeward side, it warms adiabatically. In square number four, the thin line shows how the temperature changed with height before such a sinking. As the air sinks, if its temperature, pressure, and density changes without heat being added, the temperature naturally rises. The very lowest level of air may not experience the sinking that the upper layer of air did, thus its temperatures remain cooler. An inversion between the stagnant surface air and the sinking air aloft occurs and marks the discontinuity.

In the last square, number five, I show a thin line that might represent a temperature profile before the formation of another inversion aloft. In the case of very turbulent mixing, where the air on the ground is carried aloft and the air aloft is rapidly pulled down, an inversion frequently forms. Again the explanation without additional heating occurring from another source is that air forced to rise adiabatically will get cooler according to the interplay between pressure, temperature, and density. Air aloft forced to sink without heating from another source will rise in temperature by the same interplay of temperature, pressure, and density. An inversion then forms in between.

The inversion of my pursuit in the Antarctic, which Lettau and Schwerdtfeger labeled the Great Inversion, was of the radiational cooling type in square number two. At the small station planned as Plateau Station many balloon launchings were not possible. I had been told and I planned to take measure of the Great Inversion by selecting the time of ideal inversions and concentrating on the changes by launching a series of balloons each carrying a radiometersonde aloft as close in time as possible for the periods of changing and ideal conditions. I planned several series of balloon ascents after the final sunset to observe the growth of the inversion with the final absence of the sun. Maximum radiational losses probably would occur then.

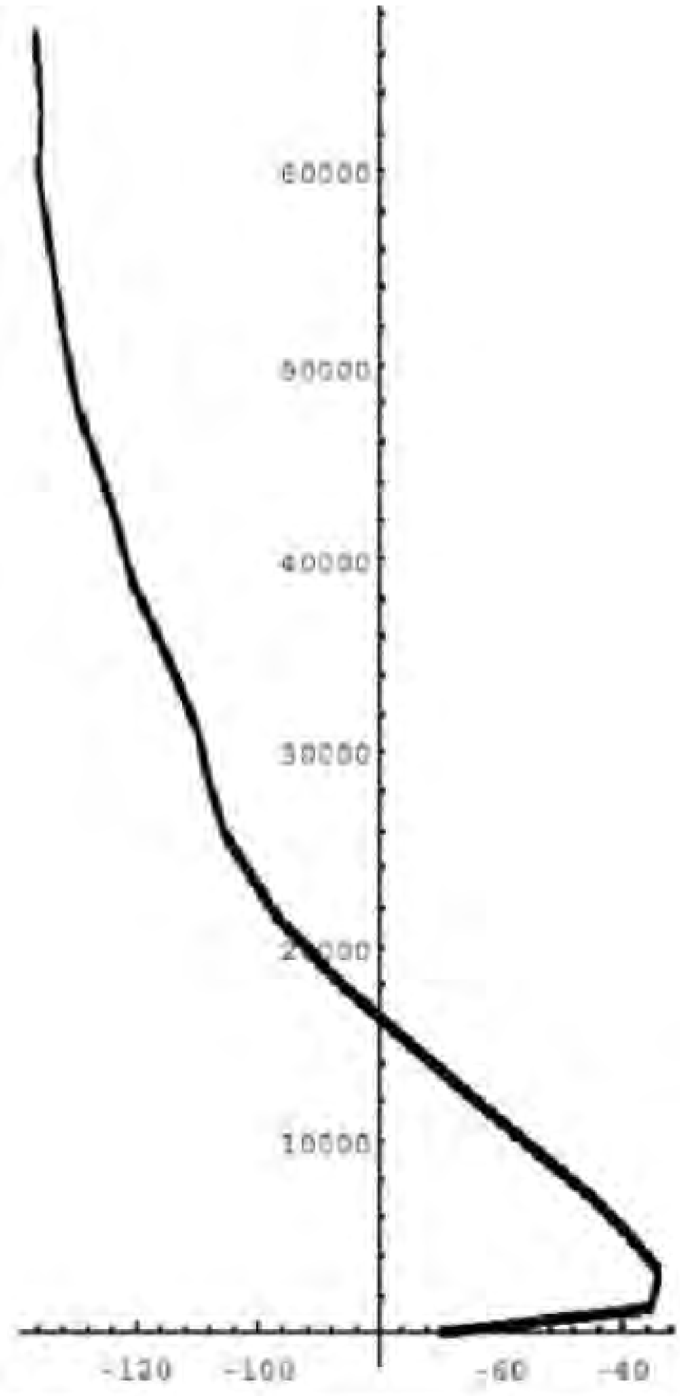
Serial launches near the first sunrise would be another good fixed time easily identified as a time for the Great Inversion to be monitored as the solar heating would break it up. The high polar plateau would also offer many times of extreme cold when the Great Inversion would be at its greatest.

But these other types of inversions should also be present in Antarctica. Weather systems have been known to penetrate across the extremely high plateau. With these invasions of warm air, inversions from horizontal advection and from violent mixing should occur. These times also needed to be reserved for serial balloon launches of radiometersondes. Clouds were known to radiate considerable heat as they migrated across the severe cold icecap. These cloud invasions with storms or without storms were also to be monitored by multiple balloon launchings.

Still other times for such serial balloon ascents were times of increased surface winds or sudden deceased surface winds. These changing weather patterns hopefully would be predicted by men at the International Antarctic Analysis Center (IAAC) in Melbourne, Australia. Mort Rubin had promised to seek out that help and learn how I might be informed such a great distance away. These were my plans. My crash course of disconnected journal readings was beginning to take on meaning with these plans.

Ed Flowers was the best of the professional staff for my personal development. Reviewing my criterion for launching balloons to monitor temperature inversions, Ed told me that unless I had confirmed cooperation in writing from IAAC, he doubted if they would be concerned with my research interests. What about the U. S. Navy at McMurdo? Ed again doubted cooperation. Besides, Plateau Station's position planned on the high plateau in East Antarctica was right under the most intense aurora that usually disrupted communication. Ed Flowers felt that all my balloons should be reserved for the radiational cooling formation of inversions. These indeed were at the center of interest of the proposals from Lettau and Schwerdtfeger.

Kirby Hanson did an intensive study of the inversion at Amundsen-Scott Station (South Pole) using standard equipment in the winter of 1958, the last part of the IGY. Kirby launched a Rawinsonde twice each day, once at 0000 Z and once at 1200 Z. (At the South Pole there exists no meaningful local standard time. Time, Zulu, is the time of Greenwich Mean Time.) A Rawinsonde was a standard radiosonde that monitored temperature, pressure, and humidity. The RAWIN part of the name stood for RAdar WINd since a radar tracking antenna followed the balloon ascent and its signal then was computerized to read out the wind pushing the balloon and altitude of the balloon's instrument package. At Plateau I would not have the luxury of RAWIN. It demanded too much electricity. I would be tracking balloons manually using theodolites and would need the assistance of a second meteorologist. He would be my senior and take responsibility of the radiation programs from NLABS. That person probably would be Dalrymple as the lure of the Antarctic was in his blood.



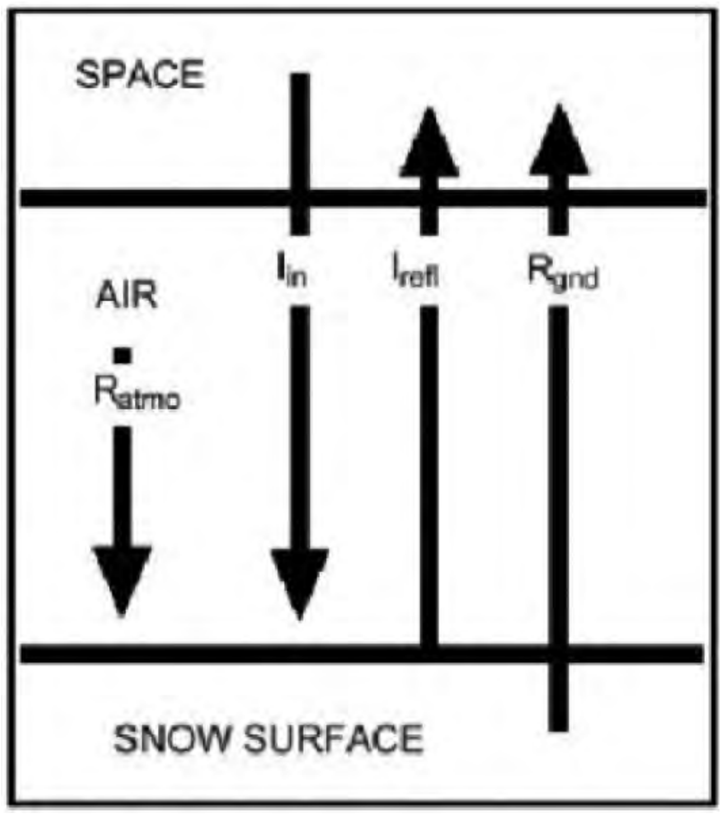
Amundsen-Scott Station
(South Pole)
Latitude 90° South
Altitude 9,800 feet (2800 metres)
Average for July, 1964
Abscissa: Temperature (°F)
Ordinate: Height above the snow (feet)

The latest standard Rawinsonde data was from the year 1964. By 1964, big federal dollars of IGY were no longer were available and only one rawinsonde launch was made per day. The inversion in its strongest form occurs during the polar night so that the time becomes less important with midnight having the same darkness as noon. An average composite of all rawinsondes launched during the month of July in 1964 is given in a graph here. But the inversion, though a dominant feature, is hardly seen with detail.

The support staff of Polar Met (I think Gertrude Sohns) found Kirby's data. Kirby approached the problem from its fundamental causing principle - radiational cooling. Kirby recorded the radiation balance day-by-day for his year of the IGY.

The sole source of energy for the earth is ultimately the sun. Thus a radiation balance study must begin with solar radiation. Meteorologists of IGY vintage and many years following considered such radiation to be in the form of waves. This wave concept has become outdated. Quantum physics, which rejects waves, today can no longer be ignored as it was. However the process of circumventing quantum physics, particle theory of radiation, could be justified along the same track of thinking that one can learn a lot about the effects of water waves even though most of us know those waves on the beach are really a composite of combined action of billions and billions of H2O molecules. Thus an outdated system of thought remains very much alive even as I write. As waves carry energy from the sun, that energy comes as short waves, some of which our eyes detect as visible light. The first form of this energy Kirby identified and measured as incoming solar (sun + sky) radiation, Iin, incident on a horizontal surface near the snow surface. We see the brilliant sun light but it looks yellow because some of the energy is scattered as it comes through the air. The scattered energy we see as blue coinciding with those waves of energy that are kicked around by the air molecules. On a planet with different gases the sky would appear a different color.

In the Antarctic on fresh snow very much of the short wave radiation is reflected right back into space. The blue and other scattered energies are also proportionately reflected back into space. Kirby identified these energies as solar (sun + sky) radiation, Irefl , reflected from the snow surface. Now, for the South Pole in July neither of these two forms of short wave radiation is present.



Once the earth receives the short wave radiation, the energy is absorbed and reradiated to space as long wave radiation. As energy, these long waves must balance exactly as equal amounts of energy to the energy from the short waves or else the planet would literally burn up. The air over Antarctica holds considerable heat in this long wave radiation form and that is radiated downward to the snow surface. Kirby called it atmospheric (terrestrial) radiation, Ratmo, incident on a horizontal surface near the snow surface. During the polar winter night this is the chief source of heat energy. It obviously comes as secondary energy initially received from the sun at nonpolar latitudes, absorbed and converted to convective energies before it invaded the Antarctic.

The last form of long wave radiation that Kirby identified was black body radiation, Rgnd, from the snow surface. Everything, including very cold snow, has received some heat energy in the form of short and/or long wave radiation. So it does not burn up, it also radiates long wave radiation. This the cold snow continually does in winter or summer.

For July in 1958, Kirby measured these four forms of radiation, really only the effective last two, both long wave forms of radiation. Over a very long time over all seasons the four forms of radiation would algebraically add to zero. The short wave radiation forms are not present in the polar night. On clear nights (24 hours long) however, more black body radiation is radiating out of the snow than is coming in from the long wave radiation of the atmosphere. Kirby Hanson measured that loss as -56 Langley's per day (calories per square centimetre per day) or -27 watts per square metre, the radiation balance (net flux) through a horizontal surface near the snow surface.

It is this steady net loss of energy, where the air layer near the snow surface loses energy without gaining more, that causes the formation of the inversion. Over the long polar night only storms bring in new quantities of energy. Without them the inversion builds and builds. Taking the average results of all of Kirby's semi-daily rawinsonde launches during the month of July at South Pole in 1958 presented an inversion with a surface temperature of -67 ° F (-55 ° C) and a maximum temperature of -38 ° F (-39 ° C) at an altitude of 1986 feet (605 metres) above the surface.

That is an inversion of nearly thirty Fahrenheit degrees in two thousand feet. Incredible! A typical inversion over the Midwest farm fields rarely measures more than five or six Fahrenheit degrees. On the high plateau of Antarctica the Great Inversion was expected to be even stronger. Kirby measured an extreme inversion on 31 August 1958 at 1200 Z (still the polar night without the sun at the South Pole) with a surface temperature of -96.9 ° F (-71.6 ° C) and a maximum temperature of -42.3 ° F (-41.3 ° C) at an altitude of 2490 feet (760 metres) above the surface, an inversion of nearly 55 F ° of temperature change.

The height of inversions in the Antarctic of 2000 to 3000 feet suddenly struck me with a little fear. A typical radiosonde launch flew through the inversion at about a thousand feet per minute. Schwerdtfeger's hope of slow rising balloons remaining in the inversion for thirty to sixty minutes suddenly was an uncertainty. Before my involvement with this project, nothing had been done as far as designing a new system for carrying the instrument package more slowly. My only hope was to under inflate the standard balloon so that a lack of helium would give the balloon a very weak buoyancy. Time would tell this outcome. I started to appreciate Dalrymple's view of being second at a new research station. In all of Kirby's launches the top of the inversion was the first data point of the record above the snow surface. There was no chance for viewing the details of the inversion with such ascents. A way to slow the balloons had to be found.

One morning, still in July, Bill Weyant came to my research cubical and announced that I had to go with him right away. He had neglected to introduce me to people in another office and it was very political. I should smile a lot, but let him do all the introductions as well as all the talking. We still were located in the old Mexican Embassy, in the central house of that Embassy. Bill took me over to offices located in the outer buildings surrounding the central house so we did not have to go very far.

On the quick walk across the court yard I learned about this other polar office, but did not piece together all the ramifications of the politics until several months later. We were walking over to the Overseas Operations Division (OOD) of the Weather Bureau. During the IGY all the chief research scientists together with administrative personnel worked together to achieve the impossible in distant and drastically different climates. While projects were new and their inventors were active with the projects, the excitement of going to the field was infested with the lure to all involved - researcher, clerk, technician, administrator - all alike.

This was the kind of bonding that occurred between men like Bill Weyant, Harry Wexler, Mort Rubin, Paul Dalrymple, Kirby Hanson, Burt Crary, and Ed Flowers. I suspect it was this bonding around a life threatening frosty existence in pursuit of discovery that kept a man like Fred Fopay loyal to his task as well as the loyalty of his polar friends protecting his government position. I was beginning to notice all these men wore only penguin tie clips on their ties.

After the IGY, the United States had many political reasons to maintain a presence in the Antarctic and that need permitted continual scientific studies in the region. Those men whose careers accelerated with the explosion of new ideas that emerged for the IGY data suddenly preferred the comfort of the research labs or the international service. Being part of the IGY was a union card for many an administrator who was suddenly promoted on the basis of his scientific discoveries and not necessarily on his administrative skills. Indeed, that is exactly what my office was - a research office headed by a Chief who had served several times in the Antarctic but probably no longer desired to get cold. Others, like Herb Viebrock, Bob Becker, and Martin Predoehl, preferred to do the research in Washington D. C. and let others get cold getting the data for them. In fairness to these men, I noted that they did not wear penguin tie clips. They were outstanding researchers. Some men were gifted for discovery from behind a desk. Others were gifted for discovery in the field. There also were many pressures to remain at home and publish. As for me, at the age of twenty-five and single, gifted or not, I could not wait for the adventure. Indeed, for me just flying to Washington D. C. was an adventure.

Bureaucratically then, the research part of the IGY scientists of the Weather Bureau formed the Polar Meteorology Research Group of OMR, which then was transferred to the Research Laboratories of ESSA. Their former colleagues, who became experts at transporting the research staffs and material to any part of the world was made part of the Weather Bureau's Administration. Jealousies arose on both sides. OOD was closer on the top of the power chart. Vaughn Rockney, Chief of OOD and of equivalent rank to Bill Weyant, was only two offices away from the Director of the entire Weather Bureau. As Chief of Polar Met, Bill Weyant served the Director of the Atmospheric Analysis Lab (AAL). He in turn served the Director of The Institute for Atmospheric Studies (IAS). He in turn served the Director of the Institute for Environmental Research (IER) and he in turn finally served the Head of the Weather Bureau who made a much larger government organization called ESSA.

The short of it was that at one time Bill Weyant of the research world served side by side with Charlie Roberts, now Polar Specialist of Overseas Operations - Polar Section (OOPS). Before all the political shifting, both men did original research but now they were bureaucratically held apart, each forced to redefine their turf, which rarely led to overlapping cooperation. Suddenly I was in the middle. All of my travel and the placement of my equipment - that really turned out to be their equipment - would be placed into the field by OOPS. Yet the "glory" of going to the high plateau and being "first" into this unexplored region would be given to a researcher who, now, normally would be spending his time behind a desk.

For the sake of the success of the Great Inversion study we needed the full cooperation of OOPS, and yet the study demanded a greater theoretical understanding of the problems in the field that faced the observer. OOPS since the IGY had filled the many observer positions in both the Arctic and the Antarctic with well-trained technicians, not men of highly theoretical schooling. Yet it was their feeling that most theoreticians lacked the nuts and bolts understanding of the equipment and the experience with the severity of the polar environment. In my case that was exactly true. I had no experience in the polar regions. From Madison, Wisconsin, I had been as far north as Minneapolis several times. I did serve the Weather Bureau as far south as Chicago.

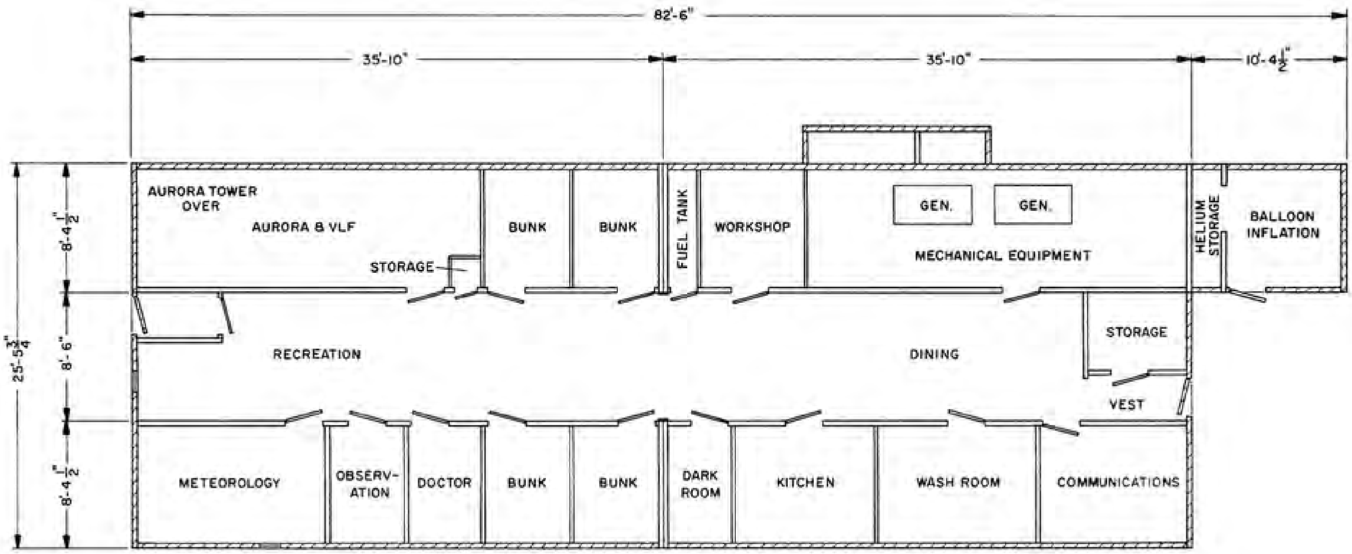
Bill introduced me to Vaughn Rockney. All that Vaughn said to me initially was nothing. In front of me, I believe to embrace Bill and to make me squirm, he angrily protested saying that all Bill needed to do was to give him the program of research he needed and Vaughn could teach any of his “polar rats” even the most complex observations. And they all had been to both poles several times. “Son, are your fillings going to stay in your mouth? Where you’re going it gets cold!” Bill Weyant promised he would arrange for my visit to a dentist familiar with Vaughn’s people’s needs.

We really came to see Charlie Roberts. He was busy. Both Bill and I had a mountain of work to do. I was learning all the needed bureaucratizes. I had much equipment to line up. Various licenses were required to move United States equipment across international boundaries and I needed to be applying for them. I suggested to Bill that we could leave and I could periodically check back. The office of Charlie Roberts was less than a city block away from my own. Bill knew the situation and knew this was bureaucratic chew time. Each office had its turf and its bird calls to claim it. We needed to hear it.

In about an hour, Charlie Roberts, a very pleasant person with the rugged look of a polar regular welcomed us to his office. After a few short pleasantries, he took us to another building and a comfortable lounge to have a cup of coffee, and I listened to Bill and Charlie chat over their many experiences in the Antarctic. I think Charlie wintered over twice and visited Antarctica at least six times. He had been Station Leader at South Pole and at Hallett. He wore a penguin tie clip. He was very glad to meet me. He seemed excited to involve a young man like me early enough to get a researcher into the field before I got comfortable with a warm research life. It was better for both the research and the observer’s camps. I knew I had a friend. At Charlie Roberts’ urging, I knew I should bring all my requests to him. He would take care of all the exporting licenses and shipping needs. He spared me several years of work over the next several months.

What about Vaughn? Why the bitterness? “Oh don’t worry about Vaughn. He’s just a seal who lost his breathing hole and has to chew a new one. Before spring training is over, he won’t know you’re with Weyant and he’ll count you on his team.”

The expected time of departure for the Ice was shortly after Thanksgiving Day. With less than four months before all material and personnel would begin their respective departures from the states Bill Weyant frantically interrupted my library studies and told me to hustle over to the



National Science Foundation (NSF) and see Bill Austin - something about a balloon shelter.

It was a brisk eight block walk from 24th and M Street, down to Pennsylvania Avenue, around the Washington Circle and continuing along Pennsylvania Avenue to 19th and G Street North West. These circles in Washington D. C. were originally designed for military control of the federal city back in the beginning of the nineteenth century. These automobile grid lock days they were a real nightmare. Imagine eight roads coming into the circle at one time. Indeed, my walk to NSF was considerably faster than if I drove a car.

I met Bill Austin with his assistant Jerry Huffman and we went to work immediately. Bill Austin was an engineer and a Coordinator with the Office of Antarctic Programs of NSF. He and Jerry Huffman were involved with the design and the construction of the buildings for Plateau Station from the beginning of this project and were waiting for some long overdue information about balloons. I immediately received the standard chew out which I was beginning to understand as the turf marking practice. They of course were protecting their decisions on the construction of the buildings, especially as those decisions impacted on my research project. Someone should have given them dimensions of the weather balloons a long time ago. Some rough plans for the balloon shelter already were at the building site in Calgary, Alberta, Canada.

The balloon shelter planned at this point was to be a square room of eight feet four inches by eight feet four inches. How big were my balloons? Deliberately placed on the defensive, as if the delay for this information was my fault, I had no choice but to accept their suggestions unless the balloons were considerably larger. What were the dimensions of a weather balloon that carries aloft a radiosonde? That was not a statistic I learned in graduate school. May I use a phone? I must have called more than a dozen people in the Weather Bureau and no one would give me the exact dimensions of such a weather balloon. In fact, most of the research men I talked to had not used one in a very long time or did not ever use one. From photographs found at NSF we agreed the original dimensions were adequate. In any case, I would be under inflating these balloons so that they would not need quite as much room as any standard balloon.

We agreed that the roof could be ten feet above the floor or less. An accordion folding rooftop door could be installed instead of a side door. Both Bill and Jerry thought, and I agreed, such a door would permit a launching direct from the balloon shelter sparing the intense chilling of the men most likely assisting with the launch. The door could be quickly opened at the last minute allowing the person in the balloon shelter to remain warm and then a rapid closing of the door after launch would fit the necessity of conservation of heat for the entire camp. These were some last minute changes. They couldn't promise anything at this late time but they would try.

I left NSF worried that my entire inversion study was in jeopardy. In time I learned that this was standard operating procedure for the government. It also protected everyone from most probable blame for failure. Scare the other guy. Make him think it's his fault. In time I also began to mistrust my Chief. Either Bill Weyant was resting on his most accomplished successful past or he was becoming too involved with running bridge tournaments on the East Coast. I think things such as the dimensions of weather balloons and plans for balloon shelters should have been worked out many months before.

I learned from Bill Austin that the plans for the Plateau Station buildings began in January of 1965. NSF plans were given over to the U. S. Naval Support Force, Antarctica, where air officers performed the first axing of the program. The first plans from NSF included room for six civilian scientists and six military support personnel. However, there simply were not enough flight hours by LC-130F cargo airplanes of the Air Development Squadron Six to airlift such a planned station as far inland and to such an extreme altitude as the high plateau of Antarctica during the window safely afforded during the summer. The Naval Facilities Engineering Command (U. S. Navy bureau of Yards and Docks) trimmed the station building to accommodate only eight men.

These airlift requirements or limits of the Navy were the driving force behind every decision and the decisions were coldly carried out without much input from the scientific side, which was the chief reason for building the station in the first place. You can imagine the difficult role Austin and Huffman played trying to defend original plans of idealistic scientists who pared back their programs from the start over the eternal problems of inadequate funds. You could understand their effort to put you on the defensive a lot easier when you saw the bold, and at times seemingly not well thought out decisions of the support forces changing the programs and asking the NSF coordinators to smooth everything over.

Only eight men for Plateau Station meant only one meteorologist. Did Weyant know this? Did Dalrymple? With only one meteorologist, with the uncertainty of a balloon shelter, was there going to be an inversion study? Would it be worth anything if inadequately supported?

Delays in designs of buildings always occur. The single largest delay occurred as Lt. Commander Paul Tyler demanded studies on the potential need for pressurized bunk rooms. The anticipated altitude for the placement of the buildings was 12,000 feet above sea level. Making the decision more complex was the spin of the earth that made polar atmospheric pressure even lower and exaggerated extremes. The oxygen content over the polar plateau could be equivalent to altitudes anywhere between 14,000 and 18,000 feet - only about half the oxygen at sea level. Paul Tyler decided to provide oxygen if needed for the builders of the camp on station and, following the lead of the Soviet Union at Vostok, Antarctica, demand high physical and psychological standards and high lung capacity for the winter personnel. Also acclimatization in stages of these men who would winterover would be necessary by having them train at the South Pole before being taken to Plateau Station.

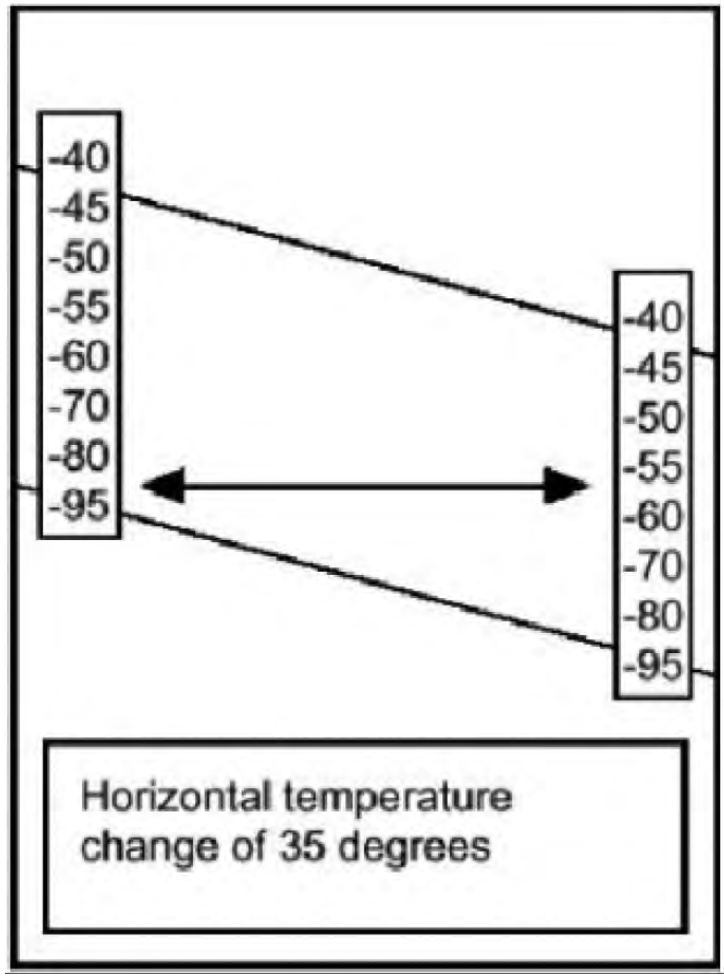
Here is where the U. S. Navy Support Force, Operation Deep Freeze, rightfully knew its business and I'm here to tell this story because of their skill in spite of all the complaints I, as a scientist, had. Saving and maintaining life is what the Navy took very seriously and did not let over enthusiastic scientists' desires over their personal research projects get in the way. I did not come to this view until twenty-five years after leaving the Antarctic.

By May of 1965 Ensign David Ramsey, CEC, USNR, received his orders to be the Officer-in-Charge of construction and pulled together his team of ten men of the Mobile Construction Battalion Six. Their headquarters was the naval Construction Battalion Center in Davisville, Rhode Island. They would train as much as possible in theory first and then be taken to Calgary, Alberta, Canada, to practice building the prefabricated buildings manufactured by the Alberta Trailer Company. Obviously, here in Washington D. C. in August, redesigned balloon shelters seemed a hopeless idea. Hope for effective changes emerged once I realized that the main building of Plateau Station was made of four fully outfitted vans linked as two vans on each side of the building and separated by a permawalk in the middle and roofed over. The central permawalk area housed the recreational and dining areas. Science labs, bunks, kitchen, generator rooms, and a medical office were preoutfitted in the vans. The balloon shelter was an add-on at the end of one of the vans. Some adjustment emerged as possible. In my mind balloons began to fly again through the inversion.

Nothing happened in Washington D. C. without pain and frustration. Power and favors were the only things that seemed to work and I was a pathetic rookie. Yet, the cult that wore penguin tie clips had an unwritten bond of support among themselves. The mention that I was working for Weyant or doing work for Dalrymple opened a lot of doors. It was a different world than academia. Names like Lettau and Schwerdtfeger meant little here. Kirby Hanson was a name and the name of Mort Rubin would get a little bit of attention. "Is this Weyant's boy?" With these words, Burt Crary, at the time Deputy Division Director of The Division of Environmental Sciences of the NSF and Chief Scientist of the Office of Antarctic Programs, summoned me into his office at NSF before Austin let me go.

"Are Lettau's and Schwerdtfeger's ideas worth anything?" He's asking me? These men were my professors. I was no judge of my professors. I was a disciple! I had nothing to say. Crary filled the silence, "Well, Dalrymple trusts them." He talked quite a bit about his exploits establishing Byrd Station for the IGY and then in that low quiet voice where he let you think he was letting you in on a secret Burt Crary told a story where he suddenly found himself stranded on a small ice floe moving out to sea at Little America with a killer whale in pursuit looking at him as though he were a tasty seal. After a heroic rescue mission mounted by the Navy, the dried out and warmed Crary mused with the Navy chaplain about prayer. No, Crary uttered no prayer. All he could say as he watched his ice floe move farther and farther away from his rescuers was “Shit. Oh dear. Shit. Oh dear.”

With sins of omission I said nothing. I even laughed. Inwardly I was troubled. I stood before one of the chief scientists in the world who was accepting me as a friend, or at least as a young man recommended by very close friends. Why this unneeded put down of religious belief? I was in nearly continual prayer to be accepted on this assignment. I would be in fervent prayer over our safety and life in less than a year. Where was the joke? Much of the research over the Antarctic dealt with evolution and very few of the scientists I met professed any religion at all. Most had this kind of disdain. I was taught in my religious background at parochial schools that the best scientists all believed in Creation. I was taught very wrong.



My inversion wind study was central to the research as I saw it. I intended to work out much of the mathematical modeling before going to the Ice. I never anticipated the overwhelming logistics taking the needed observational equipment to the field. Also unanticipated was the politics and turf defense within the government. The only greater turf defenders more troublesome were those later in my life that practiced their odd trade in the church. But the greatest shock slowing my youthful enthusiasm was the difference in schools of meteorology between the East (schools like Penn State, NYU, Boston U, and MIT) and the Midwest (UW-Madison and U of Chicago).

As a rookie, I was encouraged by and wanted to have my theoretical work looked over by more seasoned colleagues. Trained to develop formulas founded on theoretical principles of standard acceptance I started with functions expressing radiational losses within inversions and horizontal temperature differences caused by regional inversions father down slope. This horizontal temperature gradient would cause a force changing both the wind speed and direction with height. This change I desired to be the first person to measure. I desired also to develop the mathematical model for this phenomenon first proposed by Lettau and Schwerdtfeger.

Most of my colleges at Polar Met and especially down the hallway at the Air Resources Lab led by Lester Machta, particularly Atmospheric Radioactivity Branch and the Atmospheric Trajectory Branch, most were trained at schools out here in the East. They all asked why I was approaching the wind structure over a glacier in such weird ways. Everyone preferred to examine these winds as katabatic winds. Most of them, while having heard of Prof. Lettau, didn't think much of the Midwest. "What could Wisconsin or Chicago offer besides milk and beer?"

Let me try to explain katabatic winds and their placement in the grand scheme of wind classification. Five chief forces are recognized for their strong influence on creating the wind structure. The first is gravity. The earth's gravitational force on the air as a substance with weight is a dominant force compacted by the severe cold and laying on a slippery ice slope.

Hydrostatic force, primarily differences of air pressure over different but nearby regions, is a major cause of all wind and easily recognized in mid-latitudes as causing winds around high and low pressure regions.

Frictional forces of the atmosphere are divided into two kinds and Lettau was an expert on both. The first kind of friction is identified as an internal force meaning a force governing the interplay between the various molecules of the mixture that is called air. Realistically, among meteorologists, this kind of force seemed to govern the small "eddies" of air that still moved in smooth flow lines.

External frictional force is visible in the wild churning turbulent eddies, most visible among the patterns of leaves in air motion or felt as strong buffeting rapid changing currents or air against objects.

The fifth and last force is the Coriolis force, a very misunderstood force. It is caused by the earth's spin about its axis. The Coriolis force is strongest at the poles and weakest in the tropics because the earth's spin is strongest at the poles and weakest in the tropics. It is hard to say with a straight face that this is because there is no spin at the equator. Really, more qualified, the spin around a flag pole pointing up while stuck into the ground on the earth's surface is what I am talking about. Try it. Hold a pencil, as a model flag pole, on a spinning globe on the equator and see that the pencil is not spinning but tumbling. That is exactly what air does or does not do. It definitely does not spin near the equator in the tropics.

The same pencil held at the North Pole does not tumble but, in fact, spins as the earth does. Air, not attached very strongly to the ground as a flag pole, is free to spin on its own and thus spins the opposite way. Thus a high pressure region sitting over the North Pole spins clockwise, opposite the way of the earth's spin.

By moving your pencil to the South Pole but keeping the globe spinning in the same direction, you will notice the pencil and your globe spin the opposite way from the way they spun when the North Pole pointed up. This time an unattached high pressure dome of air over the South Pole will spin opposite the clockwise spin of the earth and spins counter clockwise. This opposite spin in the air over against the spin of the planet is called the Coriolis force.

Contrary to many nonsensical textbooks written for the liberal arts student, who shuns the scientific knowledge of the world around him or her or is only interested in fifteen second explanations, the coriolis force cannot be detected in a toilet bowl or bathtub. The Coriolis force is a force of a very large scale of the order of the planet. It also requires a very long time to set up a balance of forces in the air flow over the earth. Time frames of twelve to twenty-four hours are required. Thus, wind systems of short time duration, such as tornadoes, spin both clockwise or counterclockwise in both hemispheres.

In a sense mathematical modeling is simple. All that is required is to set up equations with all the forces listed as terms. Complete equations for atmospheric motion, easy to string out, are just impossible to solve. They involve too many terms with too many derivatives at too high of powers. What can be comprehended in the mind cannot be rigorously carried out with the best of mathematics then, today, or any time soon. The role of the theoretical scientist is then to reduce the terms and simplify the equations with meaningful and realistic assumptions in order to arrive at equations that can be solved or at least approximated with iterative systems on high speed digital computers.

The most common meteorological equation is the geostrophic wind equation that assumes all terms to be negligible except the pressure gradient force and the coriolis force. These two forces are then set equal to each other and they effectively describe the high speed steady winds between a high pressure region and a low pressure region such that if a high exists in South Dakota and a low exists in Wisconsin, strong winds from the north pour over Minnesota.

$$f\,\vec{k}\times\vec{V}_g = -g\,\vec{\nabla}_P\, z$$

This vector equation really describes all three dimensions. Let me reduce it to the horizontal equation for the Minnesota scene just described where v is the wind from the North and the pressure gradient slopes upward toward the West.

$$f\,\vec{k}\times\vec{V}_g = -g\left(\frac{\partial z}{\partial x}\right)_P$$

I believed katabatic winds were of a short time duration and only a local wind structure. In that case coriolis forces would be negligible. Local winds without coriolis forces were identified as Eulerian winds. However, equations for Eulerian winds, which were mathematically less complicated than the general wind equations, still had too many terms.

Wind systems with one force term balanced against only one other term were potentially solvable with integral calculus. These two term equations were sought after with great intensity. Obviously the first scientist to find a solution that also matched the observable in nature, no matter how trivial, would be a success with publication. Wind systems governed only by the pressure gradient and frictional forces were classified as antitriptic winds. Some antitriptic winds were known as foehn winds, chinook winds, bora winds and the zonda. Most of these winds, well understood, were due to sinking air on the leeward side of mountains and were abnormally warm dry winds resulting from the adiabatic warming of the air as it sank and changed its density, pressure, and temperature.

Similarly, katabatic winds were considered to be a balance between the force of gravity on the air made heavier by the extreme cold as well as the addition of snow crystals entrained into the air stream by frictional erosion from the glacial surface and the frictional force on the air.

Following first principles, as Lettau taught, a system of three differential equations could be hypothesized for katabatic winds.

(1) Continuity equation

$$\vec{\nabla} \bullet \vec{V} = 0$$

(2) Momentum equation

$$\rho_0 \frac{d\vec{V}}{dt} + \vec{\nabla} P + \vec{k}\left(g\rho\right) = \vec{F}$$

(3) Energy equation

$$\frac{d\theta}{dt} = \frac{\partial\theta}{\partial t} + \vec{V} \bullet \vec{\nabla}\theta = \frac{H}{C_p \rho_0}$$

Continuity required that all nearby changes in any field of variables were all interrelated. In particular, there could be no increase or decrease of mass. There were no abrupt changes of the coordinate system used.

The momentum equation said simply that all momentum changes were balanced and that the only loss of momentum in any and all transfers of momentum to different parcels of air was lost to friction only.

Likewise the energy equation claimed that all energy changes were in balance. This is the time honored law of conservation of energy.

A list of parameters:
H = rate of heat per unit volume by the process of heat of diffusion.
V = vector of motion.
P = atmospheric pressure.
k = vertical unit vector.
F = a vector of frictional force per unit volume.
ρ = density of air.
R = gas constant for dry air.
C_p = specific heat of dry air at constant pressure.
θ = potential temperature, where,

$$\theta = T\left(\frac{1000}{P}\right)^{\frac{R}{C_P}}$$

In words, potential temperature is the temperature a parcel of dry air would have if brought adiabatically from its initial state to the standard pressure of 1000 millibars.

These equations, continuity, momentum, and energy could then be expanded into their respective component forms.

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$$

$$\rho_0\left[\frac{\partial u}{\partial t} + \frac{u\partial u}{\partial x} + \frac{v\partial u}{\partial y} + \frac{w\partial u}{\partial z}\right] + \frac{\partial P}{\partial x} = F_x$$

$$\rho_0\left[\frac{\partial v}{\partial t} + \frac{u\partial v}{\partial x} + \frac{v\partial v}{\partial y} + \frac{w\partial v}{\partial z}\right] + \frac{\partial P}{\partial y} = F_y$$

$$\rho_0\left[\frac{\partial w}{\partial t} + \frac{u\partial w}{\partial x} + \frac{v\partial w}{\partial y} + \frac{w\partial w}{\partial z}\right] + \frac{\partial P}{\partial z} + g\rho = F_z$$

$$\frac{\partial \theta}{\partial t} + \frac{u\partial \theta}{\partial x} + \frac{v\partial \theta}{\partial y} + \frac{w\partial \theta}{\partial z} = \frac{H}{C_V \rho_0}$$

Usually a system of equations as this needs to be reduced considerably before integration is possible. For katabatic winds, one would limit the development of this system of equations only to the fall-line or down slope line, dropping all other components. This procedure would constrain the solution to only two dimensions, the vertical and in the direction of the fall-line. These simplifying constraints were a major reason for going to the polar region with its long polar sunless night. The mathematical demand for steady state conditions,

$$\left[\frac{\partial f}{\partial t} = 0\right].$$

were met when solar heating over short periods of time did not exist during the long polar night of many months and thereby greatly simplifying the mathematical model.

I'm not trying to solve things by writing this. I only wish to outline the attack of research. It certainly was more than just reading books in the library. Many times a system of equations as I've just given takes several weeks, even months, to develop. Before solutions are attained, many dead ends are followed. One such dead end for me took me down a path for nearly nine months and almost a hundred hours of computer time, time that my grant simply did not have, time that was stolen during the midnight hours when normal people slept and computers stood idle. Then came the shock that equation six is identical to equation 42 and I had followed a long but continuous circle. No solution possible! What do grown, intelligent, and stable scientists do when this happens? This scientist got drunk!

The large scale pressure changes due to traditionally forming storms and cold clear regions were ignored. Katabatic winds were too small a scale and too rapidly expended as an out rush of cold air down the glacial slope to involve the Coriolis force. These winds were not the winds I was looking for in the Antarctic. I was trained by Lettau and Schwerdtfeger and as their disciple, I was committed to temperature gradients and thermal winds to explain the wind profiles of the great Antarctic temperature inversion.

Yet most of my new colleagues strongly advised that the problem of winds over a glacier had to be dominated by gravity alone and balanced against friction as the heavy cold air accelerated down the glacial slope. Herb Viebrock and Ed Flowers, trusted leaders at Polar Met, encouraged me to study hard and fast the possibilities of katabatic winds as a model for the winds formed by the temperature inversion. Real coastal data from the Antarctic and Greenland pointed to a katabatic solution - gravity winds and not thermal winds. Although Herb had not been in the Antarctic himself (no penguin tie clasp), he was well read in much of the polar literature. To young me he became another Lettau, always ahead of me in the reading race.

With his reading knowledge, Herb alerted me to meteorological details of which I was not familiar published in the descriptive volumes of an Australian expedition. While the world watched the English and the Norwegians race to the South Pole in 1911, the Australians were exploring more than a thousand miles of Antarctic coastline south of Australia and had three separate land parties exploring and mapping details from the south magnetic pole, then at about 150 ° East Longitude, to 90 ° East Longitude. Led by Sir Douglas Mawson from his base camp at Cape Denison on Commonwealth Bay, the Australians were confronted with the most severe surface winds ever recorded. These surface winds were heavy down sloping winds, somewhat warmed by adiabatic sinking of air but held cool by the large quantities of ice crystals carried along and eventually blown out to sea.

("Picking Ice for Domestic Purposes in Hurricane Wind [showing the high angle at which E.N. Webb leans into the wind]." Adelie Land. Photograph by J. F. Hurley, Photographer of the Australasian Antarctic Expedition, in *Home of the Blizzard* by Sir Douglas Mawson, 1915, Vol. I, p. 114.)

"The equinox arrived, and the only indication of settled weather was a more marked regularity in the winds. Nothing like it had been reported from any part of the world. Any trace of elation we may have felt at this meteorological discovery could not compensate for the ever-present discomforts of life. Day after day the wind fluctuated between a gale and a hurricane. Overcast skies of heavy nimbus cloud were the rule and the air was continually charged with drifting snow."(Mawson, *Home of theBlizzard*, Vol. I, p. 111.) The highest steady wind speed ever recorded on the surface of the earth to this very day was recorded at this same Commonwealth Bay, George V Coast, where gales reached 200 miles per hour (*GUINNESS BOOK OF RECORDS*, 1992, P. 47)

Many of the east coast scientists believed that all down sloping winds on the Antarctic ice dome were katabatic, and stretching the definition of katabatic winds, they wanted me to include long time intervals for Coriolis effects on the katabatic winds. Lettau and Schwerdtfeger always spoke against simple katabatic theory and pointed to the unlikelihood of down sloping outward moving winds, which warm and dry out the air, to be able to sustain a polar icecap for the many thousands of years in such apparent unalterable stability. The transport of large quantities of snow outward from the icecap seemed contradictory. That is why they insisted on a new thermal wind approach where the inversion wind would make the air flow around the icecap and preserve it.

Confronting me was the very real gale and hurricane force winds down slope across the Australian camp. Further study also showed similar winds at the French base at Dumont d'Urville and at two other Australian stations, Wilkes Station and Mawson Station.

The library of Congress has everything. What other katabatic studies were available? The Russian experiences? Too late to wait for Israeli translations. Phone calls to the Russian Embassy. Yes, they had many researches on Antarctica and its weather. I could have them in several months. I wanted them yesterday, not soon or even now. Contacts with Russian scientists through Burt Crary were great helps. Being able to translate a little Russian also was a great help even if I needed a large Russian to English dictionary. I hated studying the Russian language back at school, but that knowledge was now paying off.

Astapenko's volume, *Atmosfernye protsessy v vysokikh shirotakh yuzhnogo polushariya*, was overwhelming. It covered everything about the weather in Antarctica. The Russians called the katabatic winds gravity winds and used a formula developed by L. V. Dolganov:

$$V \cong 2\sqrt{SK\frac{\Delta T}{T_I}g\sin\alpha}$$

S = the extent of the slope.
K = a coefficient of proportionality.
ΔT = the difference in temperature between air in gravity wind and the immobile state.
T_I = the absolute temperature of immobile air.
g = the acceleration of gravity.
α = the angle of inclination of the slope.

Although this was a strictly empirical formula, the Russians used it to forecast the severity of the gravitational katabatic winds between their several stations on the icecap going down slope from Vostok (inland as our proposed Plateau Station) to the coastal station Mirny. The Russians saw the snow surface winds increasing as the ice surface slope increased. Wind speeds were expected to be three times faster than the wind speed with normal pressure patterns. Although they did not experience the extremes that the Australians and French experienced, the Russians did indeed experience very strong winds, sometimes gale force, at Mirny, Molodezhnaya, and Novolazarevskaya. The countries of Belgium, Japan, and South Africa also maintained coastal stations in East Antarctica but as time ran out prior to my own departure to the Ice, I was overwhelmed and the meaning of their data was lost to me.

Questions of self doubt filled my mind. It was obvious that katabatic winds were a major wind feature for the coastal regions of the high plateau of East Antarctica. Was my college training at good old Wisconsin-Madison offbeat? How could I discover, and worse, publish, views different from “my” professors? Viebrock’s encouragement always included statements about maturing scientifically. One needs to grow beyond his or her teachers. Often he spoke of PhD friends who still promoted the same ideas of their professors long after they had been awarded their degrees. How could that be? Loyalty had played no part in experimental science. And science is not static. If, after several years of research, one was still narrow to his or her teacher’s views, it was doubtful that such a person was a scientist. More than likely even the research professor had changed views. Nonetheless, what was I to do about inversions and the corresponding wind profiles? I needed to observe them first.

I grew up in a home where there was a dining room chandelier with six light bulbs. Five were always loosened so that they would not come on when the light switch on the wall was turned on. A calendar was placed at the telephone and every call recorded to monitor the number of calls even long after the restricted number of sixty calls per month was dropped from the billing methods of the telephone company. We also had a three minute egg timer by the phone to limit calls to the three minute minimum charge even though no one ever called long distance. Suddenly having access to the government’s WATS lines was difficult for me personally to adjust to. When talking to scientists from different parts of the country, I had to conscientiously think about not suddenly hanging up at the point of three minutes.

One long call was with a research scientist working for the Jet Propulsion Laboratory in California. We discussed at great length (hours) problems related to measuring moisture in an extremely dry climate. He was working with instrumentation to detect water vapor on Mars. Antarctica, as the world’s driest desert, was a good natural laboratory for testing such equipment. The more I studied the limits of the humidity collecting carbon hygristor, a plastic resistor with a coating of ionized carbon on the surface that would collect molecules of water vapor from the air as a balloon carried it aloft, the more I was skeptical about its ability to measure the humidity in the inversion layer. At temperatures as low as -100 ° F, even if saturated, the air would be drier than the driest desert on earth. At the late date, now only four months from date of departure for the Ice, pursuance of newly designed instruments was hopeless.

We also discussed ways of using subtle light and polarized light to detect the presence of “dryice” crystals of solid carbon dioxide in the air or in a vial of snow. At the expected extremes of cold temperature the presence of “carbon dioxide snowflakes” was a strong possibility.

Over and over again I was amazed at how frequently the major problems confronting the scientists at the forefront of their disciplines came down to careful redefining of the fundamental first principles learned in grade school and high school. It was not the unsolvable differential equations that stopped research progress. Just what was the shape of dry ice crystals and how did they reflect light when compared and contrasted with the ice crystals of snow? Large scale models of the molecules that a teacher might use to show a child were needed by the research scientist to visualize what might be happening. These were the questions and this is where the solutions lie.

Another item to cause panic suddenly arose. A multichannel recorder for the radiosondes was not available. I learned the game of government logistics, that all research stops to play the government game of swapping. Weyant sent me to the U. S. Naval Observatory at Massachusetts Avenue and Observatory Circle. It was a huge circular area of wooded park land within the District of Columbia in which several old astronomical observatories were maintained, I believe mostly for their historical value. At one time these observatories served as the standard fixed point for all determinations of exact time for the U. S. Navy. Since then all of that standardization for the government and military was transferred to Boulder Colorado and buried deep within the mountains so that the perfect recording of time might be continued even during a nuclear war. At the U. S. Naval Observatory several research offices for several government agencies existed so that their close physical proximity to each other could aid in the continual and smooth exchange of data and ideas. Feodor Ostapoff, head of the Sea Air Interface Laboratory (SAIL) maintained an office there. He had several men out at sea on various research ships. One ship, the *USNS Eltanin*, sailed the Antarctic water for many years surveying and exploring long term sea problems. At Weyant’s directive I went searching for a recorder that I might borrow with the promise to pay for a new one from our grant money.

To me this seemed a fair request and this kind of swapping was done all the time. What was also done all the time was the initial denials by everyone. I think I went back and forth between my office and the Naval Observatory more than a half dozen times until I got Weyant and Ostapoff face to face at Blacky’s House of Beef at a noon lunch and pushed the issue. About three years later I was pulling the same delaying stunts when different scientists needed equipment from me. Some of this cat and mouse game was related to the process of counting favors. Some of it was related to a strong desire to cooperate, but sometimes there was a true need to stall while the items were located. The federal government was a big place.

My entire experience in those first several months was filled with confusion, misdirection, many mistakes, and no linear orderly advance toward Plateau Station. Forgotten instruments had to be ordered. Learn this new theory but maybe the theory I did learn had no relevancy at the South Pole. Will the hygristor on radiosondes work in Antarctica? Did I have a license to ship helium out of the country? I needed special glasses to filter out strong ultraviolet rays before they reached my eyes while standing in the twenty-four hour sun in the Antarctica. Some of the instruments that I was required to order I had never used or even seen before. Even common thermometers caused trouble. Viebrock, who had not been to Antarctica, saved me from one of my more embarrassing orders. "Marty, what's the freezing point of mercury?" Forty below. "How do solid crystals rise in a thermometer when it's a hundred below outside?" From Runge-Kutta methods for solving or at least approximating solutions to systems of differential equations to questions of just how does one measure the temperature of the air or measure that amount of snow that falls on old snow fallen the thousands of years before were questions that arose without end?

All these questions were set in a panicky state with time rapidly running out. Weyant kept asking if I had ordered enough string. No stores in Antarctica! All routine supplies had to be on the Naval manifest for the *USNS Towle* before mid-October. All supply ships were departing from the U. S. at that time in order to penetrate the coastal ice sheets as they began to break up during the austral late spring in December. Some slow cargo ships had already left the States. The *SS Dorset* left Davisville, Rhode Island for Port Lyttelton, New Zealand on 22 August 1965. The USN Cargo Handling Battalion ONE (CHB-1) was already in Christchurch and Operation Deep Freeze 66 was well on it way getting all of its support forces in place.

Finally, at what Paul Dalrymple called "spring training," Bill Weyant had arranged with Charlie Roberts and Vaughn Rockney that I attend their school for observers for the polar regions. At this Polar Operations school held for six weeks starting at the end of August and lasting through most of September at the Test and Evaluation Laboratory of the Weather Bureau at the Sterling Research and Development Center in Sterling, Virginia, about thirty miles west of D. C., there existed a lab housed with all the current instrumentation used for the routine research observational programs conducted by the Weather Bureau in Antarctica and the Arctic.

At this school different groups were brought together for final training before their departure for either the Arctic or the Antarctic. Some of the personnel were known as the "polar rats" because of their employment habit. They began by accepting an assignment in the far north for the Northern Hemisphere summer or an entire year on an ice floe starting in summer. They then would come out of the polar north in fall, and sign up for the Antarctic. Departing the states during the Antarctic summer, they would again return in the northern spring to register for the North again. Many would earn tremendous quantities of money, live high for half a year, and head back to the poles.

These "polar rats" were truly experts at their polar trade while I, in my polar naiveté, wanted to measure the temperature with liquid mercury thermometers that would be frozen. I had more anxiety for attending this school than giving a seminar on the difference between Gaussian and Stefan-Boltzmann distributions and the need for non-centered chi-squared tests. (And I never was comfortable with seminars until I became a teacher.) I was aware that I might know more theory than these men, but the practical use of equipment and under severe conditions? No contest. These men were way ahead of me!

At this school I finally got the background to put my expedition together. I saw my first radiosonde. I launched my first balloon. I took apart and put back together again electrical functioning thermometers. I was laughed at for believing I could measure the humidity in the Antarctic and after testing the humidity device in an air chamber in the presence of dry ice at -109 ° F, I could laugh too. It was impossible. A major source of heat and energy exchange, ice to gas back to ice again, would be denied in the Antarctic air.

The polar school was run by Wesley R. Morris who spent most of the IGY supply season on the icebreaker *USS Atka*. He also winteredover at Eight Station and received a partial disability for severe snow blindness, which still bothered his eye sight in the sunlight. He was a short rough and tumble man not prone to swear publicly, but I think if a person crossed him, Wes would not lose.

My first day at polar school I could tell I was the odd man out. These polar men were all rough and rugged polar heroes. They were for the most part upset that they didn't have an opportunity to go the unexplored high plateau of the Antarctic and be first at Plateau Station. When they saw naive me, they knew they were right. Experience always triumphs over knowledge.

I gave in immediately. Of course they knew more about polar life and observations. I learned quickly. I had to. Every day at the polar school I was losing ground on my theoretical studies as well as follow up time on equipment checks and shipments to the cargo ships leaving from Davis, Rhode Island. Yet, every day at the polar school I became more knowledgeable of my challenge at Plateau Station.

The four students bound for Amundsen-Scott Station were Ronald Stephen, Jerry Hollingsworth, Harold Preston, and Charlie Mabe. Gary Davy, Phillip Gale, William Galkin, Norbert Novocin, Karl Staack, and Brent Scudder were on their way to Byrd Station. Paul Carlson, a very tall and powerful man with a deep booming voice was also part of the school, but on a day when our pay checks were due, while training exercises were just starting, he demanded his pay check. Of course Wes did not have it. When we worked out at the Sterling Labs, we were away from our duty station in Washington D. C. Wes called Vaughn to see if someone from OOPS could deliver Paul's check. Paul, near violent, spent most of the morning on the phone and when his check did not show up at 10 A. M., a specified time to be paid by according to the Civil Service Code, he quit.

We all joked teasing Wes that Paul may have shown us all a way to escape polar service. It was sad at the same time. None of us seemed to get close to each other. Competition kept us all struggling, wondering if we were going to still get selected out of the United States Antarctic Research Program (USARP). On the Ice we would become intensely close even when separated by thousands of miles of glaciers.

At Sterling Labs we memorized the weather codes, took tests and memorized some more codes. It was a different school. At the University, tests seemed always way over your head. I remember getting a 23% once and still receiving an A. The professors wanted to spread the grades out to identify the brilliant, the smart and the just average. Here at polar school it was impressed on us that this was no longer just school work. We would be sending the weather encoded to ships in the frozen sea and to pilots flying over snow their radar could not detect. A single error could lead to the loss of life far quicker than one cared to think about. The training was intense, repetitious, and intolerant of error. Written tests were few and not as complex as the mathematically oriented tests that I was used to, but any screw up was unacceptable. No one wanted B or C students informing the support operations in the Antarctic of weather. Only 95% or better was acceptable. Scrutiny of your performance with equipment and the speed and exactness of obtaining weather data was even more intense than taking a written test.

QUIZ-ANTARCTIC (August 26, 1965)
Synoptic Code

1 Unscramble the following symbolic elements of the Antarctic code and place them in proper sequence as they would appear for the 0000Z obsn.

$9S_pS_ps_ps_p$ ANT Nddff $3T_xT_xT_nT_n$ 02600 IIiii $T_dT_d$app VVwwW PPPTT $8N_sCh_sh_s$ $4d_xd_xf_xf_xN_hC_LhC_MC_H$ $2D_mD_LD_MD_H$ SYNOP PLAIN LANGUAGE $8N_sCh_sh_s$

2 Briefly define the following symbols:

dd	h	h_sh_s
W	C_L	9
VV	7	pp
N	RR	2
S_n	a	ww
N_h	8	D_m
D_M	R_g	D_H

3. Encode the following:

a. Temperature -2 ° C, 12 ° F, -103 ° F, -16 ° C, 14 ° C
b. Wind direction: missing, 155 °, 010 °, 275 °, 180 °
c. Wind speed: calm, missing, 8 knots, 88 knots, 109 knots
d. Prevailing wind past 6 hours South, low clouds moving from North, low overcast sky.
e. (cloud group, mandatory section only) Sky obscured by 10/10 blowing snow and ice fog, vertical visibility estimated 1000 ft.

4. What fraction of the celestial dome is an octa?

a. 1/16
b. 1/8
c. 1/2
d. 1/4
e. 1/10

5. The Maximum Wind Speed is determined from:

a. The highest 1 minute average speed equals or exceeds 33 knots during the past six hours.
b. The highest instantaneous speed 33 knots or above during the past 6

hours.

c. The highest 1 minute average speed equals or exceeds 33 knots during the period covered by W.

d. The highest instantaneous speed 33 knots or above during the period covered by W.

6. Encircle the incorrect:

a. Code figure 4, barometric pressure now the same as or higher than 3 hrs ago.
b. Code figure 8, sky cover overcast, but with openings (binovc).
c. Code figure 24, visibility variable zero to 2 miles.
d. Code figure 55, maximum wind during past 3 hrs. 55 knots.
d. Code figure 01, net 3 hr. change in station pressure .010 inches.

7. Encode the following:

a. Clouds moving from the NE, direction coded ___.
b. At the Pole Station the surface wind is blowing from the 090 West meridian, direction is coded___.
c. The maximum wind is 117 knots from the West, coded group would be___.
d. Light continuous snow is falling (71), visibility is reduced to 1/2 mile by ice fog (46) and slight blowing snow, generally high (38). Present weather would be coded ___.
e. In the max min code group, the highest temp for the past ___ hours is missing and the min temp is 13 ° C. The coded group would read ___.

8. Encode the following weather information using the Antarctic code:

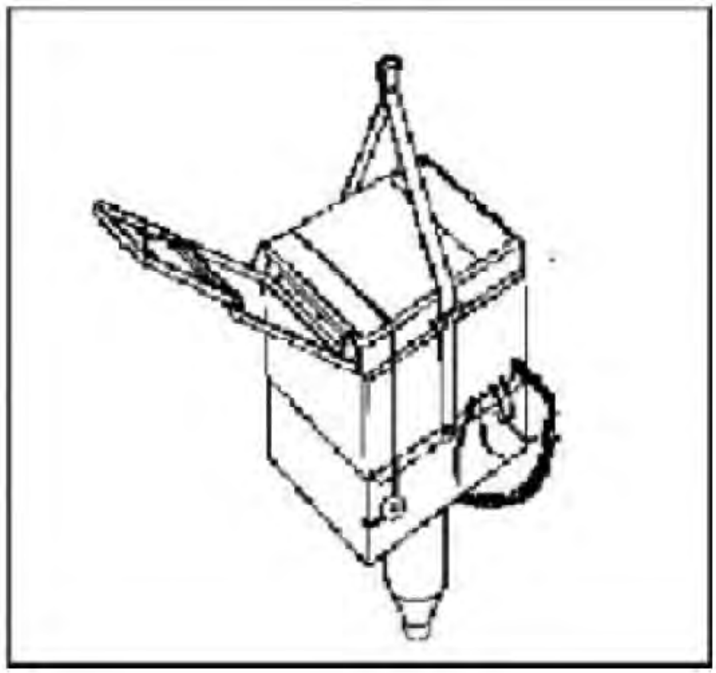
Byrd Station, Longitude 120 ° W, Latitude 80 ° S, Time 0400 LST. Visibility unlimited. Past weather clear. Wind speed calm. 850 mb. Height 1499 meters msl. Net 3 hr pressure change .000 inches. Sky cloudless. Peak gust during past 6 hours calm. Temperature of the dew point missing. Pressure tendency past three hours rising then falling, pressure same as 3 hrs ago. Air temp 28.6 ° F. Ice crystals began 1130Z. Maximum temperature during the past 12 hours 35 ° F. Minimum temperature past 12 hrs -22.5 ° C.

9. A whiteout is considered an obstruction to vision and must be so coded. T or F.

10. Ice crystals, ice fog, and ice crystal haze are classified as precipitation even though they may occur from a clear sky. T or F.

Trick questions simply did not exist. The desire of Wes Morris was to help you never to make an error while on the job and in a position serving others. Test questions were never a secret. You always knew the test would be straight forward with no trick questions. You never had to ask, “What is going to be on the test?” Wes taught me more on how to teach than any work shop of educationese.

At the Sterling Labs I touched my first radiosonde, the chief instrument that was sent aloft by balloon and sent back to a radio receiver data of pressure, humidity, temperature, and by tracing the balloon, the wind speed and direction. The radiosonde was an inexpensive, even for the government, package of cardboard and plastic. The bottom half was a small empty box about five by five by three inches. Into this space the observer placed a water activated battery and connected all the parts that would send signals.



Since the water activated battery’s power would drift off its standard voltage level, the first task was to check a high pitched tone and a lower pitched tone which on the recorder in the office gave fixed positions. As the instrument package gave slightly different readings for these standard tones, the recorder could continually be recalibrated in flight, thus giving a continual accurate monitoring of the radiosonde in flight. Important to me, who planned to launch these radiosondes as rapidly one after another as possible, there was a radio dial on each radio transmitter hanging below the radiosonde and underneath the battery that permitted broadcasting of the signals at slightly different frequencies in order to listen to a new launch before the previous one had finished its flight.

In the chamber just above the battery was an aneroid barometer with a pointer like that on the barometer in your den that would show the pressure. On this flying instrument package that pointer was a switch moving across electrical connections that gave tones associated with the changing temperatures recorded by the thermistor. As the balloon rose the associated lower atmospheric pressure would cause the pressure pointer switch arm to cross over to the next connection to give the tone of the hygristor for the humidity. Thus the recorder on the ground simultaneously recorded the pressure by knowing which connection of the baroswitch was on and the temperature or humidity. After sequencing through the temperature and humidity five times, the standard high tone and low tone would be touched by the baroswitch enabling the observer on the ground to recalibrate the entire electrical system.

Critical to an inversion study was the heat budget. Major factors in a heat budget are the heat changes associated with the formation of ice crystals from the gaseous state in air as well as the reverse of ice crystals evaporating back into a gaseous state. A measure of this moisture was achieved by the carbon hygristor on the radiosonde. To a man, everyone at Sterling Labs laughed at my interest in this polar use of the carbon hygristor. Every radiosonde that Wes Morris' polar rats launched at the polar school would ascend to the stratosphere where the temperature cooled to -70 ° F and the humidity sensor would sing back "putt, putt, putt, putt, ..." This toneless signal, too low to interpret, was identified as the tone of motor boating. Without fail the entire school chanted, "Marty's fishing at Plateau again."

At Wes Morris' suggestion I spent some time at the Sterling Labs consulting with an electrical engineer with the Weather Bureau who was introduced to me as Saxy. Saxy showed me the hard facts. At -100.0 ° F, an expected common temperature during the polar night during the most intense inversion conditions, the saturated vapor pressure is 4.664x10-5 inches of Hg. At 56.9 ° F, an arbitrary warm temperature (when compared with polar weather) for Sterling, Virginia, the saturated vapor pressure is 0.4667 in Hg, 10,000 times more moist than what I had to expect on the plateau. This means in the Antarctic, at Plateau Station, even if it was at 100% relative humidity, the hygristor, the humidity measuring device, had to be 10,000 times more sensitive. The sensitivity of the standard hygristor simply was inadequate for polar work, especially on the Antarctic high plateau. It also was too late and too complex to design a new one. My enthusiasm to make all things work was dashed and I had to face reality that this instrument simply could not do the job. Giving up on humidity, Saxy and I proceeded to redesign the radiosondes that I would use at Plateau Station to eliminate the humidity and maximize the temperature data.

Dr. Peter Kuhn of the Weather Bureau Office at the University of Wisconsin (center) examines a radiometer which was used in the intercomparison tests. Standing with him are Professor Whal of the University of Wisconsin (right) and Edward Jurasinski, Director of Special Products for the Johnson Service Company in Milwaukee.

A surprise appearance, at least for me, was put in at our polar school by an old friend from the University of Wisconsin. Dr. Pete Kuhn was driven out to the Test and Evaluation Labs at Sterling by Charlie Roberts and introduced to us. He monitored the net-radiometers used on the radiosondes in the Antarctic. I knew Pete Kuhn as the inventor of the airborne net-radiometer. They measured heat radiation from the sky and the ground simultaneously. This measurement was fundamental to all meteorological studies because it measured directly either the heat energy entering or leaving a given place. Net-radiometers were quite expensive. But expensive instruments could not be put on a balloon to be sent aloft as a throwaway. Pete Kuhn together with

Professor Verner Suomi invented a very simple but amazing device that remained inexpensive and thus opened the way to attach their instruments to radiosondes and be launched everywhere.

Pete's net-radiometer had two polystyrene plates painted dull black. Both plates were horizontal, one looking at the sky and the other looking at the ground. Glued in the middle of each plate was a very small bead thermistor. Trapped air space over each bead thermistor was held in by circular polyethylene disks, which permitted long wave radiation to penetrate and be absorbed by the bead thermistors. Incoming radiation minus out going radiation gave the desired net radiation usually measured in calories per square centimeter per minute or converted to degrees of heating or loss per day.

Next to the invention of the digital computer and satellite, no single invention changed meteorology more than Pete's net-radiometer. It measured directly one of the most fundamental components in weather. It measured energy gains or losses at every level. In fact, satellite data might not have been anywhere near as valuable without the net-radiometers they carried. And computers for meteorology may never have been able to begin the basic research without these fundamental measurements of energy.

In 1965 these measurements, especially polar measurements, were far from routine. Although Pete wanted all of us at the polar school to send out some radiation data, he still maintained personal control over every number his instruments measured. All the data collected from these net-radiometers, carried aloft by the Weather Bureau's radiosondes, which were held on the side of the instrument package by masking tape (the entire government is held together by masking tape), were sent to Pete at his office in Boulder, Colorado, where he served the government as a research scientist with the Atmospheric Physics and Chemistry Lab.

The government previously had set Pete up near Prof. Suomi at Madison. By the time of my expedition both Prof. Suomi and Dr. Pete Kuhn had become world leaders on fundamental measurement theory for global problems working with remote sensing devices on satellites, on rockets, and on balloons. Pete's single mindedness for meteorological research sent him to every research center in the world. And now he was giving us considerable time and seemingly enjoying himself while doing it.

I learned how to launch balloons, run the radio receiving recorders, calculate the data as rapidly as possible as it came off the charts while the balloon was ascending, and chart the profile heights from the pressure changes and elevation, range and azimuth of the tracking radar. Although I never could keep up in speed with some of the men who had done this work before, I was capable of holding my own. I had a fundamentally different purpose. While all of my polar classmates learned to reduce their data to only the significant changes as the balloon ascended, I was interested in every change, no matter how small. In fact, my balloons would be sent aloft at the slowest possible speed to record every little change in the inversion and the corresponding radiation and wind profiles.

I would not have at my disposal a tracking radar. At about the halfway mark of the time allotted for me at the polar school, I made contact with the Coast and Geodetic Survey. Their geophysicist selected for Plateau Station, Robert H. Geissel, promised to assist me if a second meteorologist would not be able to go to Plateau Station. Lettau's suggestion, that the detailed wind speeds and heights could be calculated from elevation and azimuth readings from two fixed theodolites a fixed distance apart, was going to be the only method on the high plateau.

Two theodolites were acquired through who knows what shenanigans of either Bill Weyant or Charlie Roberts and were delivered out to the Sterling Labs. Since Bob and I both had apartments in D. C., when it was time for him to join us at the polar met school, he would pick me up in his Austin Healey and cruise at more than 90 mph to Dulles and around the airport to the experimental labs to launch our balloons. Bob had been an expert surveyor and served several years surveying with the Peace Corps in India and Nepal. I was glad of that since again I had no experience with theodolites.

Robert H. Geissel, C&GS geophysist, wintered at Plateau Station, Antarctica

Oddly enough this time my inexperience served me best. Bob carefully showed me how to level the theodolite as a careful surveyor. He also established for me some very valuable methods for shooting a base line and gathering error measurements for corrective purposes with the two theodolites. These small tasks, needed to be repeated every time we took the theodolites out of their cases, took considerable time and our classmates had to delay their balloon launch until we both were ready.

Suddenly the balloon was off as a shot rising one thousand feet per minute and out of sight in about fifteen minutes. Inside the experimental lab, the school mates would follow the balloon for several hours as it ascended to more than twenty miles high. On the ground outside I, in panic, wrote down angular elevations and azimuths missing the first two time stations 30 seconds apart. I lost the first balloon altogether in about three minutes. Looking over to Bob about a thousand feet down wind, I saw him diligently turning the keys of the theodolite so I assumed he at least got good results. When I walked out to talk to him to confess sheepishly that I lost the balloon, I discovered he was still getting ready for launch. Objects that surveyors look at through their transits don't fly away. We both had a lot of training to do.

Accepting the hazing of the polar rats for our failure to track the radiosonde on the balloon, at Wes' suggestion we appropriated a large number of PIBALs, small constant-rate-of-ascent balloons used by a weather observer to determine the base of a cloud ceiling. We gave up trying to write numbers down while we tracked the balloons— that is, once we in fact could move our theodolites fast enough to track them. With two tape recorders next to us we tracked the balloons and by hearing a buzzer through a walkie-talkie we simultaneously marked and barked out the angles of elevation and azimuth. These then were transcribed at a later point and then used to calculate the heights and wind speeds and directions. I learned to capture the balloons. Not knowing that you couldn't track moving objects with a theodolite, my inexperience permitted me to capture launched balloons by tracking them before the experienced surveyor could. In time Bob did too.

QUIZ-ANTARCTIC September 4, 1965

1. Using the strip of Aerovane wind recorder chart furnished complete the following:

   a. Assume the end (time wise) of the wind record is the end of the Chart roll and it is time to replace it with a complete new chart roll. Make the proper entries and identification features thereon. Use the current date.
   b. Assume the beginning of the wind record is a newly installed chart roll. Make the proper entries and identification features thereon.
   c. Record proper time-check entries on the entire chart. assume LST:GCT.
   d. Pick off gust data for each 3 and 6 hrly observation as appropriate and encode gust groups by identifying time indicator.
   e. Pick off any maximum one minute wind and encode using appropriate time indicator.
   f. On WBAN 10B make appropriate entries for peak gust and maximum one minute wind for the day.
   g. On WB 733-1 make appropriate entries for peak gust and maximum one minute wind for the day.
   h. Assume low clouds were observed moving from the NW throughout the entire day; middle clouds were moving from the NE during the first 12 hours of the day and moving from the SW the remainder of the day; high clouds were moving from the SE during the first 6 hours, from the N the second 6 hours, from the W the third six hours, and from the E the last six hours, encode the prevailing wind - cloud direction group for each 3 and 6 hrly observation and identify by appropriate time indicator.
   i. On WBAN 10A, in column 13, record any frontal passage as indicated by significant wind shift.
   j. From the wind chart, list any and all occasions (independent of cloud direction observed) when inclusion of the wind - cloud direction group would have been a mandatory group in the 3 or 6 hrly report due to wind shift alone.
   k. Using the wind chart, enter all of the hourly wind direction and speed values for the day on WBAN 10A.

2. Briefly describe noctilucent clouds, when they would NOT be observable, and how you would distinguish them from nacreousclouds.

3. You are shipping a defective Aerovane Wind Recorder from your station to Polar Operations. List the number and distribution of shipping documents involved in this operation.

4. List the procedures for mailing data records to POP at the close of the summer season.

5. Give an example of a RAWIN message for your particular station, identifying significant and mandatory levels. Balloon burst, last plotted level of wind at 31,162 meters above surface.

6. List the synoptic observations when the following groups would NEVER be sent:

   a. precipitation group
   b. maximum one minute wind group
   c. gust groups
   d. maximum and minimum temperature group
   e. blowing snow group
   f. special phenomena group 93000

7. List the synoptic observations in which the following groups are ALWAYS sent:

   a. maximum and minimum temperature group
   b. maximum one minute wind group

8 In the synoptic message the following are given in ___?

   a. TT; b. RR; c. pp; d. s_n; e. dd; f. VV; g. ff; h. T_xT_x

9. Encode the following weather information using the Antarctic code.

   Byrd Station, Latitude 80 ° S Longitude 120 ° W, 0400LST. Low clouds moving over the station from the north. Middle clouds, direction indeterminate. Peak gust during the past 6 hrs 68 knots from 355 °. Visibility 1/2 mile. Present weather blowing snow, overcast, ice fog, continuous light snow. Maximum temperature past 6 hrs -32.4 ° F. Surface wind direction 015 °. 2/10 sky obscured by blowing snow. Pressure tendency rising, then falling. Wind velocity 38 knots with gusts during past 15 minutes up to 45 knots. Dew point temperature missing. Total sky cover 8 octas. Minimum temp past 6 hrs -40.6 ° F. Weather during past 5 hrs ending 1 hour ago ice fog, blowing snow, overcast, light snow. Light snow began 0115 LST. Height of 850 mb level 1480 meters msl. Temp of air -25.8 ° F. Net 3 hr change in station pressure 0.215 inches. Snowfall since 0115 LST estimated .05 inch. Maximum 1 minute wind speed during past 6 hrs 41 knots from 020 °. 5/10 stratocumulus clouds estimated base 2,000 ft.

The last days of the polar school Hugh M. Muir, a scientist from the United Kingdom with the Arctic Institute of North America, planning to study the aurora from Plateau Station, also visited our polar school to learn how to assist me with the balloon project. Hugh was the kind of bloke we'd all die for, but there was no way he was going to be able to follow the balloons with a theodolite. After every launch when the balloon was miles away, Hugh would get around to ask, "Now you want me to see if I can telescope that balloon, do ya?" The balloon was gone! It was settled. Bob and I were the team.

For research work the pressures of time to meet operation demands was fortunately not present. The data would be collected and interpreted much later. A danger of collecting much useless data was a serious potential problem but physical constraints of our isolated remote station gave us no choice. I knew the problem, in fact, would become much worse in the polar field.

Some other chaps need mention. Charlie Mabe was from the National Weather Records Center in Asheville, North Carolina and had a secure position with the Weather Bureau. I could not understand this thin blooded southern fellow with a wife and six children leaving them for a year to go to the South Pole. He needed money. Before the Antarctic summer was more than half over, Charlie abandoned ship and headed home to North Carolina. I was glad for his family. Oddly, Wes Morris knew he wouldn't make it. He teased him seemingly unmercifully, always calling him Charlie Maybe and made no bones about his most likely failure on the Ice.

Hugh Muir, Aurora Scientist, Arctic Institute of North America, From the United Kingdom, Scotland—actually!

By the end of school out at Sterling, the *USS Calcaterra* arrived at its forlorn ocean station between Dunedin, New Zealand and McMurdo, Antarctica to assist with radio traffic between the States, New Zealand, and all stations in the Antarctic. She also remained at this precarious station in the worst of sea conditions for any emergency needs for Deep Freeze 66. Such was the lonely but vitally important work of a sailor. Also the four LC 130Fs began their overcrowded flying schedule on the Ice.

Somehow, although far from true, after polar school was over, after some very kind words from Wes Morris, I had the confidence of a polar rat and was more than ready to explore. There was much work still to be done. I desired to spend considerable time with Lettau and Schwerdtfeger before departure for the Ice. I had to visit Dalrymple's lab in Massachusetts. His program now was still a big unknown. I still did not have thermocouples for under the snow measurements. Snow accumulation was a puzzle until the day I arrived at the Pole. But ships were leaving with cargo bays full. Time was flying. As the leaves began to fall in Wisconsin, as the temperature began to become comfortable in the District, we were ready and sadly we knew we were ready. Hugh Muir, Bob Geissel, and I, now acquainted, began the ritual of drinking more and more frequently growing in restlessness before the big move.

CHAPTER 5
Good Bye

Wes Morris' polar school prepared me for the imminent expedition intellectually and practically. However, he scared me about the need to be in reasonable physical shape for successful living on the high plateau of Antarctica. I was tested many times for my physical stamina and lung capacity, but I never believed I was in good shape. Never at schools I attended before college did I ever receive encouragement for my physical abilities. Coaches only seemed interested in finding boys for their next team and if you were not taller than most, faster than most, or bolder than most, then it was open season for the mob to ridicule you while the coach looked on. If you complained, you either were ridiculed more or the teacher added his own scorn along with the big boys to show you that you need not complain.

At Wes' encouragement I began a jogging program of my own following a published program of physical fitness of the Canadian Air Force. It included a run of about five miles every other day, running full speed the last half mile. When I returned to my apartment evenings from my office at Polar Met at the Old Mexican Embassy I changed into old clothes, which for me were shiny dress slacks and a T-shirt used while painting. In prim and proper Georgetown, where people were well dressed for walking their dogs, I looked out of place so I would sneak around the corner from my efficiency apartment at Q and 30th Street Northwest and start jogging north for about two blocks on 30th Street to Montrose Park. From there I ran past the John Howard Payne House, through Oak Hill Cemetery along the west bank of Rock Creek, heading southeast until I came to the bridge at Q Street. Once over the bridge I enjoyed an easy run along the Rock Creek Parkway winding north past the National Zoological Park as far north as Pierce's Mill where I turned around and followed the same way back to my Georgetown apartment.

I learned all about a second wind and some of the joys with long distance running. But it was 1965. No one was health conscious. No one was jogging for recreational purposes except Senator Proxmire from my home state. One of the first weeks I was jogging, heading south and pouring on the coals for a speed run between the Zoo and Massachusetts Avenue, a police squad car with lights flashing came over the curb and down a grass embankment to the path I was running along. I thought it strange and looked over my shoulder to see if anyone was behind me. No one was in front of me. Why was he trying to drive down to the river? He even momentarily got stuck in a mud patch. I continued to run, not wanting to slow the great speed I thought I had achieved. Maybe I even ran faster. The police officer put on the siren and seemed very angry as he shouted to "Stop running immediately!" Only then did it dawn on me that he might be after me. Although it was not the first time that I was stopped and restrained by the law, it was the first time that I was somewhat angrily pushed over the squad car and roughly searched.

I desperately tried to explain that I was not running away from something. I told the officer

I was training for a research expedition to the South Pole and needed to build up my lung capacity. He only laughed at the mention of the South Pole. He reminded me of a coach, but alone on this parkway I was beginning to get worried. The policeman made me remain standing with my hands flat on the hood of the squad car while he radioed for robbery and rape reports and then waited for other reports to come over the radio for almost thirty minutes. Again I tried to explain that I ran this route along the Rock Creek Parkway every Monday, Wednesday, Friday, and Saturday. It was Monday. He suddenly was called away for a traffic accident somewhere else, but before releasing me he warned me that he would be watching for me the next several days. Wednesday, he was there, parked down along the mud path along the creek. I waved as I ran around the squad car as fast as I could, never to see him again.

People used to say that good rigorous exercise made the mind fresh. In my case that certainly was not true. Evenings of the days I ran for lung strengthening were shot for intensive theoretical study. Complex articles from scientific journals to me sounded like mush when read after a long run. In the end, although my running program rightly prepared me for high altitude living, it slowed necessary intellectual development. Everything not learned before the time of departure for the Ice was lost.

My social whirl of life in our nation's capitol was drawing to unreachable heights, unreachable as the common voice finds the National Anthem unsingable. A high school and college classmate, Alan Merten, in the Air Force, was a rapid climber as a "whiz kid" in the computer world of Defense Secretary Robert Mac Namera, and we continued that friendship in the District of Columbia. Al became a White House Aid for President Johnson and lived in the "Glass House" mansion along the George Washington Memorial Parkway on the west side of the Potomac River. As his friend, on several occasions the social whirl for a slum child like me seemed too much.

An apartment of girls, all friends of Al Merten, two blocks away from my apartment in Georgetown, became a good escape from the politics of swapping equipment, memorizing formulas, and crash learning little bits of trivial information without which it was impossible to use the mainframe computers. To these good friends and especially to Betsy I owe thanks for sharing their slower southern pace of life and the taste of grits and bacon.

Nearby Georgetown University sponsored many free cultural events such as political lectures and dances. The associated street trappings of restaurants and taverns were always luring along Wisconsin Avenue. At one of these very fine and expensive restaurants called the Ross House, I met a wine steward who worked in the White House during the Eisenhower years and learned from him many social graces concerned with the ordering of wine. "All the rules were of no value, but personal taste was everything." When Nancy visited me for a lengthy weekend several years later, it was this wine steward who put on quite an elegant display of his knowledge of wines, all the while letting us think we were knowledgeable about wines instead. He told us about the fragrance of strawberries being drawn up into the grapes when grown nearby and by doing this, he reaped the benefit of selling several bottles and a large tip.

Free Watergate concerts started or ended with the National Anthem that always sounded better and louder in the District. Melanie Masters, a girl in a basement apartment which opened onto a sunken garden, went off to marry an Arab from the Tunisian Embassy. I ate "koos-koos" at a banquet she served for her Arabian friends, all who were appreciative of my interest in their country that I had because of my service with the Model United Nations I participated in at Madison.

I learned to carry cigarettes and matches, even when I did not smoke, for Carol Anderson, an aid to Senator Scranton from Pennsylvania. We shared an interest in politics and jazz, particularly Peter Nero's concert. Carol seemed to be inordinately concerned about American involvement in Vietnam.

Frequent trips were made at extreme speeds down the Henry G. Shirley Memorial Highway to Richmond, Virginia en route to Langley Air Force Base at Hampton, Virginia and the Naval Station at Norfolk to visit Don and Carol Panzenhagen and Larry Burroughs. With these long time acquaintances dating back to all my years in college I made many friendships among the several armed forces. They too were concerned about Vietnam, not about an over involvement, but about the need to serve our nation when she calls.

Their occupations were new to me. I, who could never stop talking about my job and the interesting aspects about what I was working on, found the military crowd dedicated to the elimination of shop talk, not because of a lack of enthusiasm, but out of necessity to eliminate the temptation or accident to release secrets. To that end I was always thankful for the openness of Antarctic service where any and all studies were expected to be published for the sharing of all interested parties.

While living in the District, I attended two Lutheran churches. A Missouri Synod Lutheran Church, on Connecticut Avenue as I remember it, was accessible by bus. I found the people truly Christian with open hearts and socially open to accepting me. At Bible studies and volleyball gatherings at the Church I met many people of like mindedness, some of whom were, like me, facing service in a foreign country. One couple of note accepted a tour of duty for the State Department in India and was struggling with how to follow the guidance of the State Department when dealing with the greatly impoverished versus their Christian principles of freely giving of their wealth.

I also attended Grace Lutheran Church, a Wisconsin Synod church, in Falls Church, Virginia. The members, although members of a church of my heart, seemed very removed from a young man of twenty-five years of age. They also seemed to be all Republicans. Why was it that to be conservative in one's scriptural beliefs, it was expected that you had to be hard heartedly conservative in your political beliefs, which in my view meant you were callous and unforgiving to the poor. Our WELS church was not in the District of Columbia where you might meet a poor person or a person of another color. I saw that in Milwaukee where I grew up as church after church abandoned the inner city as the lily white German descendants moved to the suburbs. There were still many souls of mixed races living very near these churches, yet little or no mission work was done. This false German pride will ruin our church body one day. We are asked by our Lord to be loyal to Christ, not to ethnic origins such as Germany or Wisconsin. I was most gratified that the Bible was being translated into all languages, even into American English.

After a while, the considerable hope to have someone from Paul Dalrymple's lab come to Washington D. C., came to an end. Things there seemed to be in a state of delay. I arranged to go to Natick, Massachusetts, and visit the Polar and Mountain Research Labs of the U. S. Army. With time running out, ships long gone from Davisville, Rhode island, and procrastination beginning to shorten programs in the field, I was more than nervous about the radiation measurement program I was expected to conduct for NLABS while at Plateau Station.

When I arrived at NLABS I found the fundamental equipment had just arrived. I met Leander Stroschein, an engineer for Paul Dalrymple who had recently conducted field measurements of radiation in Alaska and the Yukon Arctic. Lea was a very personable guy originally from South Dakota. He was still unpacking the newly purchased equipment we were supposed to use at Plateau Station. I was stunned that it was still in house and not at the docks. Sailing time to McMurdo was hopelessly too long to get there on time. In fact it was too late. The Army rarely trusted the Navy and both Paul and Lea were unconcerned. Paul said that the Air Force at one time was part of the Army and he trusted fly boys before sailors.

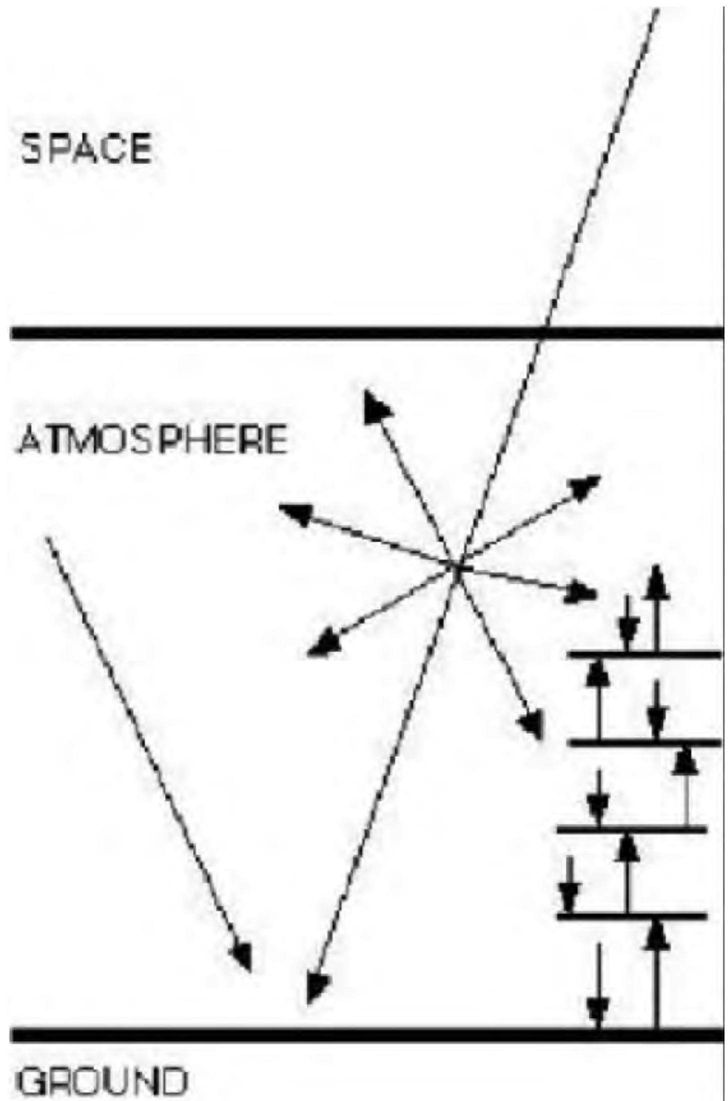
I began to mistrust this outfit. As it turned out, Dalrymple and Stroschein just played a little closer to the edge than I wanted to. Even though I thought I was a professional procrastinator, I learned in the government while I might be a workaholic I had no right to expect that those serving under me would be willing to work with the same fanaticism without reward. To expect it was simply wrong and taking undo advantage. Luckily for Stroschein, we both wanted the thrill of acquiring the most sophisticated and complete set of data for the top of the south polar icecap.

Suddenly Stroschein, with me observing, started to take apart all the newly purchased instruments. He was the engineer. For me, I would have left them alone in their box and been more concerned that they were shipped. Lea wanted to see how they were put together and what is more important, what repairs should be anticipated for the isolated Plateau Station during winter when resupply was impossible.

The plan now was that I would now be hand carrying some of the chief radiation instruments. Heavier recorders and auxiliary equipment were air freighted to Christchurch. The first instrument was a Linke-Feussner actinometer that could monitor the solar energy by looking directly at the sun. I was given two Kipp solarimeters. One was aimed upward, the other aimed downward. They measured solar radiation coming in from the sky and the radiation being reflected off the snow surface. I also carried a CSIRO Funk pyrradiometer to be faced upward and a CSIRO Funk net-radiometer for measurements of the radiation absorbed and then reradiated from the earth and air.

I was excited to learn with my own hands on these instruments that would measure the most fundamental data, the very heat energies that drove the heat engine of the earth from the sun. All other factors — wind, temperature, humidity, pressure changes, air density, cyclonic or anticyclonic air flow, etc. — were related to the four radiation components: incoming short wave solar radiation, outgoing reflected shortwave radiation, downward long wave radiation from the atmosphere, and upward long wave radiation from the snow surface. These were clearly defined and measured by Kirby Hanson at Amundsen-Scott Station. Yet when working with the actual instruments, I became aware what is not taught in the class room, the beating of the data into submission. The four components of radiation cannot be measured directly.

First of all, meteorology, a multi-disciplinary subject in 1965, still dealt with solar energy as light formed of waves even though physicists had shown clearly that light is made of weightless particles called photons emitted by electrons as they shifted levels of orbiting of the atoms. Some people hid behind a phrase “duality of light” but this phrase just hid ignorance. Like teachers teaching science as a vocabulary lesson, they didn’t understand the phenomenon enough to explain it in their own words and hid behind big words.



Secondly, there is the problem that light simply does not come into the atmosphere straight. A beam of light from the sun enters the atmosphere at many places, not all parallel, and scatters in all directions as it interacts with the atoms of the air. This scattering sometimes is called diffused light and can commonly be seen as a blue sky on our planet.

At first blush, short wave (waves being already an erroneous point of view) radiation from the sun can be seen as direct solar and diffused solar. Every layer of air diffuses the light both upward and downward. Then the diffused light from all directions and many many paths eventually reaches the ground to be reflected and scattered all over the place again. This is just talking about the unabsorbed shortwaves.

Every layer of air and the surface of the ground absorbs differing quantities of this short wave energy and reradiates it as long wave radiation and these long waves are likewise scattered and reradiated. The problem was compounded with short wave and long wave energy moving in and out of semitransparent glacial snow and ice as a surface. Each instrument used sees all these waves (remember also that they are really photons) as composites that come out as differing sensitivities registered on our recorders and greatly interpreted. The instrument pointed directly at the sun is measuring mostly direct solar radiation but also some diffused energy and some energy coming back down that reflected off the surface. Each instrument in turn had to be analyzed with all these interpretations. Radiation studies were a computational nightmare before the digital computer. Nevertheless the high speed computational techniques of modern computers have masked this dressing of raw data and given an illusion of certainty of measured knowledge. None of the uncertainty detained our drive to the high polar plateau to acquire this most valuable and fundamental information about our atmosphere.

Before leaving NLABS Paul Dalrymple insisted that I meet his "war department," namely his wife and child. I enjoyed his very comfortable home in a suburb of Boston and met his very British wife and bright young child. Knowing Paul only from casual acquaintance I had no idea he was still planning to come to Plateau Station and maybe even held a desire to stay the winter but had not told his wife. I made the horrible mistake of speaking about his possible wintering over and a livid, cold, silence descended like a thick blanket of ice fog choking off all further conversation for the evening. I suspect his wife was beginning to plot another trip to Bermuda.

I returned to Washington D. C. with a promise from Leander Stroschein to come to the plateau and assist with the installation of the radiation instruments and his recording system, assuming he could get it all back together again. Another of the pieces of the puzzle of all the work to be done before the expedition now was in place and I was at greater ease.

At polar met the mood was one of crisis. Phil Smith, claiming to represent Burt Crary, was in touch with Bill Weyant. The original plan to have two meteorologists at Plateau Station was formally changed to allow only one. Apparently the air operations officer of the U. S. Naval Support Force, Antarctica, arrived at this conclusion several months ago. There simply were not enough flying hours in the austral summer to carry all the required building materials, fuel supplies, and personnel so far inland at such a high altitude as that required for Plateau Station. By cutting the size of the station from twelve to eight men an economy of flights by FC-130F could be achieved. I suspect that the powers that be always knew there would only be room for four civilian scientists and therefore only one meteorologist, but either Dalrymple simply did not listen or his close friend Burt Crary did not have the heart to tell him until the last minute.

We all knew the Navy was the support force and not the only force. The civilian scientists' researches were the only reason for being in Antarctica. The Navy just helped us to get there and to keep us safe while we stayed there. So in principle, if it was important to have two meteorologists at Plateau Station, the Navy should have been told they had to support them there. Number two at the National Science Foundation as deputy head of the Office of Polar Programs and thus chief civilian coordinator to the Navy was Phil Smith. None of us liked him. We all believed he continually was betraying the scientific efforts, giving in to the military for little or no reason other than for the pomp and circumstance and hoopla the military is capable of providing when it needs to.

It was Phil Smith who telephoned Weyant asking him to break the news to Dalrymple and me that at Plateau Station I would be alone with the inversion project and the radiation project. Weyant was in near panic at this very late announcement with no changes of the program possible other than simply to quit. I knew Stroschein would be coming during the summer season to help me set up the radiation instrumentation. The inversion program was another matter, but I had a potential solution. Bob Geissel was improving as a workable aid for tracking the balloons. Hugh Muir could not follow the balloons but would be effective at other support tasks during a full balloon flight operation. I primarily feared the responsibility for the initial establishment of the meteorological program and the very formal calibration requirements for this new weather station called Plateau Station. If it truly was to become a major milepost for weather research, I had too little experience and I knew it. Yet I certainly was prepared for the long haul of the wintering over and isolation. I persuaded Weyant to let me negotiate this one.

Exploration of an entirely new region of the polar continent was a lure for any "polar rat." I desperately wanted to be on the team to fly first into the high plateau region. Now I had an opportunity to mend some fences with the boys who finally took me under their wing in spite of some bitter politics of the past which I had not been part of. I walked over to the Polar Ops. Eddie Goodale, an old polar hand back in Admiral Byrd's day, was already in Christchurch. Vaughn Rockney, a Chief of OOPS, was a good choice to sound out the plausibility of my first major foray into civil service politics. Together we found Charlie Roberts. As an old polar hand with several expeditions in his experience it was easy to see the logic in asking Charlie to take my place as the first meteorologist to Plateau Station. He would be able to deal with the Navy and establish the correct position of the station for meteorological research on the highest "ridge" of the plateau. He could set up the standard weather station and was an expert on the standardization process required for the United Nations Global Weather Network. I would follow and together we could set up the inversion program. He then could leave Plateau Station and survey other stations operated by Polar Ops.

Charlie was polite. He knew how important being first was to me. I knew it too. That is why it was such a good swap. I could rest in the assurance of having the best man assist me in setting up my program, which without a doubt would launch my research career as an expert on inversions. The smile that swallowed this grown man's ears assured me that Charlie was very excited to help. The trip to the Antarctic high plateau was getting closer.

Just before the new summer personnel and the replacement teams of the wintering personnel were to embark from state side, the National Science Foundation conducted an orientation session for a week sequestering all these scientists at Skyland Resort in Shenandoah National Park along the Appalachian Mountains of Virginia about a hundred miles west of Washington D. C. Our individual researches were set aside for an intensive immersion into everyone else's research as well as lessons in our national interests.

The keynote address was given by Ambassador Paul C. Daniels of the State Department. He was President Eisenhower's special adviser on Antarctic affairs and headed the U. S. Delegation to the Conference on Antarctica. Ambassador Daniels wrote the first major draft of what eventually emerged as the Antarctic Treaty and was signed by him on 1 December 1959.

Ambassador Daniels reviewed for us the mileposts of this famous treaty, still (1994) functioning quite well. In spite of great mistrust between the East and West, between the USSR and the USA and its allies, at the height of the Cold War this treaty provided for free exchange of all information gathered in Antarctica, a nuclear free zone for all of Antarctica, and open inspections of all stations and military material in Antarctica. When the Soviet Union had been closed to any and all thought of inspection, such ideas were accepted in Antarctica.

“The Governments of Argentina, Australia, Belgium, Chile, the French Republic, Japan, New Zealand, Norway, the Union of South Africa, the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland, and the United States of America,”

“Recognizing that it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord;”

“Acknowledging the substantial contributions to scientific knowledge resulting from international cooperation in scientific investigation in Antarctica;”

“Convinced that the establishment of a firm foundation for the continuation and development of such cooperation on the basis of freedom of scientific investigation in Antarctica as applied during the International Geophysical Year accords with the interests of science and the progress of all mankind;”

“Convinced also that a treaty ensuring the use of Antarctica for peaceful purposes only and the continuance of international harmony in Antarctica will further the purposes and principles embodied in the Charter of the United Nations;” “Have agreed as follows:”

“Article I”

“1. Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons.”

“2. The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purpose.”

. . .

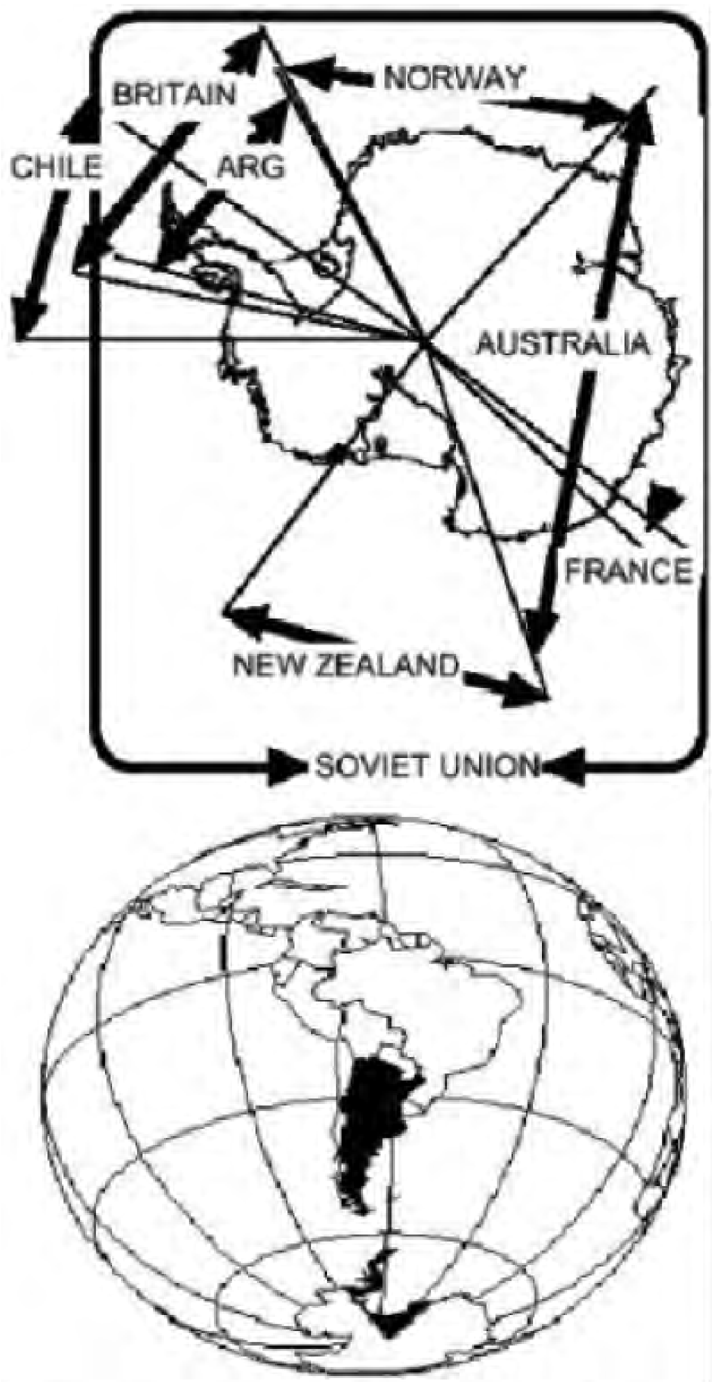
“Article III.”

“1. In order to promote international cooperation in scientific investigation in Antarctica . . .”

“(a) information regarding plans for scientific programs in Antarctica shall be exchanged to permit maximum economy and efficiency of operations;”

“(b) scientific personnel shall be exchanged in Antarctica between expeditions and stations;”

"(c) scientific observations and results from Antarctica shall be exchanged and made freely available."



ARGENTINA'S FULL MAP

. . .

"Article IV"

. . .

"2. No acts or activities taking place while the present Treaty is in force shall constitute a basis for asserting, supporting or denying a claim to territorial sovereignty in Antarctica or create any rights of sovereignty in Antarctica. No new claim, or enlargement of an existing claim, to territorial sovereignty in Antarctica shall be asserted while the present Treaty is in force."

"Article V"

"1. Any nuclear explosions in Antarctica and the disposal there of radioactive waste material shall be prohibited."

. . .

"Article VII"

"1. In order to promote the objectives and ensure the observance of the provisions of the present Treaty, each Contracting Party whose representatives are entitled to participate in the meetings referred to in Article IX of the Treaty shall have the right to designate observers to carry out any inspection provided for by the present Article. Observers shall be nationals of the Contracting Parties which designate them. The names of observers shall be communicated to every other Contracting Party having the right to designate observers, and like notice shall be given of the termination of their appointment."

"2. Each observer designated in accordance with the provisions of paragraph 1 of this Article shall have complete freedom of access at any time to any or all areas of Antarctica."

"3. All areas of Antarctica, including all stations, installations and equipment within those areas, and all ships and aircraft at points of discharging or embarking cargoes or personnel in Antarctica, shall be open at all times to inspection by any observers designated in accordance with paragraph 1 of this Article."

"4. Aerial observation may be carried out at any time over any or all areas of Antarctica by any of the Contracting Parties having the right to designate observers."

. . .

Daniels made us feel that our work was the embodiment of this great Treaty. The pursuit of human understanding of the earth's environment was the most noble cause a human could pursue for the preservation of all of mankind and the sharing of that information maintained the peace and preserved humanity.

The issue of claims, set aside for thirty years, remained a real one. Scientists serving in the Antarctic Peninsula needed to get a visa from Argentina. As part of its contiguous territory it claimed all the Antarctic between its eastern and western most longitudes south to the South Pole. In order not to raise an issue, most nations, including the United States, complied.

We heard inspiring reports; we heard technical reports. We saw uplifting films of past explorations. One memorable enlightening report was really a travelogue on "Man Hauling in Antarctica." It was a glorification of the original man hauling of British fame carried out on numerous expeditions of Robert Falcon Scott and Ernst Shackleton in the first quarter of this century. Dr. Robert L. Nichols, Professor of Geology at Tufts University, still led such parties in the Antarctic where each man hauled a one ton sledge between mountains and over glaciers.

On one hand it seemed ridiculous. It was man hauling that led to the frozen death of Scott's party in 1912. Yet, by walking over the ground you were exploring, geologically you did not miss anything. The search for detail was the Tuft mark of excellence and the National Science Foundation rewarded such excellence.

Antarctic research led the way in many earth sciences. Van Allen, leader of Antarctic projects during IGY and discoverer of the Van Allen radiation belts that circled above the poles, spawned an awesome research program from many universities all using the quiet Antarctic icecap from which to monitor the ionosphere and the magnetosphere of the earth.

Peter Kuhn, in a most enthusiastic and impassionate manner, delivered his speech. In doing so, he showed us all and charged our enthusiasm to obtain the most fundamental measurements, the basic radiational energies at the South Pole. When he was finished, those of us using his netradiometers knew we had the most important task of all explorers in the Antarctic. Even scientists of other disciplines seemed to believe it for a while.

Lieutenant Jimmy Gowan, MD.
Officer-In-Charge,
Plateau Station, Antarctica

Antarctica was becoming a bench mark against industrial pollution for the earth. DDT was found even in penguin eggs, evidently reaching the polar region by way of wind and wave from industrial counties far to the north.

We heard brilliant deliveries. We heard utterly ridiculous reports. Mr. Tickell with a heavy British accent but with the Johns Hopkins University told and showed slides on how he captured wandering albatross (diomedea exulans), spray painted them international orange and chased them with his helicopter to monitor what they did during their life in the Antarctic ocean waters. He had the audacity to claim, with colored photographs even, that the spray paint did not interfere with the albatross' sex life.

During smokers and other breakout sessions we met each other. It was my first meeting with Rob Flint, the chosen scientific leader for Plateau Station. He had spent a previous winter at Byrd Station and was an electrical engineer and physicist from Stanford University. He would be the only member of our exploration team that had any previous experience wintering over. I was glad he was tall. Somehow it helped me to accept his leadership.

We also were introduced to Lieutenant Jimmy Gowan, MD. He was of a very fair complexion, from South Carolina without a sun tan. He had a slight southern drawl but not too noticeable. He seemed a very pleasant fellow and promised each and every one of our scientific team - Rob, Bob, Hugh, and me - the very best assistance the Navy could provide. The navy crew men, three in number were not present.

When Sir Charles S. Wright, a veteran of the Antarctic since Scott's expedition to the South Pole in 1911, arrived at Skyland via a limousine and was escorted by all the NSF dignitaries, we all knew to stand and applaud before he began to speak.

On Robert Falcon Scott's march to the South Pole, he started his man hauling with a team of eight men: E. L. Atkinson, a surgeon; Lieutenant Henry Bowers, RIM; Petty Officer Edgar Evans; Apsley Cherry-Garrard, a paying volunteer and a zoologist; Petty Officer Keohane; Captain Lawrence Oates, 6th Inniskilling Dragoons; Dr. Edward Wilson, expedition zoologist; and Charles Wright, a Canadian physicist. On 21 December 1911, after the nine men man hauled all of their supplies up the Beardmore Glacier, Scott selected four disappointed men to return to base camp at Cape Evans on Ross Island. The remaining five — Scott, Bowers, Evans, Oates, and Wilson — marched to the Pole and froze to death on the return march. Sir Charles Wright was one of the four disappointed men who was not allowed to go with Scott to the Pole. It was Sir Charles Wright, navigating for the search party the next year, who first found the tent with the bodies of three of the five men - Scott, Bowers and Wilson - who froze.

What did he tell us? What did each of us ask him? I don't remember. But I did not remember the next day after his speech either. What difference does it make? I saw him. I heard his voice. I learned just by looking at him to press on with my duties without looking back. I learned never to be disappointed with what my God ordains, no matter how disappointed I might be. I knew before my expedition started, the men I would get cold with together would be forever bonded as true friends. Sir Charles Wright was on his

way back to the Antarctic as a consultant for the Canadian Pacific Naval Laboratory in Esquimalt, British Columbia.

Finally, Mr. L. D. Bridge from Wellington, New Zealand gave us the straight skinny on survival on the Ice and, of course, a manual. (Some signals to be memorized are shown here.)

After the Skyland conference different members of the Weather Bureau embarked for the Ice at different times. Those bound for Byrd Station were the first to depart. A few short weeks later, the South Pole parties left. Everything depended on the Navy's schedule and their schedule depended on God's weather. The high plateau was the last region to open for the summer so I had a short respite to dash to Wisconsin for last good byes.

First, shots. I was avoiding the inevitable. At Skyland the Navy chaps learned that I did not have my shot record up to date and all laughed. On return to Washington D. C. I immediately visited the U. S. Navy Dispensary on Constitution Avenue next to the Reflecting Pool. The officer in charge asked for and received my travel orders, read them and laughed. I had to ask why every Navy person was laughing? I learned in the next painful minutes and suffered for two weeks after. He simply took a map of the earth, drew a line that traced out my flight plan from Washington, to Hawaii, across the equatorial zone, to New Zealand and down to the bottom of the map representing the South Pole. That line crossed essentially every disease area and I received shots in my left arm, in my right arm, in my left buttock, in my right buttock, in my left thigh and in my left arm again. Enough said. He was laughing; I was groaning.

A last visit was paid to Prof. Lettau and Prof. Schwerdtfeger. This time not much information was exchanged. I reviewed the criterion for balloon launches. Each professor still tried to add more to the project but now, as a government civil servant I no longer listened. I wanted to, but time simply was gone. I was already covering all the last minute blunders of my own plus some of the procrastinations of NLABS.

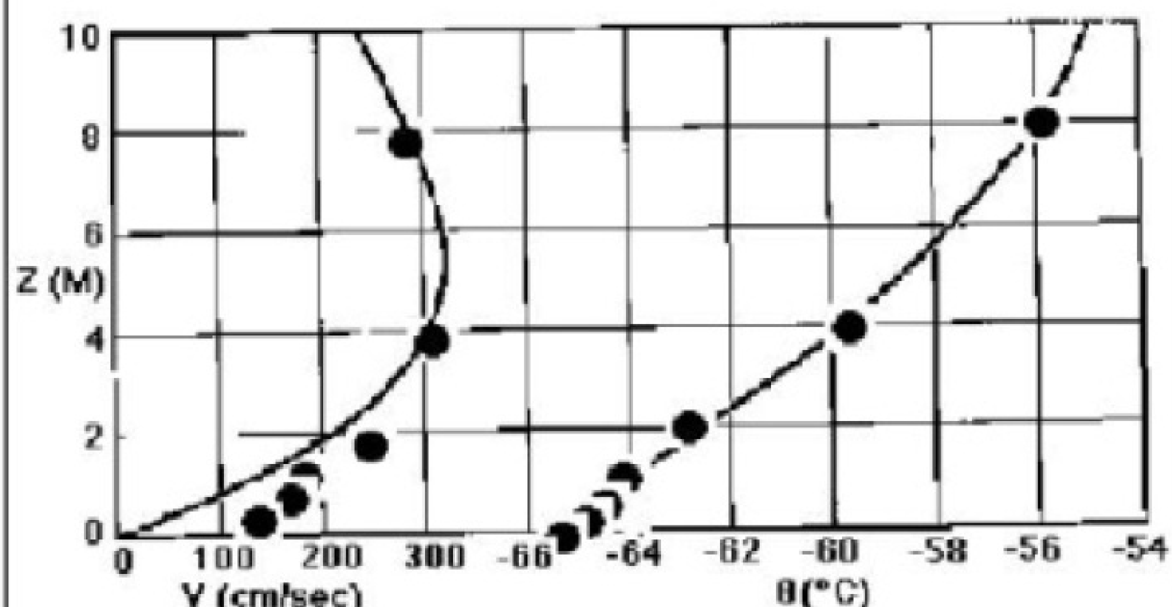
Lettau insisted he receive the warmest temperature measured in the air the first few weeks at Plateau Station and the temperature of the snow at the deepest level I could dig to. He wanted to predict the coldest temperature of the year. At that point I knew nothing about communications on the Ice. It was hard not to be able to promise Lettau's request. I asked for his prediction method but he only smiled and said he would wait for my data and would be glad to share after that.

Lettau did show me some advanced draft of a work on South Pole data he intended to publish soon. I was somewhat stunned although I should not have been. It was evident Prof. Lettau was racing on with research on air flow over the Antarctic interior speculating on the plateau from data already published by NLABS from the South Pole micrometeorology program of Dalrymple.

I chided him about the debate his class through my work out east was causing. Would the winds over Plateau Station be katabatic or of a different nature? Lettau saw katabatic winds as a special case.

The direction Lettau wanted the research to go strongly pointed to katabatic winds as truly down slope winds of a short time duration. Thus, they did not involve the Coriolis force from the spinning earth. Katabatic flow was caused by a piling up of cold air held on to the sloping plateau by another wind system.

> “. . . Dalrymple et. al. They found that, at the south pole, the difference vector between the wind velocity at the top of the inversion layer and the wind velocity in the surface layer gives evidence not only of a systematic frictional backing of wind direction with height, but also of an additional prevailing tendency toward a crossslope motion. In other words, there appears to exist a physical cause that tends to make the air motion in the surface layer an ENE wind regardless of the velocity vector in the free atmosphere.”



Wind and potential temperature data at the South Pole, September 17, 1958; averages for 02 to 06 GMT, in comparison with theoretical profiles in katabatic flow.

> “An obvious explanation presents itself in the thermal wind effect, or the geostrophic balance between a force due to gravity and a horizontal density gradient, and the Coriolis force, which accompanies the resulting equilibrium motion of the air. Namely, the prevailing condition of a substantial ground-inversion layer of several 100 meters thickness, on a sloping boundary, must of necessity mean that the temperature increase normal to the snow surface sets up a horizontal temperature increase in the air away from higher ground. The large horizontal extent of the sloping plateau provides sufficient opportunity for the Coriolis force to develop the balance, because, at a mean speed of 5 m/sec, it would take nearly a full day to traverse a distance of 400 km. In conclusion, it can be said that the

surface wind distribution at the south pole is primarily caused by geostrophic motion above inversion height, which is modified by a prevailing thermal wind (due to systematic horizontal density gradients in the sloping inversion layer) as well as by surface friction." (Heinz H. Lettau, "A Case Study of Katabatic Flow on the South Polar Plateau," in *The Antarctic Research Series*, Vol. 9, Morton Rubin, Editor, American Geophysical Union, 1966, pages 1-2, also figure 2, page 8.)

It was obvious no one could develop mathematical models faster than Prof. Lettau and his students. Nor should they. I was a recipient of his gifts as his student. Nevertheless I did feel envious of the younger student who could sit comfortably in the classroom, take notes and formulate theory at the whim of the theoretician. I now had to depart to the frozen field to collect the confirming evidence and I did not like my disconnected role from the theoretical side of things.

Schwerdtfeger was formulating a stronger and stronger case for sinking saturated air which in an inversion then would precipitate ice crystals from a clear sky. As warm nearly saturated air descended into cold stable air, super saturation would be achieved or the moisture would have to precipitate out. I would watch for this phenomenon.

Insert: 30 November 1965. "To meet this possible—and in my view likely—Communist buildup, the presently contemplated Phase I forces will not be enough (approx 220,000 Americans, almost all in place by end of 1965). . . . If it is decided not to move toward a compromise, I recommend that the U. S. both send a substantial number of additional troops and very gradually intensify the bombing of NVN. Amb. Lodge, Wheeler, Sharp and Westmoreland concur in this prolonged course of action, although Wheeler and Sharp would intensify the bombing of the North more quickly. . . .recommend up to 74 battalions by end-66: total to approx 400,000 by end-66. And it should be understood that further deployments (perhaps exceeding 200,000) may be needed in 1967. . . . Evaluation. We should be aware that deployments of the kind I have recommended will not guarantee success. U. S. killed-in-action can be expected to reach 1000 a month, and the odds are even that we will be faced in early 1967 with a 'nodecision' at an even higher level." (Memorandum for President Lyndon B. Johnson from Secretary McNamara.)

The visit back to Wisconsin was like a crash course in saying good-bye. I tried to look up everyone I knew to say good-bye and in the end said very little. At the homestead in Milwaukee on Second Street official paper work let the reality of a year in Antarctica sink in. In spite of my personal demand to be truly independent, all efforts to do so, at least with respect to federal income taxes, became impossible. Every federal tax official I talked to said simply mail your taxes. It was impossible to get anyone to accept the thought that for another part of the government, namely the United States Antarctic Research Program (USARP), there would be no mail after the last supply plane at the end of summer sometime in February 1966 until the first flight again in the next summer in December of 1966. I had to turn power of attorney over to my Uncle Edgar Hahm.

Some of the paper work quietly announced that there could be some danger though no one said anything. I had to have several signatures on forms designating my brother Ray Sponholz as my nearest next of kin. And likewise I needed signatures and witnesses that if I died in the service of my country in the international territory of Antarctica that burial in Antarctica would be acceptable. It was my wish to let it so be.

I don't remember this good-bye, again with Tanna, Ray and Trudy and their children Scott, Debbie, Craig and little Brad, being as emotional as the departure for Washington D. C. the previous summer. Antarctica was incomprehensible. Also, I had been independent now living on my own for five months. I had turned from a dependent child to a relative and you just didn't make a big deal of saying good bye to a relative after beer and cards.

Back in Washington D. C. I immediately got in touch with Jim Sparkman, an old college acquaintance who developed a PhD dissertation using pictures of targets to show a mirage and then using the refraction of light and his mathematical models to compute the details of temperature changes within the column of air of the mirage. Lettau thought that Sparkman's model would be a helpful and subtle way to measure the details of the lowest layers of the Great Antarctic Temperature Inversion.

Feodor Ostapoff, Director of the Sea Air Interface Laboratory (SAIL) encouraged me to abandon ideas of thermal winds as a mechanism for the winds in the interior of Antarctica. His research of the ocean with Viebrock kept him interested in my work but he, like most of the meteorologists along the East Coast, saw katabatic winds with a Coriolis force dominating all of Antarctica. My greatest lament was that I was about to go off to the field without my or anyone else's mathematical model of inversion winds. I would be looking for a phenomenon without the guidance of a hard and fully shaped model and the young men at home probably would invent one. Newly invented models have a way of changing the need for observations and identifying what is important. Whatever happened, the adventure to come was going to be mine.

CHAPTER 6
To THE South

I could not wait for Sunday, 11 December 1965. Not an avid sports fan, but nevertheless aware of important mileposts in sports, I held several tickets for the big showdown between quarterbacks Johnny Unitis of the Baltimore Colts and Bart Star of the Green Bay Packers at the Baltimore stadium. All East coast sports writers saw only Johnny's arm. Yet it was the powerhouse days of Vince Lombardi's Packers with Bart Star doing all the passing. Suddenly, delivered by hand were military travel orders. You shall board DC-7/SARD 2737 at Andrews Air Force Base at 1500 LST 10 December 1965. All passengers must report to the terminals two hours prior to flight departure. You must have in hand passport, travel orders and inoculation record. Warning, as a civilian you need to know the military travels on time!

Bill Weyant drove me to Andrews. Herb Viebrock and Ed Flowers came along. Besides the two personal suitcases I checked in, I was hand carrying two crates holding my last minute purchase of theodolites, several boxes of extra thermistors for monitoring the temperature of the snow at several depths beneath the surface, and one large box about a cubic metre in size painted in international fluorescent orange with red and white letters spelling out DO NOT FREEZE. Inside this box, buried in styrofoam about a foot thick, was a little black box that had two electrodes coming out of a leather pouch holding a sample of liquid water, ice crystals, and water (gaseous) vapor at a very low pressure sealed in heavy plastic. This was my standard triple point bottle, which would be used to calibrate all temperature devices at Plateau Station.

Leander Stroschein also came loaded down with more than a dozen boxes of instruments that were purchased or acquired too late for shipment by the Navy to the Ice. It was a little embarrassing shuffling in loading lines pushing all these boxes along. In time it became our standard way. We checked in, found our stanchions to park for the military world of hurry up and wait, bid farewell to our friends who came out to Andrews to say good-bye and settled in. I wished I could be leaving a day later for the sake of the football game.

We waited around more than four hours, now two hours late according to my travel orders and itinerary. Working the crowd of polar personnel was Helen Gerasimou, the secretary of the head of Polar Programs of NSF. She was our queen, our mother, our girl friend. She personally said good-bye to everyone leaving for the Ice. She never missed a person. She was whoever you needed her to be. She let the men who needed to be draped around their girl friend or wife find a quiet corner of the air terminal until the very last moment and then gently pried them apart, even caring for these women as the airplane took off. She talked sports to the sports men, about hunting bear, deep sea fishing, the past World Series, the football games of the last weekend, but had not heard of Bart Star. Helen automatically knew who to give a hug or kiss as a mother might say good-bye to her young polar hero or who to slip a Playboy magazine or a bottle of whiskey. I got a great big hug.

At 2000 LST, now five hours late, we at last boarded the airplane. But almost immediately after we fastened our seat belts we were asked to disembark. No reason was given. One ranking military person jokingly announced that for an airplane loading drill we did poorly and had to do it again. In fact, at 2130 LST we loaded up again and were sent back to the terminal again. Someone thought President Johnson was departing with Air Force One from a hangar at Andrews and it was a rule that the air space all around Andrews had to be cleared while a fighter squadron patrolled the sky and escorted the President's plane. Activity on the ground seemed to support this idea.

At 2245 LST, now seven hours and forty-five minutes late, we started taxiing down the runway, blew a tire, and skidded to the very end of the runway before being towed back to the terminal. Once more we walked into the terminal. This time all personnel were beginning to get perturbed and some were scared and shaken. The military was not exactly leaving on time.

Nothing was said. No excuses were given. Just do as you're told. Wait!

We could not leave the military air terminal. Wanting to depart for some tavern or other more comfortable places, we were told that in essence we were checked out as though we had gone through customs and technically had left the country. I didn't believe this and knew the military in charge of the transport of all polar personnel were running out of reasons but also could not do much better. I just never have believed official statements. I know gossip can bring serious panics and undesirable consequences. In reality, with lying as the standard policy for all official statements issued by the administrative powers, or at best, shaded truth that releases no information and takes no responsibility, gossip is the closest answer to the truth. The bigger the organization, the greater is the need to rely on gossip for truth.

	Arrive	Flyg Time	Depart	Gnd Time
Andrews AFB Maryland	1500 10 DEC	--	1435 11 DEC	23.5 hrs
Travis AFB California	2100 11 DEC	11.5 hrs	0050 12 DEC	4 hrs
Honolulu INT Hawaii	0730 12 DEC	8.5 hrs	0015 13 DEC	17 hrs
International Date Line ----------				
Nandi Fiji Islands	1000 14 DEC	12 hrs	1130 14 DEC	1.5 hrs
Christchurch New Zealand	1800 14 DEC	6.5 hrs		

At 0000 LST, Sunday, 11 December 1965 we thought surely they would put us up in some hotel or at least a barracks since the rumor mill identified that there were no flight personnel around, no stewards, no mechanics, and no pilots. The official statement still claimed we needed to stay alert because takeoff was imminent. By 0300 LST the bottles Helen left were dry and even the card games came to a halt as each individual gave up on the hope of flying out that night and collapsed to sleep on the floor of the terminal.

1220 LST, Sunday, an hour before game time we were in the aircraft with new tires. As the pilots revved the engines for the final check, flames shot out of the engine on the left side closest to the passengers' cabin. Taxiing at high speed on a secondary runway put the fire out, but once again we off loaded, more than depressed.

Search for a TV to see the game ended in the realization that, as a home game for Baltimore, the game broadcast was blacked out. A radio gave us the kickoff but at 1435 LST in our trusty plane out of radio signal distance, we took off without further incident twenty-three hours and thirty-five minutes behind schedule. From the depths of the polar night more than six months later our radio operator, Ed Horton, asked for me who won that great game. The Navy messages only asked us to carry on and sent us their prayers of concern over morale. I never found out who won that game.

Bound for Plateau and traveling to New Zealand together were Bob Geissel, Hugh Muir, Leander Stroschein, and me. Almost within the same time frame, on 13 December 1965, Captain V. Donald Bursik, Deputy Commander, U. S. Naval Support Force, Antarctica, planted the United States flag on the high polar plateau in the middle of the large unexplored region of Antarctica at 79º 15' South and 40º 30' East (LST at Plateau Station is nine hours earlier than at Christchurch). The advance party also included Lieutenant Jimmy L. Gowan, MC, USN, Officer-in-Charge; Robert Flint, Station Scientific Leader; Charles L. Roberts, of the U. S. Weather Bureau; Arthur Weber, architect from the Bureau of Yards and Docks; Ed C. Horton, Jr., a Navy electronics technician cross trained as a radio operator; and Robert Faul, ABC-TV. They quickly erected a tent camp and began the preliminary surveying for the eventual construction of Plateau Station.

Following my instructions and using his expertise and previous Antarctic experience, Charlie Roberts determined the prevailing wind direction from surface features on the surface of the snow. Particularly important was the undisturbed field of sastrugi, a harder small erosional feature that was dug out on the sides by wind and blowing snow erosion and grew as a pointer in the wind as sharp ice needles built up the pointer facing into the wind. Flint, Roberts, and Weber with Gowan consenting assured the placement of the camp and its orientation was satisfactory to all the scientific research projects planned at Plateau Station. Dr. Gowan bore the chief responsibility to the Navy and to all of us as our medical doctor that this station was also placed in a survivable position as well.

We were taken to the Zetland Hotel at 88 Cashel Street in downtown Christchurch for warmth, rest, beer, and comfort. At the hotel we were immediately introduced to the proprietor, Reg. McKenzie and his wife Jean. It was well known who Hugh Muir, Bob Geissel, and I were because of our connection to the establishing of a new station in an unexplored section of Antarctica. The Christchurch newspaper's headline read,

"Eight Will Dice With Cold Death."
"THEY COULD ALL DIE."

> "There are few great adventures left on the face of the globe. But while any shadow of the mysterious or the challenging exist there will be people who cannot rest until they have torn open the door or looked over the top, no matter what the potential cost."

"Everest has been subdued, the jungles are full of well-beaten tracks, and the light has been let into much of the ocean bottom."

"But this winter eight Americans are embarking on what might be the last adventure this side of space."

"They will be locked in the dark winter night 600 miles beyond the South Pole in the worst place in the world. For eight months they will be as good as on the moon, living higher and colder than any man has ever attempted."

"They could all die and not a single finger could be lifted to bring them help. When the Antarctic summer fades in February they will be heard but not seen till November. And throughout the black sunless months they will be fighting for survival in cold that is beyond a city dweller's comprehension."

Reg. and Jean showed us our rooms and invited us to join them in the Hotel Lounge after we had time to freshen up and put on a tie. Things were quite formal in New Zealand, especially hotel lounges after hours. All taverns, pubs and saloons were generally closed after 6:00 P. M., but lounges remained open as long as hotel guests were present. (In addition, in lounges, you generally needed an invitation so the attendees always were chosen.) The first night drinks were on the house. The group Reg. gathered for us were guests from quite a cross section of the world as well as some local dignitaries very interested in polar exploration. We spent most of the evening talking about each of our plans and hopes for Plateau Station and after Plateau Station.

However, once it became evident that none of us, not Hugh, not Bob, not Lea and certainly not me, had ever been to the Antarctic, Reg., an old hand giving service to all Americans of Operation Deep Freeze, had his fun with us. "Come look at these blokes who's going to find out if they have any male parts after winter." . . . "Let me tell you, you bloody yanks, your biggest problem is going to be how to get what's left of your two inches out of six inches of clothing. And if you think you have more than two inches, well, you ain't never been cold!" With laughter all around, and much free beer as well, I was afraid we'd become the "two inch crew".

First things first, we reported to Deep Freeze Headquarters the next day and met Eddie Goodale, the current USARP representative in Christchurch and the chief liaison between the civilian scientists and the Navy. Eddie held an office with Overseas Operations of the Weather Bureau but also was so well respected that NSF turned to him for this very high office with much responsibility that led to the success or failure of any and all scientific projects in the Antarctic.

Eddie was a dog trainer for Admiral Byrd in 1928 at Little America on the first modern American expedition that culminated with Byrd's flight over the South Pole. Eddie, a Harvard student, gave up his studies back in 1928 to take part in the adventure in the South and gave his entire life since to the research and exploration of Antarctica. I considered myself a theoretician and yet embarking on this adventure, I was fully aware that Lettau, Schwerdtfeger, and their stay-at-home students were racing ahead with theoretical math models while I was on this slow and deliberate adventure far removed from the theory. I was becoming very much aware that you could not do both.

I still had a shopping list of things needed for Plateau Station. Goodale pledged his assistance, sent me to Ralph Lenton, another USARP rep working with supplies and the deployment of all science personnel. One of my chief, still unpurchased needs, was a large quantity of bamboo poles for the establishment of a snow stake field and for Lettau's suggested mirage targets. Between Goodale and Lenton, I had no worry that all the last minute supplies would be delivered onto the high plateau.

Ralph Lenton, then with the Arctic Institute of North America (AINA), was an elderly carpenter, logistics man, and problem solver for nearly everything with respect to Antarctic expeditions. His greatest achievement perhaps was his crossing of the Antarctic continent as a member of the first team ever to do so. That expedition was led by Sir Vivian Fuchs from the British station, Shackleton Base on the Weddell Sea, over the South Pole, and on to the New Zealand station, Scott Base on the coast of the Ross Sea. All these men, brilliant in their own right, chose the active adventurous life and, as they themselves aged, took pleasure in assisting the younger scientists with less experience. Specifically Ralph's organization, AINA, was responsible for providing the clothing for the men of the expeditions in addition to other research projects such as the aurora that Hugh Muir was working on.

I was issued a locker and lock for all my civilian clothes and belongings I would not need at Plateau Station. Then I was issued the polar clothing that consisted of:

Helmet, balaclava	1
Cap, pile	1
Underdrawers, thermal	4
Undershirt, thermal	4
Shirt, wool, heavy (red checkered)	1
Trousers, field	2
Liner, field trousers	1
Anorak	1
Parka with liner	2
Boot, rubber, thermal, white(bunny boots)	1 pair
Boot, mukluk	4 pair
Shoe, work	1 pair
Sock, shearling, low	4 pair
Sock, shearling, high	2 pair
Sock, wool, ski	4 pair
Sock, cushion sole	8 pair
Insole, saran	2 pair
Insole, felt	3 pair
Slipper, shearling lined	1 pair

Mitten, gauntlet (bear claws)	1 pair
Mitten, buckskin	3 pair
Mitten, insert, wool	4 pair
Glove, shell, leather	2 pair
Glove, insert, wool	2 pair
Bag, guide	3
Goggles, sun	1 pair
Belt, web with buckle	1
Suspender, armhole	2
Repair kit, sewing	1
Stencil pencil	1.

Geissel, Muir, Stroschein and I were told to stay near by and not to travel much out of the city of Christchurch so that we could be contacted within a few hours for departure for McMurdo Station. We would be transported by C-121J Super Constellation, a four prop wheeled aircraft that readily could take off from Christchurch and in about eight hours land at William's Field, a runway scraped smooth on the near permanently frozen sea ice of the Ross Sea between Ross Island and the Ross Ice Shelf. This was a flight that took the plane, crew, personnel, and priority cargo past a point of no return and on to McMurdo. The point of no return for the Navy was a point along the flight path where a decision had to be made to return if the weather looked bad at the destination or to continue on to the destination with no possibility of turning back since the consumption of fuel would not permit it. For that reason Eddie Goodale told us to stick tight and warned us that there might be many frustrated calls to service followed by cancellations. Much more hurry up and wait.

It was funny and at the same time a little sad. We had a little free time as long as we stayed near Deep Freeze Headquarters but the four of us, all who had been chosen for our independence which was needed to get a job done in isolation a long distance away from our employer, suddenly faced failure in cooperating for some short time touring of this beautiful country. Hugh Muir, a Scotsman, had a very different agenda for seeing New Zealand and quickly disappeared. Bob Geissel, a former member of the Peace Corps, likewise was eager to do some skiing and mountain climbing and disappeared. That left Leander Stroschein and me to cast our lots together.

The first day, Lea and I rented a Morris-Minni-Minner (a car that had tires on it that were smaller than a kid's little toy wagon) and drove down to Christchurch's seaport of Lyttelton. We both desired to check how our main cargo shipments were progressing and enjoyed watching the ships coming in and departing for the South. To our disappointment, we were unable to see any manifest and even much less able to board a ship. The Navy was the Navy and we were USARP, "Useless Scientists Assigned to Ridiculous Projects." What was promised at the political levels in comfortable board rooms or retreats became different commitments of labor on the ships and on the Ice.

Bored and waiting around, drinking without end, and waiting some more, became our way of life but fortunately only for a few days. While drinking in a sheep field overlooking the surf of the South Pacific Ocean near Christchurch, it suddenly dawned on Lea and me at the same time, we were the important cargo. It was our projects that were the justification for the U. S. presence in the Antarctic. Why were we waiting on the Navy? Our Morris-Minni-Minner burned up the wrong side of the road and we toured Dunedin, Queenstown, the Fiord lands at Milford Sound and met Bob Geissel at the Hermitage in the Southern Alps at the base of Mt. Cook. Bob had been skiing and camping.

We used the Hermitage Lodge as a base camp. Our conscience did bother us enough to check in with Ralph Lenton frequently. His British humor understood our restlessness and he also could judge the Navy's real intent on operation in the South well enough to give us fair warning when to high tail it back to Christchurch. Exhausting hikes and climbs took me to Franz Josef Glacier and about halfway up Mt. Cook. The conditioning was long overdue after being closeted on the flight over the Pacific. We all justified our AWOL activity for the sake of our research. We all drank an incredible amount of wine at the Hermitage.

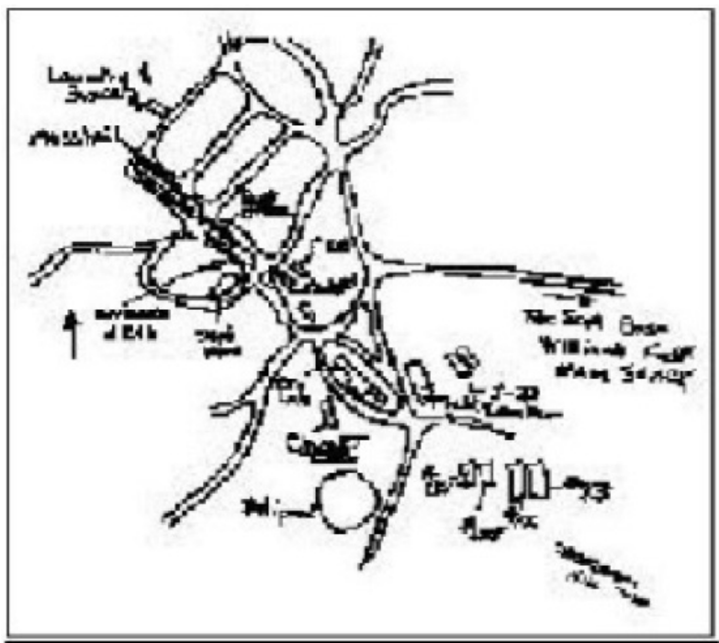
After more than a week's time, we finally got the word. The Navy was really ready to take us, the Plateau scientists, South. 24 December 1965, when many newly introduced local friends were liberal with invitations to come to their homes for Christmas cheer, we gathered in our polar gear, boots and all, on a warm summer day and waited for our flight South. Again bored, many men, including myself along with the camp followers, sang 'God Save the Queen' at a movie house and were enjoying a movie when it suddenly was interrupted, the lights turned on, and the manager announced that our Deep Freeze Flight was leaving. With a standing ovation from the Kiwi's in the theater we were sent South Christmas Eve, landing at Williams Field in the midnight sun.

I did not try to sleep the first night. I walked around McMurdo Station, the largest station in Antarctica. The cargo ships escorted by ice breakers were not in port yet. The population was only about four hundred. That was nearly double the winter population, but when the ships came in, the population would swell to nearly four thousand men. No women at all.

Writing as President of the Antarctican Society in January 1980, Paul Dalrymple reflected on his views of the new inroads women were making, even in the Antarctic:

> "A Christchurch newspaper had an article which said that there would be seventy, yes, 70, women from New Zealand and the United States at Scott and McMurdo stations this summer. I can't believe it. Whatever happened to the good old days? They quoted an Ensign in our navy, one Kris Chase, as saying, "Part of my work is to make the time fly this summer for people working at McMurdo. I'm involved in morale, welfare and recreation." On top of that, she has a staff of three full-time military personnel. I thought people were still willing to give an arm or a leg, and work 20 hours a day, just for the opportunity of going to the Ice. Now they have to be entertained, if not coddled. Ensign Chase has suggested that softball be played in the Antarctic. You mean that our government actually pays people to come up with such great ideas? I think I could come up with a better idea about how fewer women could make more men a whole lot happier, but I don't think I could get it by the Board of Chaplains."

"There is a new record for the South Pole. It isn't exactly a station record, being more of a personal achievement. But as you know, there was a female doctor at the station during the past year. That alone was history-making, as she became the first female pole sitter to winterover at either Pole. But she also became the first bona fide female member of the 300 Club. As I understand it, one has to undergo in the altogether a temperature difference of 300 Fahrenheit degrees, with one of the temperatures being at least -100 º F. To make it official one has to tiptoe through the sastrugi patch and remain outside in the buff for at least one full minute, and it has to be authenticated by a photograph. What Paul Siple used to do in the interest of science, determining when stout hearted men froze their extremities in the interest of refining the windchill monogram, is now not only done by men but also by a woman as a routine lark. And who says nothing ever changes." (Paul Dalrymple, *Antarctican Society Newsletter*, January 1980, page 12)



McMurdo, Antarctica
A Frontier City

I walked around examining a few of the tourist sights. Scott's Hut, built in 1901, renovated by the Kiwi's, was a fine reminder of the sacrifices made by the men who came here before we did. Overlooking this little house was a very large oil storage tank that provides comfortable heating or rapid air transport everywhere on the continent. Scott's hut was built by men who walked everywhere pulling one ton sledges.

Three months earlier a memorial statue, a bronze bust of Rear Admiral Richard E. Byrd on a polished black Norwegian marble pedestal, was set up next to the Chapel of the Snows. In only three months' time skua gulls had taken aim and found their mark just as every other statue in America was found by pigeons.

On Christmas morning I attended church in the Chapel of the Snows, the only church in Antarctica. It was built during IGY and maintained by the military with services conducted by the military chaplaincy program. We sang the familiar Christmas carols. During the first service a Navy Chaplain tried to assure us that the peace on earth was being maintained by the constant vigil of the atomic submarines. Not getting a very comfortable message from the secret subsurface force, I stayed for the second service.

The second Christmas service was conducted by an Air Force Chaplain and he saw the ever readiness of the Strategic Air Command every hour carrying their nuclear devices to our enemies' borders before being called back as a certain method to maintain the peace on earth. Enough! I never understood my church body's schism with its sister synod, in part over the chaplaincy program. Now I saw more clearly.

I climbed Observation Hill, the primary landmark in the immediate McMurdo area. It was a volcanic black ash cone that rose from the sea about two thousand feet. Half way up was Nuki Poo, a nuclear reactor to generate electricity and heat for the station. It was established during IGY as a show off piece of American engineering and as a model of President Eisenhower's atoms for peace plan. It never worked well. Either it produced too much heat or not enough. The last four or five years the Navy was increasing their reliance on conventional oil for both electricity and heat.

From on top of Observation Hill I was overcome by the size, the stark weathering of, and the nearness of the great wooden cross erected as a memorial to Captain Robert Falcon Scott's polar party that perished during their march back to Ross Island from the South Pole. High on top of Observation Hill I looked down at McMurdo Station as it slowly came alive this Christmas morning. For the entire camp it meant a great feed at noon, a day off for most of the military personnel, and just a routine day for field work and observations for most biologists and geologists.

Looking over McMurdo toward the West I could clearly see glaciers descending to the sea between the Royal Society Mountain Range. They seemed to be just a few miles away, but when I returned to the science Chalet and consulted a map, it revealed that these mountains were beyond the coast more than fifty miles away. The names of the glaciers carried the names of the explorers from England who did the intensive studies in this region the first quarter of this century - Wilson Piedmont Glacier, Debenham Glacier, Wright Valley and Wright Lower Glacier (after the very Sir Charles Wright I spent an evening with at Skyland), Taylor Valley, and Ferrar Glacier. Maps and aerial photos made these geographical features look picturesque without revealing the frostbite, abandonment, panic while lost, and even death that others paid to get the earliest sketches. Looking closer at a detailed map of the same region reveals names like Mount Weyant (Bill) and Cape Roberts (Charlie).

South to the Pole and the midnight sun was the featureless Ross Ice Shelf and north and east loomed the most dominant features: Mt. Erebus, an actively smoking volcano rising out of the sea 12,448 feet, and Mt. Terror. These two mountains were named by Captain James Clark Ross on a British expedition1839-1843 after his two ships the *HMS Erebus* and *HMS Terror*.

The setting was a perfect church for this young explorer to confess my sins to my Lord and ask His blessings on the expedition I was about to embark on. Vividly imprinted during my personal church service was the reality of the loss of life both of humans struggling to understand the natural world and the wooden cross two thousand years ago erected by Roman Soldiers that displayed the sacrifice my Lord made for me. I thanked and praised Him, singing into the warm wind as loud as I could knowing with the roar of the sea ice breaking up, the thunder of gases erupting from Mt. Erebus, and the whistling of the wind only my Lord could hear me. It was a far more meaningful service that I experienced in the Chapel of the Snows and I took great comfort knowing my Lord and Savior Jesus occasionally went to a mountain or high place to pray as well.

While checking a map at the Chalet, Ken Moulton, the USARP Representative at McMurdo and chief civilian liaison between the military and the civilian scientists throughout most of Antarctica, sought me out and informed me to get my gear ready for departure for Amundsen-Scott Station as soon as the weather stays clear with some certainty, either later Christmas Day or the first thing the next day. I did not need to tell the other USARPs bound for Plateau. They would follow later. No reasons for the changes were given. Excitedly I complied.

The plan was for the four of us, Geissel, Muir, Stroschein, and me, to spend a week or more acclimatizing to the cold and twenty-four hour sun at McMurdo while assisting other scientists with field work. Then we were to be flown to South Pole at an altitude of 9,186 feet above sea level and spend an additional two weeks acclimatizing to the high altitude before flying to Plateau at still a very much higher altitude. Something was going on that I was not being told. I was to work with the U. S. Weather Bureau group with Ron Stevens as the Meteorologist in Charge until I would be ordered to Plateau.

The next day, 26 December 1965 on a ski equipped LC-130F, #321 (There were four such aircraft, #318, #319, #320, and #321, and in the high interior of Antarctica they were our life blood for all supplies and personnel transportation.) I landed at the South Pole, reported to Ron Stevens and became part of the routine observational shifts. The over ice Queen Maud Land Traverse II was well on its way toward Plateau Station and was currently at 82 º 54' South and 28 º 00' East. *USNS Towle* commenced the off-loading of cargo at Elliott Quay, McMurdo. This ship carried the four orange "vans" that would make up the main base for Plateau Station. Lieutenant James D. Ramsey, CEC, USNR and fourteen "sea bees" were already at the South Pole putting in their time of acclimatizing before building Plateau Station.

Ed Landry, a meteorologist finishing his year at Amundsen-Scott Station was rounding out Ron Stevens' crew that was suddenly made small by the abandonment of the polar job by Charlie Mabe. Ed, too relaxed as an old timer and drinking too much before his task, walked into the weather balloon shelter with a lit cigar where pure hydrogen gas was used for the balloon inflation. An instantaneous explosion took off the roof and did other structural damage to the balloon shelter.

"Mad Bomber" Landry was thrown down the tunnel between buildings and almost made it back to Club Ninety (the South Pole tavern) without touching the ice. Loose and limber, he was not hurt. The "sea bees" had some extra work with which to break them into high altitude breathing.

I met every plane that carried USARP cargo when I was not taking weather observations. Meteorologists had an "in" with the military. The military may never have understood the need to measure minute magnetic field changes or the colors of aurora but weather, on which all transportation depended, was a necessary job for a USARP. With both the display of a willingness to work and cooperate and the needed weather observations, all Weather Bureau people were readily accepted. As a result I got to know quite a few of the "sea bees" en route to Plateau and also some of the other Navy members. One Navy person that I became a good friend of during my short stay at the South Pole was Andrew Burl Moulder who did a lot of unloading as each plane landed. At South Pole or Plateau Station the conditions were always so cold that the airplane engines never were turned off. That caused a backwash of blowing snow and nearly zero visibility behind the aircraft. Two visible flags some distance behind the aircraft outlined the path heavy equipment would take in the man-made blizzards. A 10-ton Traxcavator would push a large freight sledge up to the aircraft to allow the cargo to be rolled on to the sledge and hauled to the appropriate place at the station.

In one of these man-made blizzards, Andrew Burl Moulder was crushed between the LC-130F and a cargo sledge before the resupply season finished. It was a very dangerous year. Also six other military flyers were killed in a crash on the Ross Ice Shelf. The entire crew of an Air Development Squadron Six plane died when their plane crashed while trying to move a scientific field party studying glacial movements on the Ross Ice Shelf. Witnesses observed poor visibility during a partial whiteout and some evidence of icing. "From a distance of about a mile . . . [scientists] . . . observed the LC-47 approaching at an altitude of about 200 feet. The aircraft appeared to stall right wing first, resume level flight for an instant, and then stall to the left. It plunged to the surface making violent impact with the snow. The front part of the aircraft was compressed by the force of the collision. The center section and both wings tore loose, and the rear portion of the aircraft ripped free. Before rescue operations could be started, leaking aviation gasoline caught fire and subsequently ignited JATO bottles which the aircraft carried. Six hours after the accident, fire and exploding JATO continued to prevent any effort to remove the remains of those on board. The entire aircraft, except the extreme empennage and a portion of the outer starboard wing panel, was consumed by the flames. The twisted wreckage rested in a hole in the snow approximately 40 feet wide by 35 feet deep. No evidence exists that any crew member attempted to escape." (*Antarctic Journal of the United States*, March-April, 1966, p.39)

The words of Rear Admiral Richard E. Byrd to a family of another man who died in Antarctica: "He served and died for his country just as devotedly and with as high purpose as if he had died fighting to preserve freedom. The mission for which he had volunteered and on which he served is, and will continue to be, an effort to unlock further the secrets of nature in that vast area, Antarctica, and put them to the use of all mankind." (in *Antarctic Journal of the United States*, March-April, 1966, p.39)

When the South Pole camp sobered up after New Years 2 January the "sea bees" were taken up to the Plateau to build a small base camp, first for their own needs in the growing and crowded new Plateau Station. The Jamesway they constructed would become part of the emergency camp and the needed second observation point for the second theodolite of my inversion study. Two days later, with their construction work on that Jamesway complete and the tent city taken down for warmer comfort at Plateau Station, I was given the order to take the next plane to the high country. I still had not logged enough acclimatization time, but Ron Stevens passed on a little private information that a near or actual altercation may have occurred between Jimmy Gowan, the Navy's Officer in Charge at Plateau Station, and Charlie Roberts. Tensions surely must have been high in setting up final guidelines for the permanent camp quarters and last minute changes could drastically harm a science program or put the personnel at needless risk. These were the tensions seasoned polar people like Rob Flint and Charlie Roberts were expected to resolve. I never found out just what happened, but I was headed up to Plateau.

Top: Heading for the ice, Pago Pago
American Samoa; December 1965

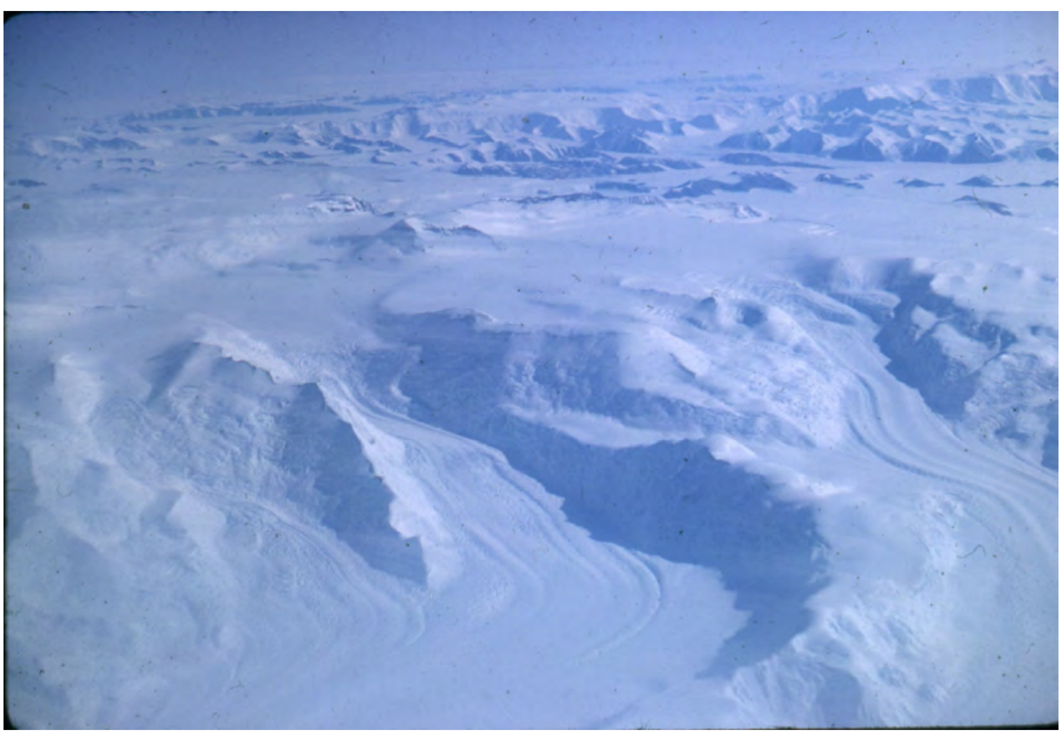
Bottom: Avon River, Christchurch, New Zealand;
December 1965

Top: McMurdo, Antarctica, looking toward Hut Point;
December 1965

Bottom: Observation Hill, Ross Island, over looking McMurdo;
December 1965

Top: Chapel of the Snows at the foot of Observation Hill. "Nuki Poo," a nuclear reactor and electric power plant can be seen halfway up Observation Hill; December 1965.

Bottom: Flying over the Beardmore Glacier with the Trans Antarctic Mountains in the distance enroute to the South Pole: December 1965.



A tunnel between buildings at Amundsen-Scott base, South Pole; December 1965 (Slide by Rob Flint)

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.

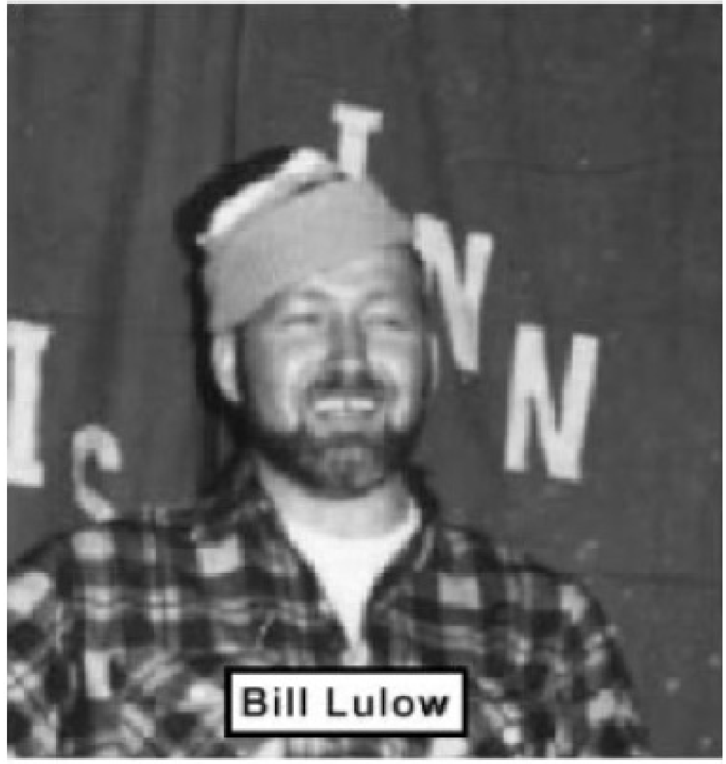
The plane was fully off loaded. The flight crew pulled Charlie into the plane as he shouted to me, "Good Luck, You have a Doctor for whom you don't want to get sick!" My briefing and in-the-field training were started and, as quickly, were over. I was the only meteorologist at Plateau.

It was incredibly cold!

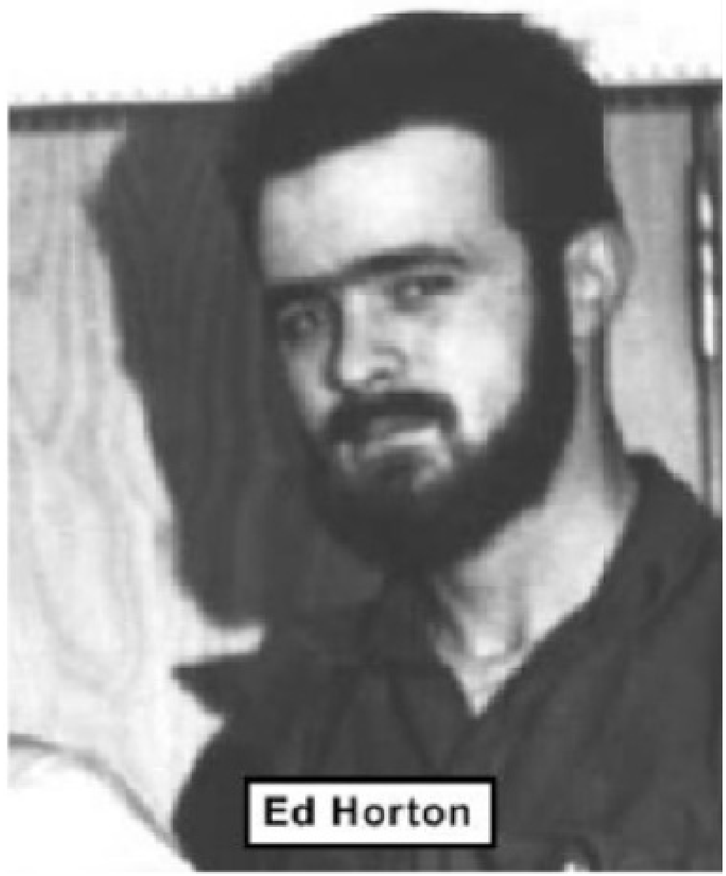
Although the walk from the aircraft to the Jamesway was a reasonable hike, it seemed infinitely long and left me wondering if I was physically up to life on the high plateau. I was more than thankful that Rob willingly assisted with hauling my personal gear while I collapsed dragging my "DO NOT FREEZE" 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.


Bill Lulow

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.


Ed Horton

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.

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.

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."

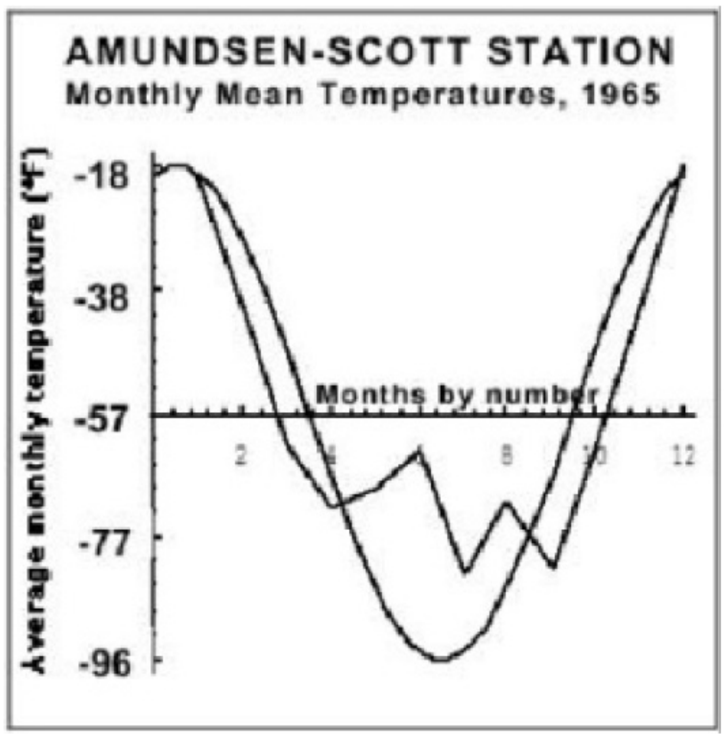
(Bob Nolan, "Cool Water", with polar revisions by Art Weber)

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."

"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."

"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.

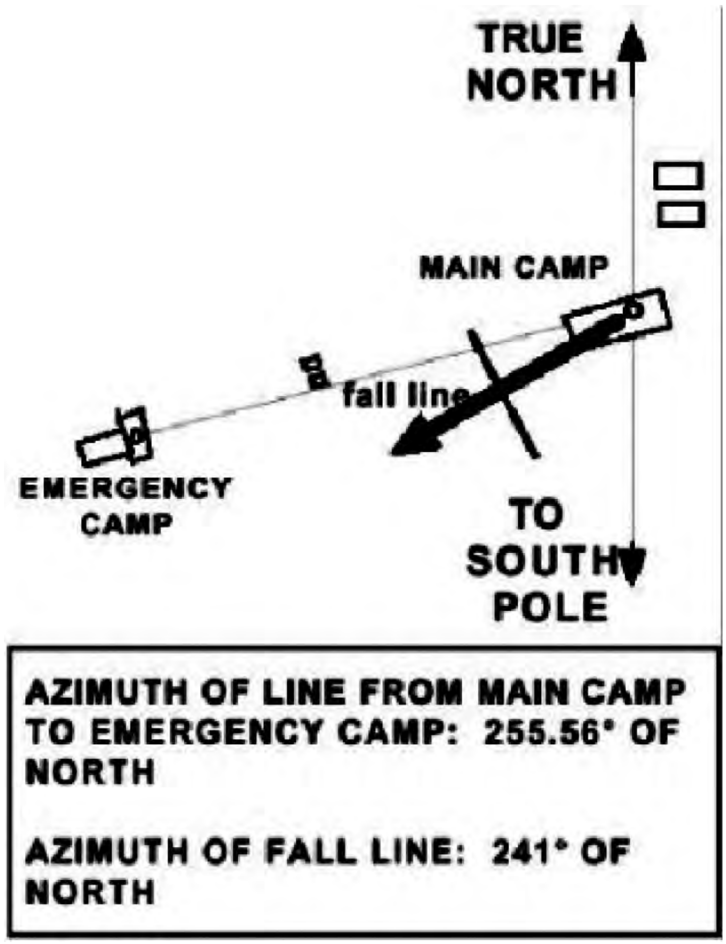
Two vans formed the windward wall. Two vans formed the leeward wall. A "permawalk" made by building a floor and a ceiling between the two rows of vans gave considerable extra living space which was fashioned by our wintering over team into "Lulu's bar and grill," a dinning area, a movie theater, and 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.

Insert: 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 º 30' S. 08 º E., and82 º S. 22 º E."(EdgardE. Picciotto, *Antarctic Journal of the United States*, July-August, 1966, p. 129-131.)

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

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.

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.

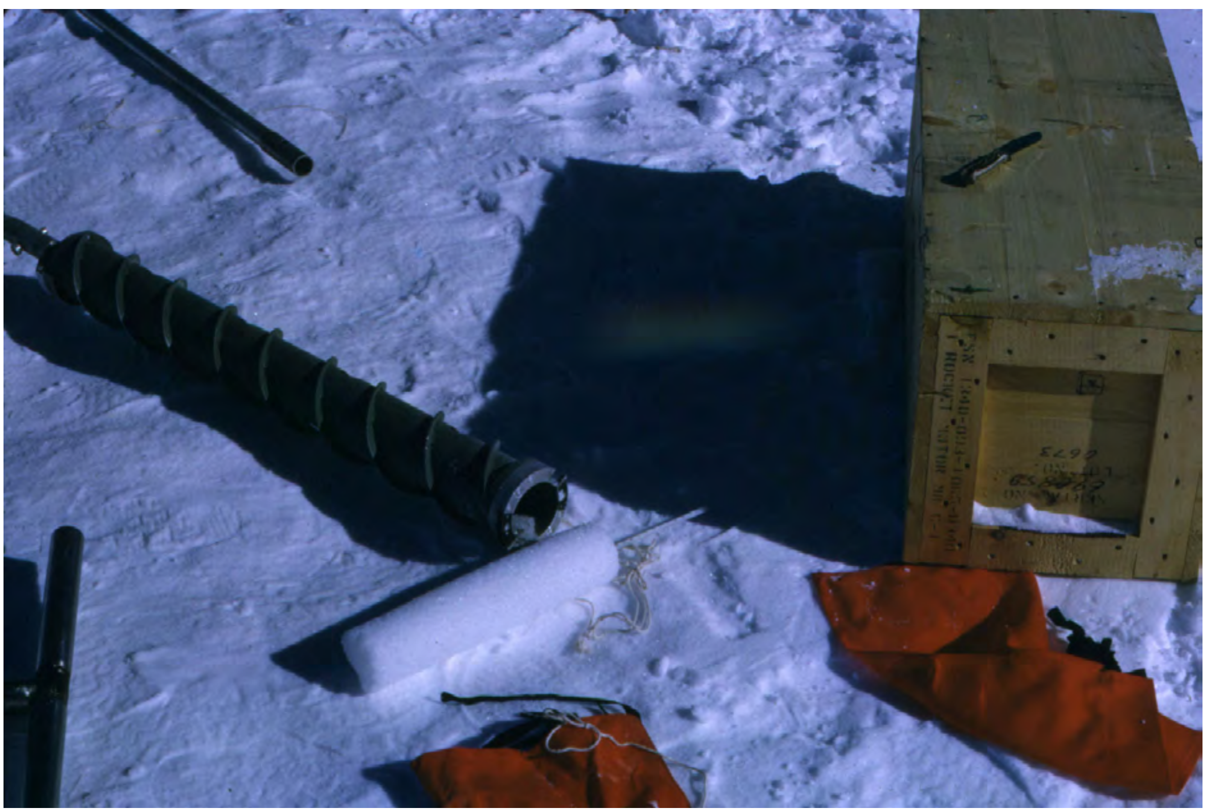
Jimmy Gowan and Rob Flint, Jerry Damschroder and Hugh Muir, Bill Lulow and Bob Geissel, Ed Horton and I were all standing outside. I was now hardened to the cold with a need of only one pair of long underwear and stared at the long condensation trail of that last plane until it evaporated. Silently each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

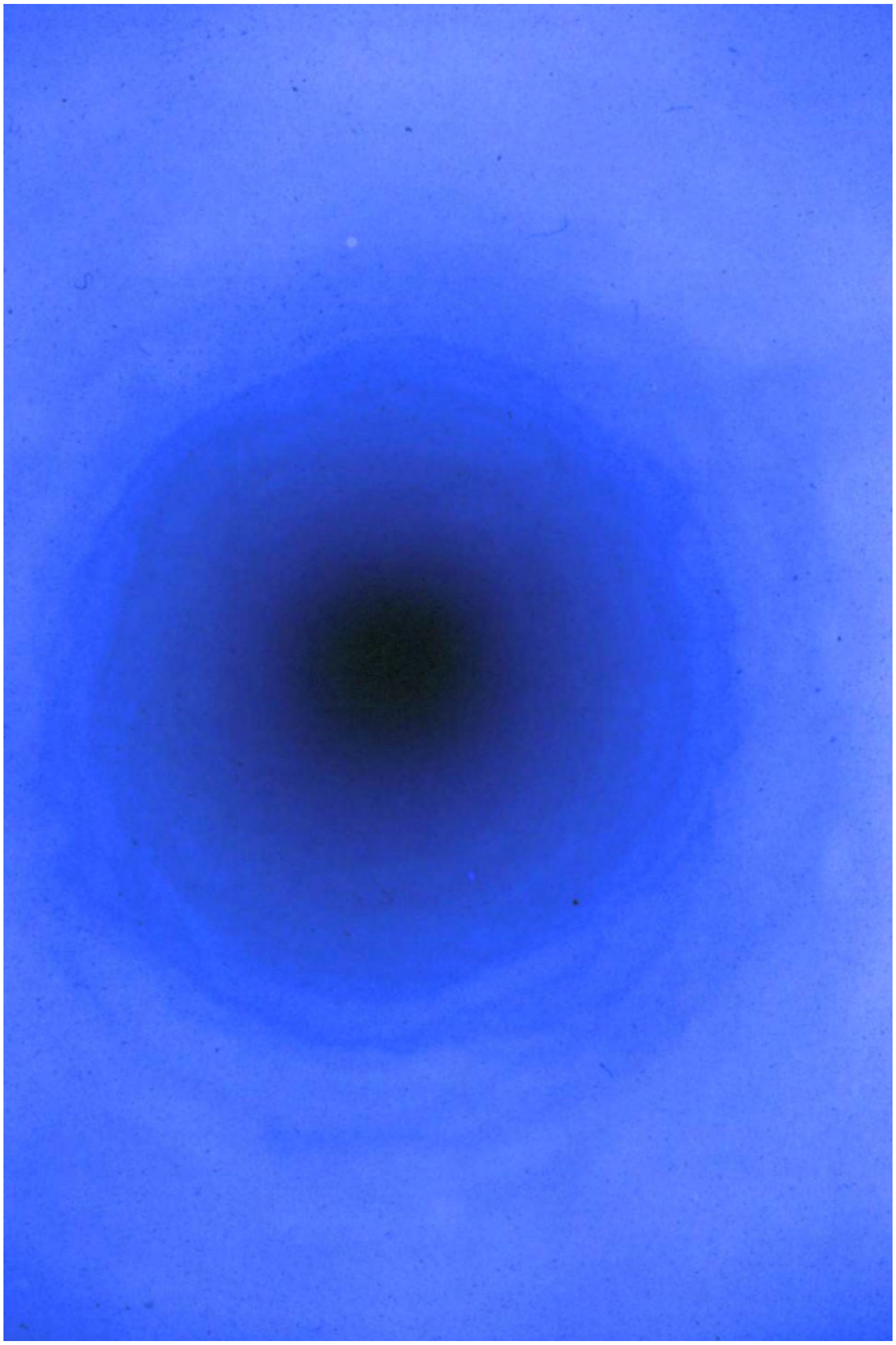
Off loading the first section of the main camp building at Plateau Station
January 1966

Top: US Navy "Sea Bees" push the main camp sections together
January 1966

Bottom: Completed main camp
February 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

CHAPTER 8
Life in Winter

Between the departure of the last airplane from Plateau Station and 21 February, a short eleven days, making the camp comfortable and safe quarters for the coming winter became the single concern of all. Called “buttoning up the camp,” this is when the leadership and previous Antarctic experience, held only by our scientific leader, Rob Flint, became most invaluable. The simple things struck me. Leave nothing laying unmarked on the surface of the snow. Even a light wind could drift snow over an item and we would lose it permanently to the icecap. How we disposed of packing material and a minor problem such as leaving nails poking up in the snow became life threatening in isolation.

Bamboo poles were set up everywhere marking cable lines, food caches, movie film caches, and extra scientific equipment. Many lines of rope held above the snow by bamboo poles permitted barriers or entrapping lines to catch a wandering walker who might become lost during a storm while doing a routine task only several yards away from the main camp door. These lines permitted a person to find “home” by feeling hand over hand along the ropes in a snow storm.

On the 21st of February the twenty-four hour presence of the sun, orbiting our horizon in lower and lower paths, slid under the horizon for a few minutes at midnight for the first time marking what we called the first day of the autumn season. The temperature was -66 ° F. Winter was coming. We felt our isolation deepen.

In this “time less” world, made so by the strange motions of the sun, the Navy personnel maintained a rigid schedule with breakfast, lunch, and dinner at the standard local times. They wore their regulation khaki green clothing while on duty and almost all other times as well. In an interesting mark of independence, trying to show that scientists needed no uniform, each of us civilians without communication to each other began to wear daily a red checked shirt. Rob, with previous wintering over experience, probably knew that. He pulled out as his mark of individuality and leadership on one of these autumn days a green checkered shirt.

Over the next sixty days the dark sunless time ominously grew longer and darker as the sun’s presence became less and less. With the daily increasing loss of sunshine, the temperatures began to plummet as my inversion began to take shape. The time a person could comfortably remain outside became less and less. Jerry Damschroder had to drain all the fluids of the traxcavator and our speedy snowmobile. When the evening temperature fell below -70 ° F, antifreeze began to freeze. At -80 ° F our bunny boots of rubber became as hard as iron and sounded like sledge hammers pounding on the permawalk as an individual came in from the outside. We stopped using the negative in our conversation referring to temperature.

Remember how the cars back home in Wisconsin or Minnesota give a squeaking sound as the tires drive over snow when it is below zero? A similar thing happens when the wind blows at truly cold temperatures. I'd say at about -90 ° F when a light wind causes a slight drifting, lifting the snow above the surface a half of a foot or more the hardened cold snow begins to screech like broken glass scraping glass or finger nails scratching a slate. Hearing this irritating sound makes one feel as if all your teeth's fillings are falling out. Then it gets colder.

I measured the first -100 ° F on 31 March. This early time of the season, with the sun still above the horizon for a little more than ten hours, I felt much pressure by Navy personnel to revise downward the coldest temperature prediction. With a little fear I hung on to Lettau's definition of a "kernlose" winter. We would expect a rapid temperature loss as the sun departed but after that, in the dark of the winter continual loss could not be without end but an equilibrium will be reached between the inflow of warm air from the outside regions and the radiational losses from the snow surface.

On 20 April the sun should have set for the last time according to my geodetic and astronomical tables and it did a few minutes after local noon time. The solar disk in the north flattened and stretched out horizontally in striated lines of brilliant oranges and reds seeming to slide over one another from east to west. A strange dark shadow of the earth in the sky was rising from the south and rolled over us ever so slowly westward with a pink band separating the sun-lit portion of the sky which was diminishing in the growing darkness of the deep polar winter.

Every one of us was outside to view this awesome spectacle of creation where day and night were different from anywhere else on earth. We watched every shining ray of the sun as it left us. The United States flag was ceremonially lowered and removed from the flag pole for the four months of dark winter. Very properly Jimmy Gowan barked the commands. Jerry Damschroder lowered the flag while Ed Horton, Bill Lulow and Jimmy Gowan saluted and the four civilians stood at attention in the cold.

The next day near local noon the sun by refraction rose again even though it was below the horizon and these colors danced again. The sunlight would warm the snow surface. The temperature would rise breaking the new forming inversion and cut off the refraction effect, sending the sun rapidly away. That would cool the snow surface again and the solar image was pulled back once more. To a surprised audience this solar dance occurred several days after the technical sunset and the temperature followed in delayed steps alternating between -84 ° F and -105 ° F.

In less than a week the sun's dance was over and although near noon the sky was lit from below the horizon, the sun no longer returned and the first several days of sunless sky saw temperatures fluctuate without a connection to the diurnal or daily time cycle. A typical fluctuation was between -98 ° F and -106 ° F. I held my breath for the reality of a kernlose winter. I did not expect the temperature to fall much below the -113 ° to -118 ° F range, but it was a long time until the sun would rise again.

The extreme cases of refraction brought to light a solution to a historical mystery. The Australian explorer Sir Douglas Mawson wrote with disdain about claims of discoveries of the

American Exploring Expedition of 1838-1842.

> "To this country, which had never before been seen, was given the name of Wilkes's Land; as it is only just to commemorate the American Exploring Expedition on the Continent which its leader believed he had discovered in these seas and which he would have found had Fortune favoured him with a fair return for his heroic endeavours." "'At noon the weather was clear but nothing could be discerned in the south except a faint blue line on the horizon. It may have been a "lead" of water, an effect of mirage, or even land-ice - in any case we could not approach it.' [Captain Davis writing in the ship's log of the Aurora.] The position as indicated by the noon observations placed the ship within seven miles of a portion of Totten's High Land in Wilkes's charts. As high land would have been visible at a great distance, it is clear that Totten's High Land either does not exist or is situated a considerable distance from its charted location. A sounding was made in three hundred and forty fathoms." (Sir Douglas Mawson, *The Home of the Blizzard*, Vol. I, p. 72, 75, and 76.)

Our own experience on the high Antarctic plateau, where we all witnessed the sun being pulled back by the refraction of light through cold high density air for more than a hundred miles over the horizon, showed that indeed Lt. Charles Wilkes saw correctly his more than fifteen hundred miles of Antarctic coast line that bears his name. Wilkes, whose discoveries confirmed Antarctica as a continent, saw the coastal high lands from the Balleny Islands to the Shackleton Ice Shelf. He placed them farther north than their actual positions. The new learned experiences of the extreme refraction of light in very cold lower inversion air showed that Wilkes really did discover his coast line that he mapped from his ship at sea a couple of months later in season than Mawson. The cold dense air of the high plateau would by Wilkes' time have been descending the long glacial slopes refracting the air at extremes not seen before.

Most of May and June and July with total sunless sky gave a noon and midnight of equal darkness. I can recall waking up at three o'clock, looking outside and asking "which three o'clock." As expected, the longest cold snap occurred in midwinter. Nineteen days between 18 June and 6 July had minimum temperatures below -100 ° F. For thirty-two days after midwinter only one day did we feel a temperature as warm as -95 ° F and not colder. Three of those days reached a cold temperature of -116 ° F. It was cold!

Rob frequently demonstrated the severity of the cold by making ice cream. While most homemade ice cream is made by a very long time of stirring the ice cream mix in a container surrounded by a mixture of ice and salt in order to keep the temperature below freezing, at Plateau Station Rob simply took a bowl of the ice cream mix outside and stirred it until his large spoon was frozen in the mix. It was not instant ice cream but it was ice cream before twenty minutes passed.

When the sun went down, our Navy Officer-in-Charge, Jimmy Gowan from North Carolina, stopped going outside and seemed to sleep almost all winter long. He became the butt of all the jokes as he failed at every one of the menial tasks each of us took on for our daily living such as shoveling snow into the snow melter for an hour every day. Yet he took the longest showers. The military personnel all made up for him, but they may not have had any choice since he gave the orders to his mighty command over three.

I remember an elaborate and long-lasting incident where Jimmy Gowan probably was set up, and I must confess that I was in the center of it and enjoyed every evil minute of it. While at Skyland Jimmy had promised the moon. Cooperation was the only reason for the Navy to be present he proudly lied. Once the brass left and we were in isolation Jimmy seemed to turn the otherwise very cooperative enlisted men against the USARPs.

The Navy always considered morale as the single most important factor for survival at such an isolated post as Plateau Station. Thus we had at least one full length movie for every day. Many were famous flicks and as a graduate student and researcher, State-side movies were not part of my entertainment. At Plateau Station these movies became very important to all. Jimmy, however, perceived himself as a person of very high taste. He spoke frequently of attending Broadway opera and concerts.

When it became evident that the movie by the Beatles titled “A Hard Day’s Night” was among the four hundred films, there was a sudden interest which, as expected, did not fit the fine tastes of Jimmy. Ed Horton, the youngest on station was truly interested in the style of music of the Beatles. Hugh Muir, being an exchange scientist from the British Isles had national interest in seeing this fine film. I wanted to see this film because the doctor Jimmy didn’t want to see it. In the debate that followed it didn’t take much to steer Jimmy to the extreme claim, “As long as I am Officer in Charge of this station that movie will never be shown.” The military personnel were ordered to bury that film in a secret location. Of course, they could not reveal to the civilian scientists, now united in mission, the whereabouts of this vital film.

I organized Operation June Bug and all the USARPs spent several hours, night time hours when either the Navy was drinking and most of the time when Jimmy was sleeping, probing the snow fields near the station and shoveling until we found the coveted film. Flint and I kept the film in our bunks allowing it to thaw out. The warming process took more than four days during which time Bob Geissel and Hugh Muir moved film equipment, projector and screen and thawed out considerable food and beer at the emergency camp.

Rob Flint quietly talked Jerry into firing up the emergency camp generator as an exercise for safety in order to have sufficient electricity and heat needed to use the cooking range and movie projector for the following party. Although anyone could have heard the loud roar of the diesel generator at the emergency camp by walking outside and listening, in Jimmy’s case that never was a problem. Finally, when Jimmy was passed out for the evening at the main camp, four scientists and three military sailors enjoyed singing “Yeah, Yeah, Yeah!”

We should not have tape recorded the sound track and played it so many of Jimmy’s waking hours thereafter. Though this event had somewhat of a solidifying effect for all personnel except Jimmy, it did create more than a negative problem that the sensitive and correct judgment of Rob brought into rein. At his warning we all finally realized Jimmy Gowan had some problems, but that no one would survive the long cold winter without some acceptance of him as a teammate needed by us all. It was hard to do. I remember after one of Rob's sobering meetings where he would warn us to stay together as a team of scientists AND Navy, Bob Geissel made me swear that I would not let Jimmy, even as a competent doctor, assist him medically in any way. And yet it was true. We needed eight men on one team to live in isolation.

Weird trivial items became major concerns in isolation. With the absence of the sun, everybody kept very untraditional waking and working hours. At any given hour, A.M. and P.M., at least two people were always awake so that nearly every night the civilian scientists would cook at least two meals between supper and breakfast. Bob Geissel loved garlic. At these meals, Bob was a frequent cook and would have a little bread and meat with his garlic sandwich. The smell of garlic became so overwhelming that all of a sudden the remaining supply of garlic disappeared.

Other individual censorships occurred. The Navy tried to have two movies every day. This eliminated much productive time, even among the civilians. The temptation to rot in front of the silver screen was simply too great when there was seemingly limitless time and no boss except yourself. Suddenly the bulbs started to burn out very rapidly and it didn't take much mathematics to figure out that we did not have enough projection bulbs to last the year and at the same time have daily matinees. I never knew who dreamed up that excellent maneuver. It probably was brought on simply by cooling and warming a crate of the bulbs too quickly. I suspect it was Flint. I thank him.

Sunday matinees continued. They usually were a TV flick such as Perry Mason. None of us had need for money on the high plateau. We had no place to go. All food and room were provided. Beer, though plentiful, was rationed at a case per man per day. Even though none of us could consume that much, on many occasions we all tried our level best. Ed Horton kept a log of our personal beer consumption and we were charged for the amount of beer consumed. As a result, beer became the commodity of exchange. At the halfway intermission of Perry Mason, each of us placed bets of cans of beer on our choice of who dun it.

Once when the plumbing froze, Bob had to use the facilities. The outhouse was still up at the emergency camp. Sitting over a hole at -110 ° F exposed is indeed a true world's record.

One Sunday matinee featured the TV flick "Rawhide." While the theme song resounded through the camp, "don't try to understand them, just rope and tie and brand them," Bob jumped out of his bunk in his rawhide to do a dance. The entire camp threw him out in the snow.

Attempts to build our own monopoly game from scratch drew much camaraderie until a debate emerged over what one of the red streets was named. The debate revolved around Massachusetts Avenue versus Illinois Avenue. With only eight men in our fair city, majority voting did not work. There simply was no way any of us would play on a wrong board so we simply did not play.

Sex of salmon and the longevity of male salmon after their act of fertilizing a patch of eggs seemed to be an eternal subject.

On the high plateau much time for personal reflection existed. All of us over-indulged in alcohol. Jimmy always slept. Ed spent a lot of time on the ham radio. Jerry and Bill never lost a night of drinking. My alarm clock for the 3:00 A.M. observation was the hiss of a freshly opened can of beer and a warning that the can was getting cold on the floor and might freeze if I didn't get up to drink it.

Some of us also did much reading. This was a long standing tradition. Robert Falcon Scott, on each of his marches toward the South Pole in 1901 and 1911 took the lead reading to his men. Darwin's *Origin of Species* was commonly read. It was the first time in my life that I was given an opportunity to read the Bible from cover to cover in a reasonably short (only a few months) time. I was amazed at its consistent message from Old to New Testament - the Messiah to come and the Christ of fulfillment sacrificing for me and for us all.

Rob at one time asked me if I would conduct a weekly devotion. Today I wish I had not refused. In 1966 I was still branded with my denomination's schism over prayer fellowship. I really wish I had learned to read the whole Bible as a high school student at Wisconsin Lutheran but school training only stressed interdenominational dangers without the whole council of God as I came to learn it on the polar plateau. I suppose I did not take stock of real sins in my youth but the religious schools I attended stressed proper behavior and not enough unconditional forgiveness. When I would walk out from camp to measure my snow stake fields and get away from the camp by as much as a mile or more, the stars and the silence became overwhelming. Except for the screeching of the snow while it drifted past me, no noise penetrated my ears. As a sinner I was struck with total fear grabbing for a weapon or a sword. For what? The Russians? Bears? No, I feared my almighty God. And over the Antarctic He placed His Southern Cross with a bloody star in its side. I knew I was forgiven of my sins.

It is hard explaining the severity of the cold weather. It was severe. The Great Antarctic Inversion was in its extreme glory most of the winter. The snow surface was always colder than the incredible one hundred below zero temperatures except when a storm would pass over the icecap plateau. The wind would pick up and the turbulence would break the inversion, pulling down the warmer air above and warm the surface to -50 ° F. This happened five separate times when several of these storms would last more than a day. One way to describe the cold, cold days is to say that these few days of -50 ° F in the depths of winter felt very warm in spite of the wind and blowing snow.

Our generators never gave full capacity and we had been experiencing more and more frequent brown outs when much of the scientific equipment had to be briefly shut down and turned back on when power was restored. At times a head gasket would blow. We had two generators in the main camp so that whenever one generator had problems, the second could be fired up while the first was repaired. On 6 July, mercifully after a proper sobering time following the Fourth of July, with one generator in a state of repair, the second generator blew a head gasket, the last gasket on station that now was deep into its isolated winter at -107 ° F.

We were all watching a movie as the electricity suddenly began to fluctuate and the generator's normal rumble began to shake the camp unevenly. When Jerry shut the generator down without starting up the next generator, the camp became awesomely silent and we all knew it was “crisis city.” In the silence the camp began to creak and snap as it started cooling. With only the small cramped quarters of the generator room, there was not space enough for anyone else to do anything.

Wisely Flint and Doc Jimmy mutually decided to evacuate to the emergency camp a thousand feet away. Leaving Jerry to assess the damage with Ed and Bill as his assistants, the rest of us made busy by hiking to the emergency camp and hauling essential equipment - thawed food stocks, new water supplies, and fuel drums -into the emergency camp. Jerry joined everyone shortly and fired up the emergency generator at the emergency camp. We all took a respite from the cold indoor quarters of the main camp.

The four scientists remained in the main camp a large share of the time caring for essential equipment and taking manual observations on vital research projects. As long as research projects remained in effect Rob could continue as Scientific Leader with a share in the command of Plateau Station. Considering Jimmy Gowan’s state of mind, Rob’s command position was probably as important as Jerry’s repair work. I promised to observe clouds and take advantage of this special quiet time to make snow drift measurements. On the whole, enough scientific tasks could be found to prevent a complete Naval takeover in this emergency.

Perhaps only Rob and Jimmy and Jerry had an understanding of the seriousness of the situation. Plateau Station was designed as a little space station with everything interconnected. With power of the main generator lost, obviously electricity to the main camp was lost. Also lost was the energy from the heat exchanger because the generator no longer produced exhaust heat. The water supply was beginning to freeze. The greatest worry to these men was the potential of losing the main fuel supply as it cooled with no more hot fuel being returned to the fuel bladders.

I remember waking with shivers in my cold sleeping bag. Actually it was the first major sleep I had in months. No time to drink. No hangover to recover from. No generator noise to let sleep be restless. Just the quiet, cold snapping of the camp’s walls getting colder and colder. Rob had to help crack open the ice buildup around my face at the opening to my sleeping bag in order for me to get out. About the fourth or fifth day all the interior walls of the main camp were heavily frosted. And then most surprising to all, a bottle of 100 proof Old Grand Dad whiskey was frozen solid. Learning that Old Grand Dad froze opened an entirely new vista of drinking when the crisis was over. We could now make Old Grand Dad popsicles. From then on we made Plateau cocktails with a glass of brandy with Old Grand Dad ice cubes.

We were not the only ones who leaped into emergency action. Years later I learned that the military went into training for a polar dark emergency flight. Landing in the dark on a snow surface that did not reflect RADAR was impossible. But a rescue technique learned in Vietnam of strapping a soldier into a harness attached to a balloon, which could be snatched by a C-130 pulling the rescued man into the plane on a fly-over was a possibility. In a short time it was ruled out because of simple numbers. Such a flight would take two crews of six men. Twelve men at risk for eight men were the wrong numbers. We were not told, but we were on our own.

When thoughts turned to the possibility of death I remembered and reread Scott's diary, which he wrote on his last march to the South Pole until he froze to death eleven miles from a saving supply cache. This diary boldly told of death. If needed, I wanted to die as proudly. I've learned since then that this diary may have been altered and Scott's last word might not have been so noble. Nevertheless, my thoughts also were along the line of Lieutenant Henry Bowers' last letter to his mother, who probably really was the last of the Polar Party to die and not Scott.

> " . . . my trust is still in Him and in the abounding Grace of my Lord and Savior whom you brought me to trust in . . . I should so like to come through for your dear sake. It is splendid to pass however with such companions as I have . . . There will be no shame however and you will know that I have struggled to the end . . . Oh, how I do feel for you when you hear all, you will know that for me the end was peaceful as it is only sleep in the cold." (Roland Huntford. *The Last Place on Earth*. New York: Atheneum, 1986, page 509)

By 14 July, nine days into the crisis, Jerry fashioned a temporary head gasket out of surplus wire and a soft weld job. The generator roared to life. By the next day the main camp was fully restored, though never to full electrical power. This crisis did pull everyone together. In that sense it was truly God-sent. We were saved by trouble. Even Lulow prayed and promised to go to church if he was allowed to return home alive. However, once the crisis was over, that promise was reduced to attend church once.

A kernlose winter remained true. Without a diurnal sun rise and set there was no forcing mechanism to control fluctuations. Storms would break the inversion and we could watch the broken inversion bringing the warm fifty to forty below zero down to our level. Shortly after the storms would pass, the temperatures would fall to -110 ° F and -116 ° F somewhat routinely. Much has been imagined about these extreme temperatures. Until you have lived through the cold air it is really hard to describe. Indeed -100 ° F is fifty degrees colder than -50 ° F just as +50 ° F is considerably colder than +100 ° F.

In fiction many such cold descriptions have been written. "As he turned to go on, he spat speculatively. There was a sharp, explosive crackle that startled him. He spat again. And again, in the air, before it could fall to the snow, the spittle crackled. He knew that at fifty below spittle crackled on the snow, but this spittle had crackled in the air. Undoubtedly it was colder than fifty below . . ." (Jack London, *To build a Fire*.)

What a crock! Spit, even cold water takes a long time to freeze. It remains true that 80 calories must be lost for every gram of liquid water to solidify to ice and that always takes time. Granted, the colder the temperature outside, the more rapid the cooling effects. The moisture of your breath did build up as frost all around your face, balaclava, and cloth material of your parka. For some reason the frost of your breath did not build up on the wolverine fur ruff of the parka. If you were outside for an hour or longer, this frost would become so thick you needed assistance when you came back to the camp to be gently cut out of your parka and it was for that reason beards were most convenient. A razor blade could easily remove a little chin hair rather than sacrifice the valuable parka.

Everyone at Plateau Station was looking to beat the world's lowest temperature record held at the Russian station Vostok. Today Vostok still holds that record at -128.6 ° F (*Guinness Book of Records*, 1992). But kernlose winters were exactly what we had. Within a week of the final sunset we reached -106 ° F and the fall in temperature leveled out after that for nearly the remainder of the winter. By 13 June, shortly before midwinter, I measured the coldest for Plateau to that date, -116 ° F. And the temperature did not get colder until the harshest cold run of four days with consistent minimum temperatures of -117 ° F from 11-14 August ending with -118 ° F.

This was a long way from the Vostok record, but it was colder than the Vostok low temperature for that year, -113 ° F. We essentially reached the lowest temperature of a kernlose winter and had no reason to believe in any hope of a new outbreak of cold. We were at the "cold pole." Cold could not move into our area. But the sun was about to rise. Under the Great Antarctic Temperature Inversion the coldest temperature was always the snow surface. It warmed up every inch higher. In the thermal turbulence that occurs with the warming of the snow surface by the sun, an outside chance for reaching a colder temperature to pacify our technical curiosity existed. The "standard" level of the Weather Bureau thermometer was one metre above the snow. When the slightly warmed air under the thermometer started lifting and mixing at the return of the sun, the colder air just above it could also be lifted and mixed in such a way to make the "official" temperature slightly colder.

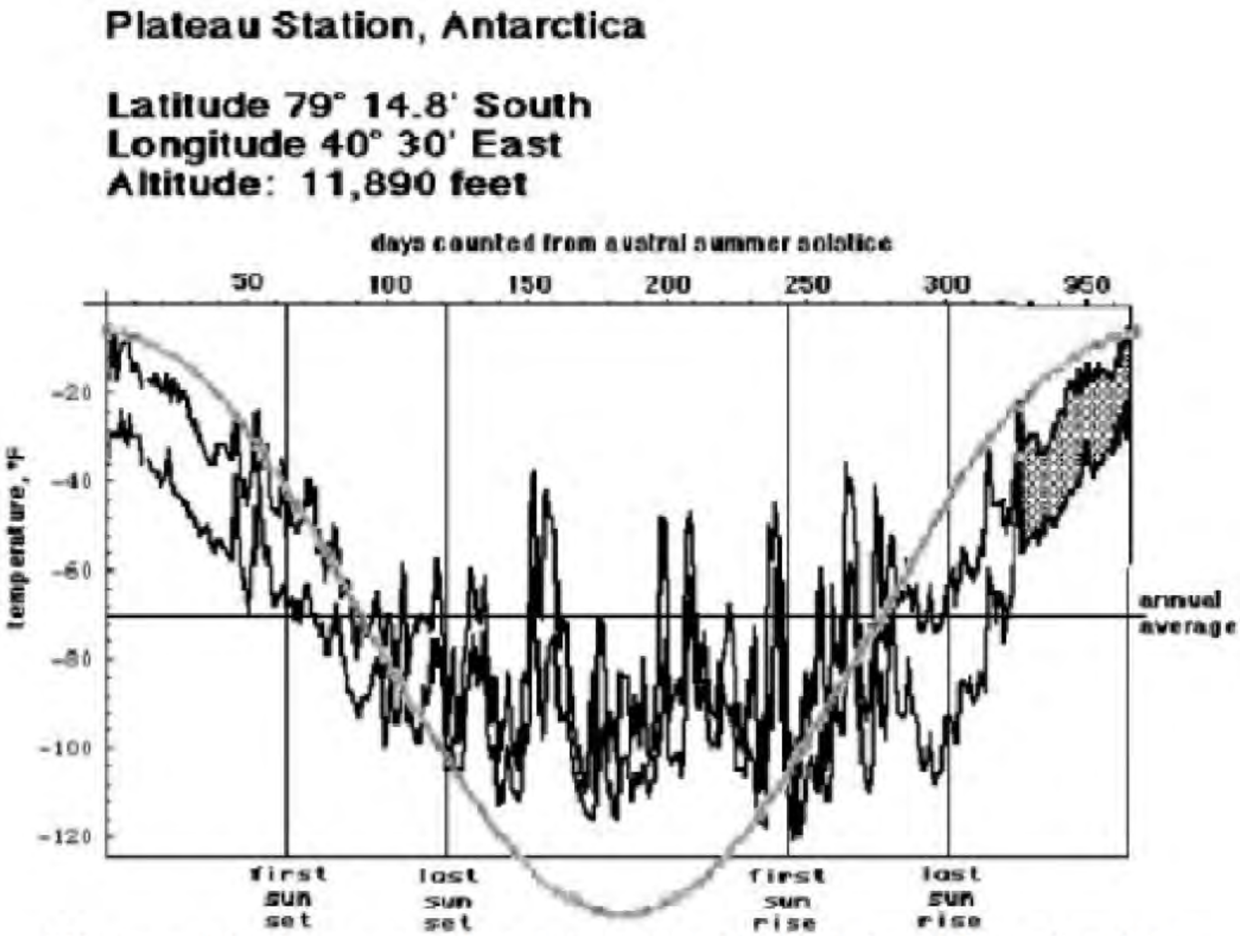
August, 1966

Date	Max	Min
20	-70	-84
21	-82	-104
22 **First sunrise**	-101	-109
23	-97	-116
24	-116	-121
25	-101	-120
26	-98	-106
27	-106	-120

That is exactly what happened (see table above) with the return of the sun's warming rays centered on local noon. Near the midday hour the first five days of the returned sun the temperature plummeted three of those days setting our record at -121.1 ° F on 24 August 1966. I verified the record with two other temperature devices to confirm the coldest temperature recorded by Americans and set a U. S. Weather Bureau record. (Two years later Tom Frostman and George S. Rubin de la Borbolla, working for Dalrymple and me, set a newer record two degrees colder at -123 ° F on 5 June 1968. That was the last year of operations at Plateau Station and no colder records have been made by Americans.)

When all the temperature results were tabulated, it turned out that the average temperature for Plateau Station for the calendar year of 1966 was -70 ° F, exactly the deep core temperature Captain Pope and I measured the previous summer. That does confirm Rob Flint's hope expressed by the station stamp commissioned and copyrighted by him calling Plateau Station the coldest place on earth. Even though we did not measure the coldest single moment of a day, to this day our annual average temperature of -70 ° F is a world record and Plateau Station is identified as the coldest place on earth in *Guinness Book of Records*, 1992, p. 47.

Often I have been asked about wind chill. An empirical association of temperature and wind speed relating how a living self heating warm blooded creature loses heat in the wind and cold temperature was developed by Paul Siple. If I used his formulas correctly, the coldest wind chill at Plateau Station may have been -228 ° F, temperature near the liquefaction point of oxygen. At these extremely low temperatures experienced at Plateau I believe the wind chill, always off our charts, was meaningless. Fortunately the wind never was very high and when it was in excess of thirty miles per hour, the temperature inversion was broken and, in fact it became warmer.



[The symmetrical temperature chart above consists of real data from 15 December 1965 to 7 November 1966 with missing data simulated by a mirror image of the opposite season.]

Back in July, when we were in crisis over the loss of our generators, members of the National Science Foundation made a long distance telephone call in the daytime to my brother Ray and called him off the production line at Evinrude Motors in Milwaukee. In a time when long distance telephoning simply was not done by any of my relatives, such a phone call had a major impact on the entire relation. Ray was informed that we were in trouble but that we were working through the problem and it looked quite promising. However, it probably would be sensationalized by newspapers. Ray was kept on the phone a whole lot longer than three minutes, which added to the sensationalism of this event. It did put my family, Ray and Trudy, their children, Tanna, and other aunts and uncles at ease.

Following the crisis ham patches became more available to us. Some ham patch time I believe was stolen or at best dominated by our southern doctor Jimmy. Most of the time radio communication from Plateau Station was very poor because of much Aurora activity. The brilliant displays of reds, greens, yellows, and purples in huge curtains overhead were received by us with pure delight. Frequently we would go outside and lie in the snow to avoid a stiff neck even when the snow was considerably colder than -100 ° F just to watch the magnetic disturbance in these vivid colors. These colors were the death of radio communication for many days both before and after. So maybe there simply was not much radio communication to ham radio operators in the States. I don't think I had more than three ham patches all year and was very satisfied. When conditions were good, Ed Horton made a communication, usually with a ham radio operator in New Hampshire. He would make a collect long distance call to my brother Ray, usually about 3: 00 A.M. Milwaukee time. Voices were tear jerkingly enjoyable. Mostly, neither of us knew what to say. I wanted to hear all the good gossip of home, no matter how trivial. To Ray that was only trivial, not worth passing on, and he wanted to hear of all the exciting things he thought I was doing. Drinking beer and measuring temperatures was routine to me and not worth talking about. So, not much was said, except the important voice was exchanged.

Insert: 14 October 1966. "In essence, we find ourselves—from the point of view of the important war (for the complicity of the people)—no better, and if anything worse off. This important war must be fought and won by the Vietnamese themselves. We have known this from the beginning. But the discouraging truth is that, as was the case in 1961 and 1963 and 1965, we have not found the formula, the catalyst, for training and inspiring them into effective action." (Memorandum for President Lyndon B. Johnson from Secretary of Defense Robert S. McNamara.)

On one of these ham patches Ray informed me that I was declared 1-A by my draft board and was drafted and had failed to show up for my physical and now was AWOL and sought after by the FBI. The Navy threw me a welcome aboard party. One good point Jimmy offered was that I could enlist immediately in the Navy and avoid the draft. I had thought I had a valid deferment, but the Milwaukee draft board always updated all paper work every twelve months. All their questionnaires were in my mail box at the airport in New Zealand. I suddenly became concerned but could not do much. Here is a message I sent.

USARP
RUECCX 001
DE RUMPMA 563 WOWQWQO
ZNR UUUUU
R 19 0530Z OCT 66
FM PLATEAU STATION
TO RUECCX/USARP WASHDC
INFO ZEN/USARP REP MCMURDO
RUHPMC/USARP REP CHCH

BT
UNCLAS
USARP NO. 132
USARP WASHDC PASS WEYANT, PMB, USWB, WASHDC

1. UNDERSTAND VIA PHONE PATCH THAT DRAFT CLASSIFICATION CHANGE TO 1A AND INDUCTION PAPERS ARRIVE IN MILWAUKEE

2. PLEASE CONFIRM IF 2A CLASSIFICATION WAS NOT REMOVED. EXPLAIN TO LOCAL BOARD 44 MILWAUKEE THAT OCCUPATION PRECLUDES PRESENCE. WOULD LIKE DEFERMENT EXTENDED IF POSSIBLE UNTIL AT LEAST SOME ANALYSES ON DATA COLLECTED HERE HAS BEEN COMPLETED.

SPONHOLZ
BT

One other winter event on the Antarctic continent that gave us all a real chill was the medical fate of scientific colleague, Larry Spitz, wintering over at Byrd Station. He developed an appendix attack and in isolation he was close to death from a very simple ailment. I enclose the entire account of the Navy's record published in the *Antarctic Journal of the United States* as a tribute to all that the military was prepared to do for its countrymen anywhere in the world, civilian scientist or man in uniform. I may have and probably will continue to cast disparaging remarks toward the Navy as they in turn did to me "a sand crab." It is the American way of freedom. I am alive because of the work of the military at Plateau Station. Larry Spitz is alive as a complete example of the full scope of the military's love for its country and its people.

> "At 2310 local time on September 4, the Washington duty officer of the U.S. Naval Support Force, Antarctica, received a phone call from Davisville, Rhode Island. The duty officer at the Davisville headquarters of Antarctic Support Activities (ASA) had picked up a garbled message from the amateur radio transmitter at Byrd Station. With a magnetic storm raging, communications were bad. Byrd could not hear the operator in Davisville at all, but the ASA operator heard enough of Byrd's transmission to relay that a scientist was stricken with what sounded like acute appendicitis and that Byrd was not only requesting immediate aerial evacuation, but was already preparing the skiways for landing."

> "As the magnetic storm subsided on the following days, communications were restored and more precise information became available. The patient was Mr. A. Lawrence Spitz of Fairfax, Virginia, an auroral observer for the Arctic Institute of North America. His ailment was diagnosed as generalized peritonitis. A course of treatment based largely on the use of antibiotics was prescribed. It was hoped that Spitz would respond sufficiently to the treatment to await the official opening of the season with the first fly-in to Antarctica; this was scheduled for October 1 and might even have been pushed forward a few days."

“At first, things appeared to be going well, but early on September 9, Dr. Robert Hunt, the physician at Byrd, reported a steadily rising temperature. In the afternoon of the same day, Rear Admiral Bakutis, Commander, U.S. Naval Support Force, Antarctica, requested and obtained approval for a medical evacuation flight. Two LC-130F Hercules prepared to take off. At 2000 hours, the first aircraft departed with Commander Daniel Balish, USN, Commanding Officer of Air Development Squadron Six, on board. His orders were to push straight through to Christchurch, New Zealand, with minimum time on the ground, and to proceed from there to Antarctica as fast as weather permitted. The second aircraft, which was to provide search and rescue support to the first, was scheduled to leave Quonset Point about 18 hours after Commander Balish.”

“In the meantime, Byrd, South Pole, and McMurdo Stations were instructed to make surface synoptic weather observations every three hours and to take upper-air soundings every 12 hours. Terminal forecasts for Byrd and McMurdo were to be prepared by the latter on a six-hour schedule. The Australian and New Zealand stations on Macquarie and Campbell Islands were requested to provide 12-hourly upper-air soundings. At Byrd and McMurdo Stations, Navy crews were busy smoothing runways, setting out emergency lighting, reactivating navigation aids, and checking out equipment. The Christchurch detachment of the Naval Support Force was asked to have a fuselage tank ready for installation in the Hercules.”

“Commander Balish arrived in New Zealand on September 11 at 1125 hours. At 0959 on the following day, he left Christchurch for McMurdo Station where he arrived at 1858. By this time, weather at Byrd Station had deteriorated and the fly-in had to be delayed for several hours. Dr. Hunt reported that Spitz was resting comfortably, although his condition was gradually worsening. The emergency, while real, was not acute.”

“The Hercules departed McMurdo for Byrd Station at 0435 on September 13. Everything went smoothly. After a brief stop at Byrd to load Spitz on board, the aircraft proceeded directly to Christchurch, arriving at 1952. After diagnosis at a civilian hospital, it was decided that surgery for an infected appendix would be delayed forthree months while treatment with antibiotics continued.” (*Antarctic Journal of the United States*, Vol. I, No. 6, Nov.-Dec., 1966, p. 274-275.)

At Plateau Station we eavesdropped as much as we could on the radio traffic praying for Larry and his rescue party every hour. Why could an emergency be met at Byrd Station and not at Plateau? Byrd Station’s temperature range in September was +14 ° F to -66 ° F only 5030 feet above mean sea level. Plateau was more than twice as high in altitude with temperature still below -100 ° F or forty degrees colder than the freezing point of air fuel, and several hundred miles on the other side of the Pole of Inaccessibility from McMurdo. Basically we were COLD! We felt colder considering Larry’s plight and the risk taken by the flight crews. Similar flight crews would soon be doing the same for us.

(Logo: ©Rob Flint, 1965)

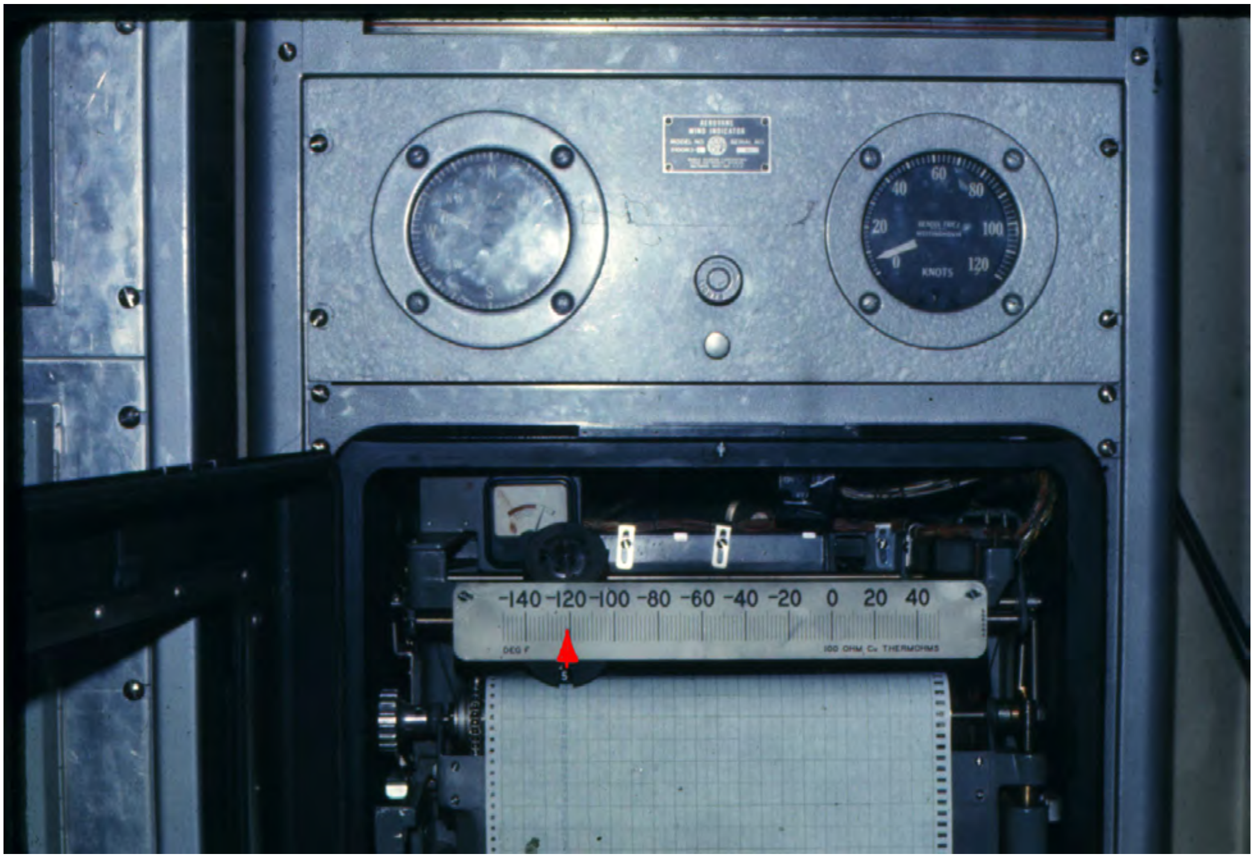
The last C-130 takes off before the long winter's night creating its own blizzard February 1966

Top: Lowering the flag for the long sunless winter at the final sunset April 1966

Bottom: The Southern Cross during the enless night of winter

Top: Four layers of clothes (time delay photo)
Left to right: Rob Flint, Marty Sponholz, Hugh Muir, Bob Geissel
Bottom: Operation June Bug—the search for "A Hard Day's Night" by the Beatles;
Evildoers: Marty and Bob (Slide by Rob Flint)

Failed generators make the main camp cold—one hundred proof wiskey frozen on the indoor shelf at -108°F



Top: Record low temperature for the year -121.1°F
24 August 1966

Bottom: A barbecue to celebrate the return of the sun
(Slide by Rob Flint)

CHAPTER 9
Research in Winter

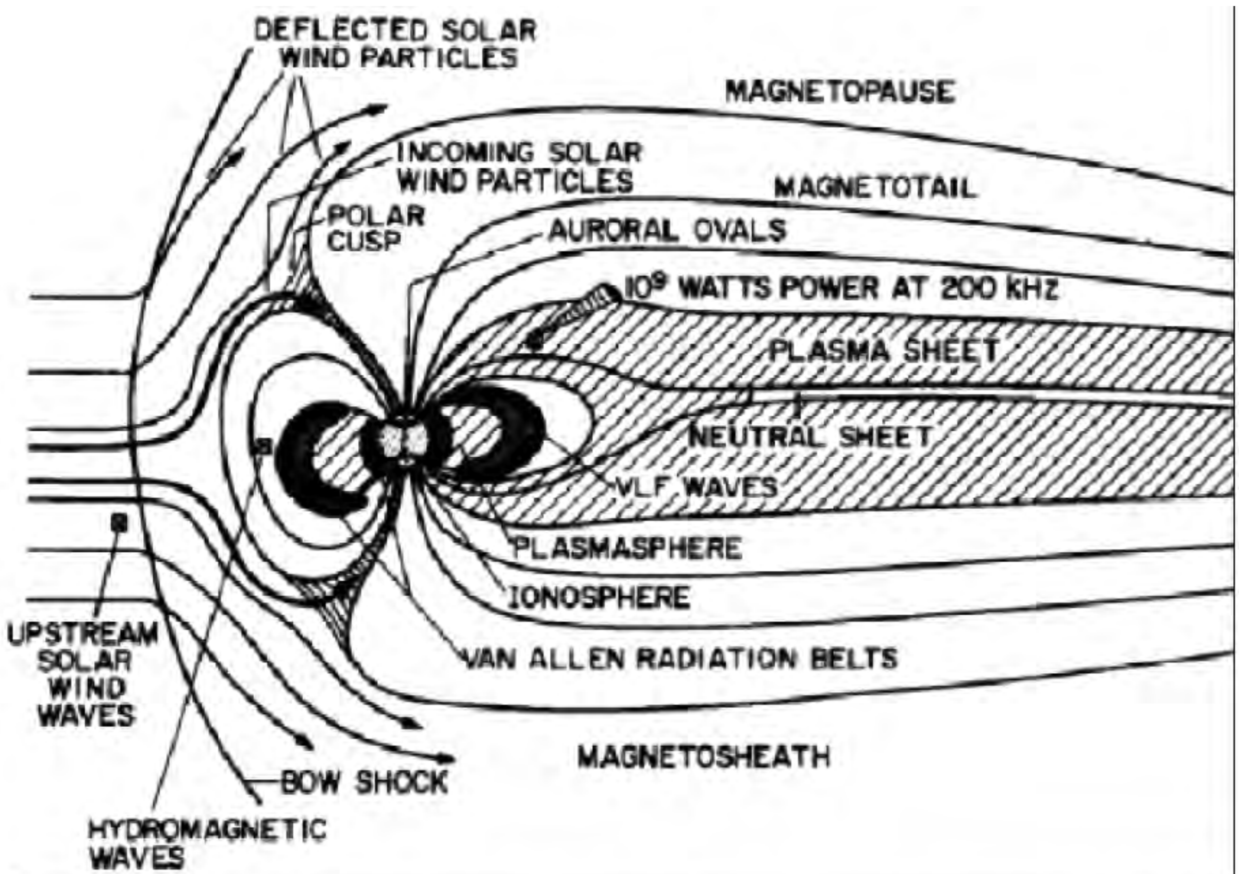
"Nowhere else on earth are external geophysical-meteorological environments as test-tube like or clear-cut and well defined as in the Antarctic." (H. H. Lettau) This was our mission. This is what all of us had come to Plateau Station for. Exploration of the polar regions contributed most to the discovery and understanding of near space, the very high altitudes of the atmosphere, especially when you consider knowledge growing from zero to the present day understanding.

Specifically, Rob Flint's research dealt with the studies and mapping of Very Low Frequency (VLF) electromagnetic disturbances occurring in the ionosphere and the high magnetosphere above. One phenomenon Rob monitored was what was called the South Atlantic magnetic anomaly. Changes of phase and frequency of VLF signals seemed to be created with large quantities of electron precipitation from the Van Allen belts and drastically disrupted normal behavior of the Dregion of the ionosphere. Little was known of this phenomenon. Global monitoring and synchronous measurements on a global scale were required. Plateau Station was in an excellent position for such studies of the South Atlantic magnetic anomaly being on great circle paths connecting the U. S. Navy VLF transmitter NAA (17.8 kilocycles per second) at Cutler, Maine; U. S. Navy Station NSS (21.4 kilocycles per second) at Annapolis, Maryland; and a VLF recording station at Tucuman, Argentina.

Flint brought to his studies the wintering over experience at Byrd Station where he also performed VLF studies. His expertise on "whistlers" a VLF signal that becomes trapped in the magnetic field and bounces back and forth from one magnetic pole to the other in less than eight seconds, served well the research of the Institute for Telecommunications Sciences and Aeronomy and Stanford University. The study of these whistlers also displayed the instrumentation coordination necessary over the entire globe. A whistler bouncing between Byrd Station, Antarctica, and its magnetic conjugate point at Great Whale River, Canada, demanded perfect clockwork and coordination with precise wave length and frequency measurements for motions near the speed of light.

Almost all of our knowledge about the upper atmosphere and its electrical and magnetic effects rests on such intensive accurate measured observations from the polar regions. The main features like the Van Allen radiation belts were discovered in the IGY and electron precipitation and the flow of plasma independent of the solar wind were discovered in the subsequent years after IGY during which Plateau Station played a major role.

Intricately connected with Rob's VLF program was the aurora program conducted by the Arctic Institute of North America at the cost of the frost bite of Hugh Muir from Scotland. He maintained continuously running all-sky cameras, which photographed all 360 ° of the sky during all electromagnetic disturbances visible as the southern lights. Hugh also used photometers and an auroral spectrograph which could monitor different wave lengths of the excited electromagnetic spectrum not visible. When great solar bursts erupted on the sun, tons of plasma material was sent out from the sun, and, being charged material carried by the solar wind through space, they intersected the earth's magnetosphere setting off the aurora displays. This intersection spawned much activity also interpreted by VLF transmissions and monitoring.



(The Magnetosphere of Earth, schematically illustrating a number of important morphological features, "Advances in antarctic geophysical sciences from the IGY to the present," *Antarctic Journal of the United Stat*es, National Science Foundation, Vol. XXI, No. 2, June, 1986, page 2.)

Although scientists have known the entire earth as a planet with a dipole magnet, it was not until the modern Antarctic exploring expeditions actually came to find the "South Magnetic Pole" that geophysics became a science of the interior of the earth. [The magnetic pole currently in the Antarctic region is really a north pole magnet that attracts all south poles of all other magnets.] The first closeup triangulations for the position of the South Magnetic Pole could be done by comparisons of magnetic observations made by the German Antarctic Expedition (1901-1903) and the Great Britain National Antarctic Expedition (1901-1904).

Led by Prof. Erich von Drygalski, the German expedition's plans were drastically altered when a short summer season caused the freezing of their ship, the *Gauss*, in place near 90 ° East Longitude. This forced them to stay the entire next winter and permitted them to take magnetic observations for more than a year. During the British expedition First Lieut. Albert Armitage, and a year later Robert Scott, led parties up the Ferrar Glacier, penetrated the Transantarctic Mountains, and traversed over a short portion of the high plateau of Victoria Land, enabling them to take some of the most accurate magnetic observations of their day. From these two different places the position of the South Magnetic Pole could be established. The very next British Antarctic Expedition of 1907-1909 led by Ernest Shackleton sent a small party under Prof. T. W. Edgeworth David to the exact spot on the snow surface of the South Magnetic Pole - then at 72 ° 25' S, 155 ° 16' E.

With hindsight today, the major discovery came on the Australasian Antarctic Expedition of 1911-1914. R. Bage, Hurley, and Webb marched to the South Magnetic Pole, then still on the high plateau of Victoria Land. Disappointingly they only measured a magnetic dip of 89 ° 43.5' and had to turn back because of the severity of the wind and cold. Yet, they reached 70 ° 36.6' S and 148 ° 10' E, still 175 miles from the previously measured magnetic pole position reached by Prof. David. With only 16.5 minutes of arc of magnetic dip left to reach a place where they could see a perfectly vertical magnet, the still apparently large horizontal distance left to traverse presented itself as a mystery. The magnetic pole was moving.

During the IGY (1957-1958) the South Magnetic Pole appeared near the coast of the Antarctic at about 68 ° South, 144 ° East, and the French established the station Dumont d'Urville very close to it. A National Geographic Society's map of Antarctica locates the South Magnetic Pole in 1986 at a position nearly one hundred miles off the Adelie Coast at 65 ° 6' South, 139 ° 30' East. These positions show a magnetic pole movement faster than most glaciers which move several miles per year.

In the comfort of smoke filled warm labs in England and Australia, the world's scientists concluded that the interior of their planet was a very complex layered structure with a large portion of the interior of the earth's core being liquid causing the magnetic poles to move and to move quite rapidly when compared to other geological phenomena.

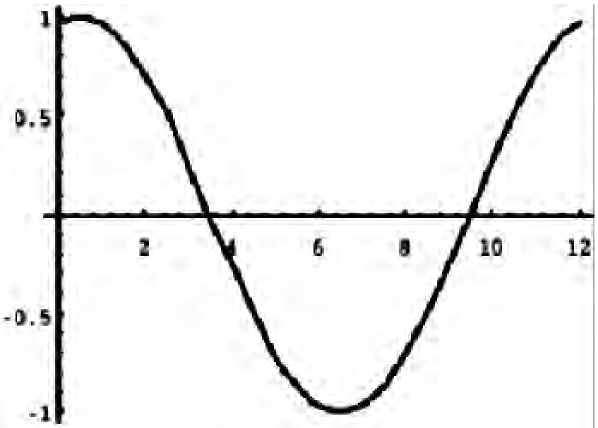
Bob Geissel came to Plateau Station with the newest designed magnetograph from the Fredericksburg Geomagnetic Center of the Coast and Geodetic Survey. He had both standard speed recorders and rapid run recorders to monitor all magnetic events from the interior of the earth and housed most of this equipment in two small shacks half way between the main camp and the emergency camp. It is to these shacks that Bob faithfully hiked in high wind and in calm every day from our warmest time at -6 ° F to our coldest -121 ° F. With his observations and the observations of many others around the world, maps of the earth's interior and its motions became possible.

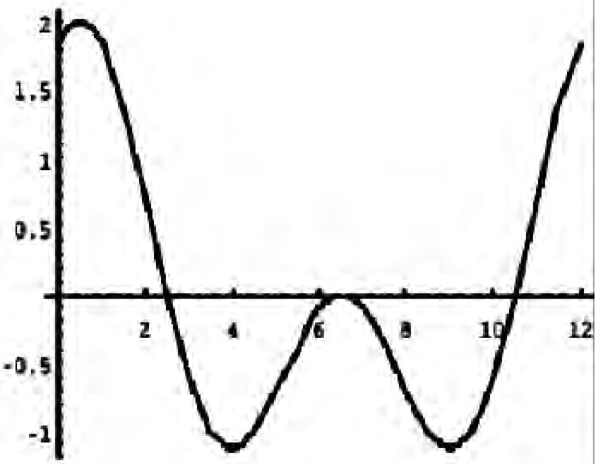
Many medical tests on the eight men wintering over at Plateau Station were planned. Most were carried out the second year. Some blood tests were made by Dr. Gowan that contributed much to revising medical understanding of “normal blood cell counts.” A publication shows that we would have been diagnosed as having leukopenia and neutropenia. Our white blood cell counts all fell way below “normal.” Our isolation in a germ free environment certainly was the major contributor. Once the resupply flights began routine operations at Plateau Station, our blood counts returned to the expected levels. (“Neutropenia in Healthy Men at the South Polar Plateau,” *Archives of Internal Medicine*, American Medical Association, 1970)

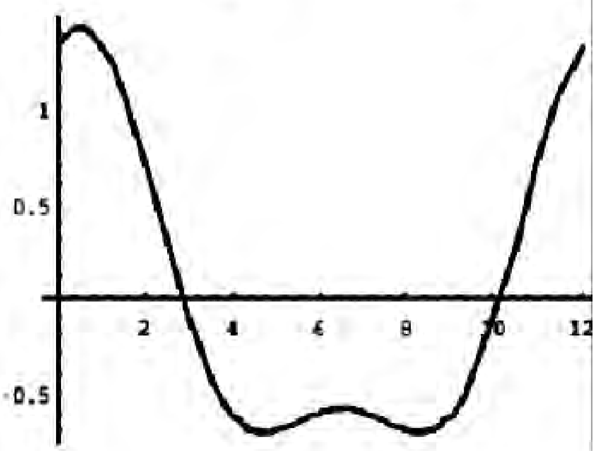
Turning now to the meteorological programs for which I had primary responsibility, it cannot be overstated how important Antarctica was for the testing of theories. “There are three important principal factors: the exceptional uniformity of the physical structure of the Antarctic snow surface, the large horizontal scale of the topographical gradients of the continental ice-dome, and the relative paucity of short-time disturbances of the dominant long-period (seasonal) variation of insolation. These factors justify a comparison of atmospheric structure with laboratory results, such as testings in a gigantic wind tunnel, or in a rotating dishpan, or a cold chamber, or the unusual combination of a cold-air wind tunnel which is whirling around. The same three factors stimulate the further development of existing theoretical models. For example, the snow-air interface energy budget invites theoretical deductions and predictions which can be tested most readily by observations from previous and future Antarctic programs.” (Heinz H. Lettau, “Antarctic Atmosphere as a Test Tube for Meteorological Theories,” *Research in the Antarctic*, American Association for the Advancement of Science, 1971, p. 443.)

By 1971 Lettau fully explained the kernlose winter. He began with the annual cycle witnessed in the seasons all over the earth. This temperature cycle with enough averages shows clearly the changes of the angle of the sun from summer to autumn to winter to spring and back to summer. The calendar year of daily average temperatures for anywhere in the Southern Hemisphere can be approximated by a simple cosine wave.

At higher latitudes than the Antarctic Circle where daily sun rises and sun sets for all year do not exist, yet the annual sequence of season continues, harmonic analysis is permissible. In 1971 Lettau explored the addition of a second harmonic, which is another cosine wave added to the annual wave. The second cosine wave had only half



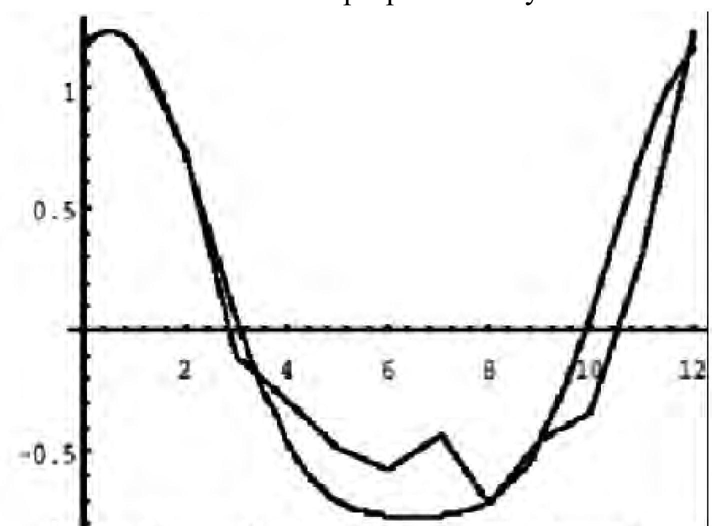


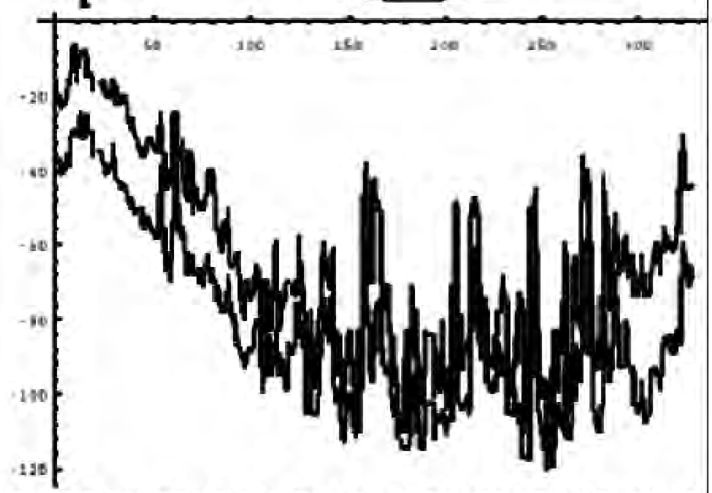


the wave length of the first so it would display two maximums and minimums in a year's time. The following graph is the addition of the first two harmonics of exactly the same amplitude.

Now Lettau determined the amplitude of the second harmonic for the South Pole where there is only one sun set and one sun rise per year as 42% of the first harmonic. Lettau's harmonic analysis then for the South Pole gave the following graph.

He claimed the amplitude for the second harmonic decreased proportionately from the maximum at the South Pole to zero at the Antarctic Circle. For Plateau Station the amplitude of the second harmonic must then be 23% of the amplitude of the first harmonic. A comparison of the monthly average temperatures at Plateau Station for my year during 1966 with the two harmonics for Plateau Station in like manner as Lettau's analysis is shown below.





PLATEAU STATION, 79° 14.8' SOUTH DAILY MAXIMUM AND MINIMUM TEMPERATURES (°F) 15 DEC 1965-7 NOV 1966, 328 DAYS

Using this graph Lettau would have predicted -122.7 ° F, as the minimum temperature, had communications worked well in January of 1966. I recorded -121 ° F as the minimum in 1966. Bob Dingle recorded -115 ° F as the minimum in 1967 and Tom Frostman recorded -123 ° F as the minimum in 1968 after which Plateau Station was closed.

What about all the many theories that tried to explain the kernlose winter? Lettau answered: "The difference between symmetry, "rounded at the bottom" [like a single cosine wave], and asymmetry, "flattened at the bottom" or "corelessness," of the annual temperature curve, as between Antarctic stations at moderate and extreme geographic latitudes, is explained by the truncation of the annual cycle of potential insolation. . . . there is no need to search for other and undoubtedly spurious causes of the "coreless" polar winter such as a mixing action of the wind."

Lettau's discovery of the answer for the kernlose winter is an outstanding example for research students to study to learn when to expect that they have an answer and need to look no further. Francis Bacon a long time ago (1620) identified this problem of looking for more order in nature where there was no more as an Idol of the Tribe. Lettau correctly taught us that unless there are first principles from nature herself giving reason for our answers or statistical curve fits and equation models, there will be no value of truth in them. Where statisticians, mathematicians, and scientists always can find different and more reasons to explain things, unless derived from nature, their reasons will remain spurious.

At Plateau Station I stood on top of an ice and snow sheet 11,000 feet thick representing thousands of years of snowfall. Yet the most difficult thing scientifically to pin down was the mechanism by which all that snow fell. Snow gauges in the open wind were untrustworthy. I brought none with me. The most effective way to measure the snowfall was to establish a grid of poles at surveyed positions. By measuring the height above the snow surface that each pole was visible, an average accumulation could be measured by statistically smoothing small localized drifts and effects of foot prints.

Charlie Roberts established the Black Field, which was set off with black flags, about seven hundred feet north of the emergency camp and it was measured once a month. I added the Red Field about four thousand feet northwest of the main camp, an extra long distance away to avoid a larger developing local drift of snow building up around the area because of the presence of the main camp as an intrusion on this region of the snow surface. This distance exceeded routine safe walking distance, but the value of the snow accumulation data I interpreted as worth it.

The Red Field, smaller than the Black Field, was measured after every significant weather event that gave an apparent snow accumulation. I had hoped this Red Field could help settle a small debate between Prof. Werner Schwerdtfeger and me. He was originator of the idea of continuous or at least nearly continuous accumulation of snow by small ice crystals precipitating daily even from a clear sky.

This of course meant that I had to hike out into the extreme cold many times and go this long distance without the aid of a life line. During the polar night I wore a miner's lamp on my forehead powered by batteries inside my parka near my chest. After about an hour, the cold penetrated my parka and made the batteries so cold that they lost power. It was a good clue that I had been outside long enough. When it was colder than -80 ° F, and most often it was colder than -100 ° F, it seemed that breathing the cold air somehow slowed my mental capacity. Thinking was slowed. All physical motions seemed slowed. Of course every activity took extreme lengths of time. To safeguard against poor judgment Rob Flint or Bob Geissel took turns marching out to the Red Field with me and assisted with the many measurements.

Several times I needed to measure the Red Field alone. Walking out that distance unescorted was considered dangerous and I logged in with both Flint and Geissel. They knew exactly how long I expected to be out and exactly where I intended to go. Plateau Station was not quite as dangerous as other interior polar stations since the wind rarely became stronger than twenty knots. The severity of the cold dominated our fears. Since my miner's lamp would be out after an hour and my glasses would be useless due to the extreme buildup of frost from my breath, it was a common practice to turn an outside flood lamp on facing the direction that I would be walking back so I could use it as a beacon. One time I stayed out a little too long but was suddenly aware of my overstay when the main camp's generators stopped as they frequently did after our major shutdown in July. Stars that day were not well defined because of light clouds or ice fog. The wind was near calm and with the momentary dead generator total silence spread over the plateau in a cold deadly fearful manner.

I painfully finished the measurements and started back. My face was well frozen into the parka. My nose was without feeling. My feet and hands were past being numb and pain began creeping up my legs and arms. I had stayed too long. Also, without a doubt, I was overdue at the main camp. Someone normally would be coming out to assist me back had it not been for the generator failure. After what seemed like several hours but was perhaps only thirty minutes, the floodlight at the main camp suddenly came on simultaneously with the comforting roar of the generator. In shock I saw my long shadow ahead of me. The light was behind me. Somehow I was confused in direction or had started walking back correctly and instead drifted in a long leftward circle and was walking northward to the seacoast a thousand miles away.

I turned and corrected my almost fatal error. The longer it took to get back the more thankful to my God I became, realizing the extent of my error. My turn was such that I never would have crossed a life line of rope and bamboo flag poles. Nor would I have crossed the ski way. In the distance, perhaps a full two miles, I could see several men coming out toward the Red Field in search of me and I was most grateful for the arms of Flint and Geissel as my legs became numb and I found them to have difficulty bearing my weight. Hugh Muir followed pulling an unneeded "banana boat." The joy over their concern for me and our quick reunion went a long way toward thawing my legs. I had my data.

Schwerdtfeger, it seemed to me at the time, built a major case on the casual statements of early explorers such as Paul Siple who said that when he aimed a flashlight upward in the polar night he could see ice crystals continually. I tried and indeed you could on some days see ice crystals in the air. My daily observations showed ice crystal precipitation on more than sixty percent of the days, summer or winter. In my view it simply was too easy for ice crystals to be advected by wind from the thousands of miles on the plateau. The polar plateau was already in the "alto" region of cloud layers. The thinnest of clouds could deposit snow or ice crystals, and if only thin clouds, they would go undetected by visual observations in the polar night.

Precipitation from a clear sky when taking into account all other possible sources for ice crystals for me was simply too hard to accept. My arguments with my professor were recorded in his major work "The Climate of the Antarctic," half of Volume 14 of the encyclopedia of climatic studies *World Survey of Climatology*, edited by Helmut E. Landsberg (1970). Later Schwerdtfeger would brilliantly argue how air in an intense temperature inversion would possess sinking qualities of motion. Even unsaturated air sinking in an inversion with a vertical temperature gradient of more than sixty Fahrenheit degrees, most common as confirmed by my own balloon ascents, would easily reach saturation and super saturations and almost certainly precipitate from a clear sky. Thirty years from my year on the Ice I am prepared to concede to my old Professor. He won.

Still, my two snow stake fields showed essentially the same snow accumulation, 6.8 centimetres (2.7 inches) snow as determined by the Black Field. No significant difference could be determined by the Red Field that I measured after each cloud or wind related event. The snow surface, hard in summer and soft in winter, may have given an interpretation in favor of ice crystal precipitation, but not positively from a clear sky. I felt the metamorphosis of the snow surface was primarily due to a fragmenting of the ice crystals on the snow surface because of the extremely cold temperatures. There was a deposition or crystal growth directly on the surface that appeared to be very large. This was a sublimation of water vapor in the air forming ice crystals in supersaturated air at the surface releasing the heat from the phase change to the air. But ice crystal formation in clear air was hard to confirm.

How are theories formulated? Most often they are put together by scientists like Schwerdtfeger who have other theories claiming certain things that might be wrong in one aspect but could be held together by adding still another theory. As the theoretical structure grows, it either elegantly explains more and more and wins the favor of many other scientists, or it becomes top heavy and begins to fragment by self contradiction. It is not often that observation alone settles the matter. Access to frequent publication aids the process. Had I not turned into a high school teacher, my debate with Schwerdtfeger might have developed into a friendly set of observational tests and perhaps more clever students of Prof. Schwerdtfeger would have developed interesting instrumentation to measure what we could not measure in 1966. The shallowness of the Great Antarctic Temperature Inversion, unable to be grasped with even the slowest rising balloons but confirmed by Dalrymple's fixed 30 metre tower constructed the next year, permitted me to give up a good fight, perhaps a little too soon.

Do not let the measurement of a year's snow accumulation, 6.8 centimetres (2.7 inches) as determined by the Black Field in 1966 and 9.11 cm (3.6 inches) in the following year as measured by my successor, Bob Dingle from Australia, go unnoticed. Bob Behling, a very close friend of mine going back to freshman calculus at the University of Wisconsin-Milwaukee and a member of the Queen Maud Land Traverse, shared with me profile data of ice densities. The snow density of the several layers near the surface averaged 0.361 g/cm3. This density of snow yields 2.45 inches of precipitable water for the entire year. Antarctica is truly the driest desert in the world.

At this rate how did 11,000 feet of snow get here?

An intriguing study that I developed with much consultation with Lettau, Schwerdtfeger, and Ed Flowers, was how the heat and specifically for Plateau Station how the cold conducted into the icecap. From a pure physics point of view, cold really does not exist just as darkness is not an entity. As darkness is really an absence of light, so cold is the absence of heat. To measure the rate at which heat penetrated the icecap, I buried thirteen copper constantan thermocouples at varying depths in the snow down to ten metres below the snow surface in January 1966. After a considerable number of calibrations that compared each thermocouple with each other as well as with standards, careful measurements were taken every three hours for the remainder of the year.

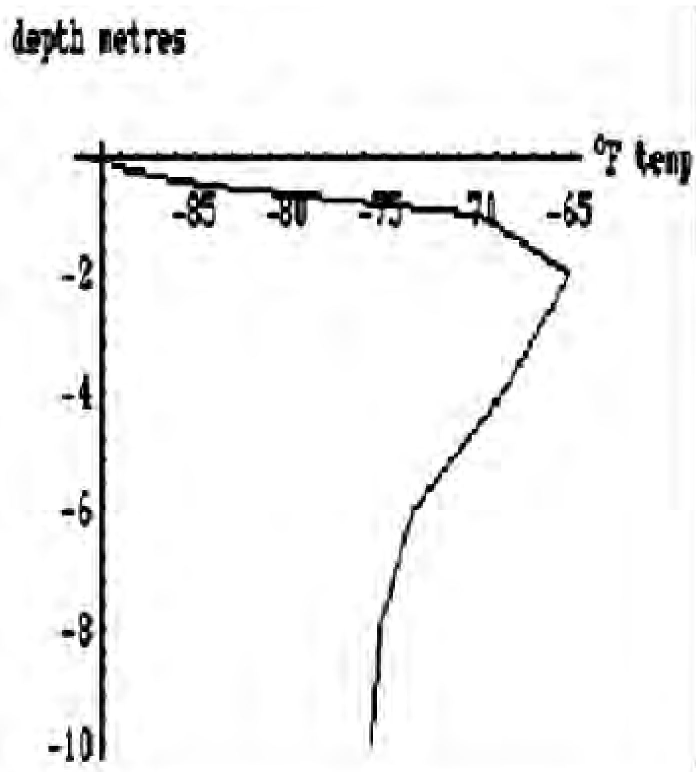
Starting with the "heat wave" of temperatures like -6 ° F and -20 ° F during January I could follow this heat in later months. But as this heat penetrated the ice its warmest temperatures were damped and were cooler. The next graph shows the summer heat at -65 ° F penetrating downward to a depth of two metres by 1 April 1966.

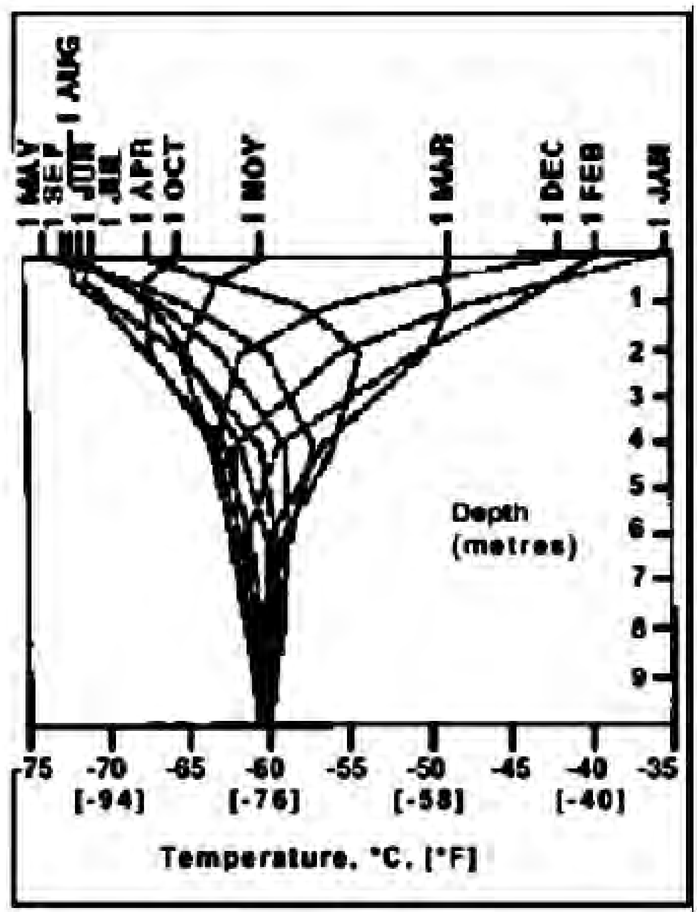
By drawing lines of averaged temperatures for the first day of each month in the second graph a cone-like figure emerges. If you carefully trace the individual lines for each month you will see the heat wave get cooler and cooler until it becomes a constant near the ten metre depth.

When the cold on the surface reaches its minimum in the darkest winter months of May, June, and July, the cold can also be followed downward but again not as severe. In other words, at each level the maximum and minimum are damped coming closer and closer together with deeper depths until a constant is reached. That constant is near the climatic average of the region. In the air above the snow surface I measured a range of -6 ° F to -121 ° F with the maximum recorded in January and the minimum recorded in August. Two metres below the snow surface this graph shows a temperature range of -58 ° F to -89 ° F with the maximum recorded in March and the minimum recorded in August and October.

The penetrating seasons by conduction become less severe and are delayed. Continuing we see at the four metre depth the maximum temperature occurs in April at -69 ° F and the minimum temperature occurs in November at -83 ° F.

Deeper and deeper into the snow, from the graph it becomes more difficult to distinguish the time. At six metres, the maximum occurs in May and the minimum probably in November with the range of temperature from -72 ° F to -81 ° F. At eight metres the seasons are fully reversed with the summer heat reaching this depth in June and the previous winter coming in December with only an annual temperature change of -6 F ° from -74 ° F to -80 ° F. By ten metres below the surface the temperature no longer varied by more than one degree averaging -76.9 ° F. This was considerably lower than I recorded in the original ice core samples with Commander Pope. Those cores may have been





warmed in the drilling process. And our year on the polar plateau may have been a "warm" one with the ten metre depth temperature not responding to the warmer year until many years of a warmer average. This of course would mean that Plateau Station could reach colder temperatures than we experienced.

Note that this cone is asymmetrical. The cold side of the cone is closer to a vertical line drawn through the constant ten metre temperature on the graph. Prof. Lettau identified this as an effect of the kernlose winter of polar regions. Tautochrones, as these graphs are called, in regions not poleward of the Arctic or Antarctic circles are very symmetrical.

(Monthly tautochrones, 1966-1967, for the layer of snow between surface and ten metre depth at Plateau Station. Published by Gunther Weller and Peter Schwerdtfeger, "Thermal properties and heat transfer processes of the snow of the central Antarctic Plateau," Paper No. 15, *Proceedings of the International Symposium on Antarctic Glaciological Exploration* [ISAGE], Dartmouth University, Hanover, New Hampshire, 1968.)

I remember being very angry about the "theft" of this publication from me. Sometime after I was in the field and, in fact, had planted my thermocouples after much labor and frozen face and hands many times over, a group of scientists teamed together from the University of Alaska and the University of Melbourne, wrote a proposal to the National Science Foundation and received a substantial grant to do the same thing at the same place. As the published graph shows, it included the year 1966. That was my data in 1966, published with not even an acknowledgment. I was the only meteorologist at Plateau Station in 1966. It had to have been a complete giveaway by either men in the Weather Bureau at Polar Met or through the Australian observer who replaced me.

When I learned of their proposal, I was determined to publish as quickly as possible but to cover the butt of whoever funded this duplicate project Bill Weyant encouraged me to make the peace and turn over the data to Alaska and Melbourne. Reluctantly I did. It was easy for administration people to give up the hard labors of others, especially when they did not make the sacrifice. As it turned out, Gunther Weller and Peter Schwerdtfeger bore no frostbite either.

In pure research work ideas and who had the idea first is everything. In free and open exchanges, as I always believed was the only purpose for Antarctic research, many ideas were traded and at times no one can say for sure who did the initiating. Men like Heinz Lettau and Werner Schwerdtfeger were always more than generous with me. Their idea of passive measurements of the air using optical views of light rays preserved with photographs of targets gave what I thought would be the most accurate method of determining the most detailed temperature profiles possible.

When you insert a thermometer into an air stream you must interrupt that air stream. In Antarctica it was always worse. The thermometers, always electrical, required heaters or produced heat and it remained an unending nightmare reducing, correcting, or explaining away the errors. If a ray of light from a refracted view of a target could be mathematically traced back to the camera with a very long distance separating the camera from the target perhaps that mathematics could deduce the exact temperature profile of the air through which the rays of light passed.

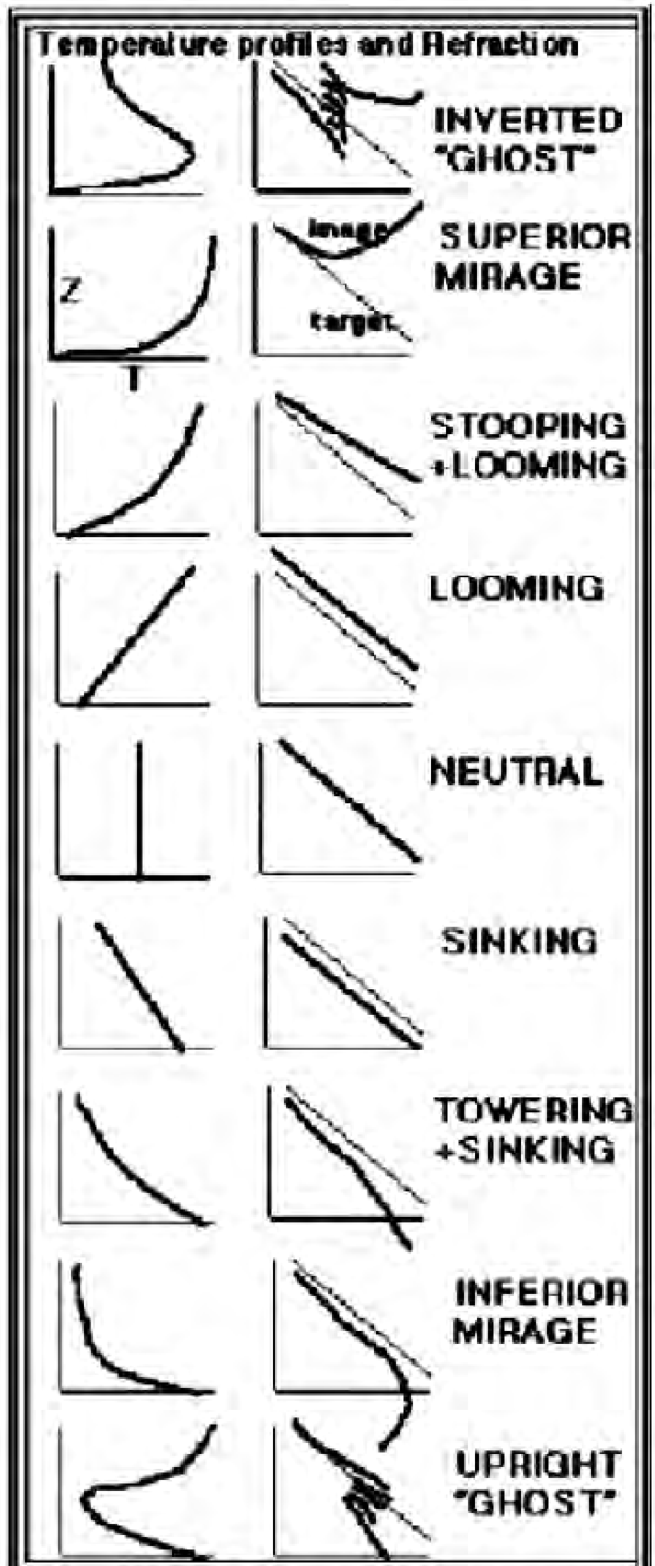
Jim Sparkman with the Sea Air Interface Laboratory tried to defend his doctoral thesis on this subject about 1961. He was Lettau's student at the time. Then this passive method was fairly new and, the rumor mill claimed, Lettau was fairly silent at the defense of Sparkman's thesis. Noting the silence, a physics professor invited from another department, ate Sparkman alive and the thesis failed.

Still, Sparkman's idea was most impressive. He spent much time with me helping me understand this very elaborate mathematical model. Likewise, Lettau encouraged me to try to establish some targets of my own design and try to photograph them for different temperature profiles.

Bob Geissel assisted with the very accurate surveying needed. I placed three triangular targets of bamboo poles each forming a 45 ° right triangle with the snow surface. The tripod of the camera stood exactly one thousand feet from the first target, two thousand feet from the second target, and three thousand feet from the third target. The first year I was limited to photographing these targets during daylight times only. My initial photographs demonstrated the potential of this method and at my request Bill Weyant sent down many strings of Christmas tree lights and very long extension cords. A successor, Mike Kuhn of Austria, followed up with many photographs of the targets draped with colored lights. With pleasure we both endured the pain of the cold and turned our pictures over to Lettau.

When Lettau published his results, (sketches shown here) he was most generous to both Mike Kuhn and me giving us credit in his famous "Antarctic Test Tube" publication.

> "Following my suggestion at the preplanning phase for additional observations at Plateau Station, M. Sponholz set up during the first year of Plateau Station occupancy a horizontal array of three optical targets to document photographically day-to-day



Schematic illustration showing how a "slant-line target will be optically distorted by atmospheric refraction if the vertical profile of air temperature corresponds to those sketched changes in the refraction of light in the lower atmosphere. Each target consisted of a rod inclined 45 ° toward the ground, supported by a ten-foot-tall pole, at distances of 1,000, 2,000, and 3,000 feet from the station. The inclined rods were initially marked by colored strips, and later by strings of electric lights brought to Plateau Station by M.Kuhn at the beginning of the second year. Because the index of refraction in air is a function of air density, the vertical temperature profile corresponds to density stratification in the lower atmosphere which causes a curvature of horizontal and nearhorizontal optical rays. This in turn will distort the visual or photographic appearance of the target. In a mathematical "inversional" process, the vertical temperature profile may be recovered from measured ray-curvature. Many applications of this principle are reported in the literature. In comparison with previous techniques, the use of the slanttarget line has the advantage that simultaneous refraction effects over a height range can be most readily documented photographically, provided that proper distances and target sizes are chosen."

> "Tentative results of direct temperature measurements along the tower [built the second year] show indeed frequently elevated minimums which explain the appearance of ghosts as indicated . . . and photographed . . . . The systematic matching of photographically documented ray curvature with simultaneous direct thermal probings has not yet been achieved; it is planned for future work. However, the photographic evidence appears to be so convincing that there remains little doubt that measurements of optical refraction can serve as an accurate method of thermal probing." (Heinz H. Lettau, "Antarctic Atmosphere as a Test Tube for Meteorological Theories," *Research in the Antarctic*, American Association for the Advancement of Science, 1971, p. 461-464.)

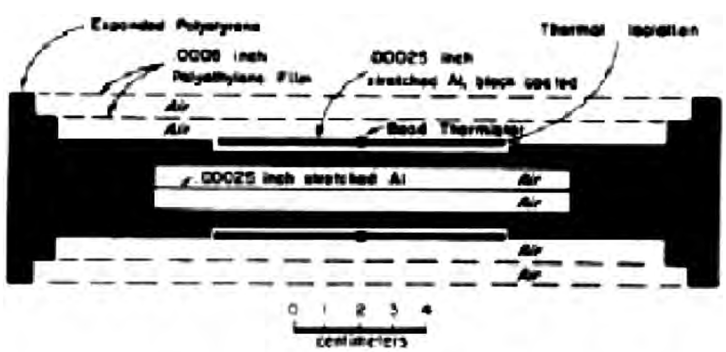
In private, Lettau praised me for the excellent choice of distance, which I arrived at with some trial and error and a lot of luck, and the shape of the targets, which I stole from Pythagoras. In research sometimes you are involved with the end of a project as a mop up operation. Sometimes you are the initiator. Sometimes you serve others. Always the pursuit of understanding the natural world was the chief excitement, love, and lure. Credit, though important to a young scientist's promotion, was not so important.

The surface radiation study, installed by Leader Stroschein and maintained all year by me was quite successful. Quoting from the literature,

> "This information [previous radiation budget studies from IGY] and the personal field experience of the designers, P. Dalrymple and L. Stroschein at the U. S. Army Natick laboratories, of the radiation program ensured that the field work stood well up to the expectations in the first year of operation, 1966, when M. Sponholz tended to [radiation instrumentation]. . . . At the beginning of the activities it became quite clear that the area of Plateau Station was unrivaled by any other site as far as continuity of fair weather periods, atmospheric transparency, and homogeneity of air and underlying terrain were concerned. This made it

promising to study the radiation fluxes beyond the primary scope of furnishing the forcing function in the overall energy budget." (M. Kuhn, L. S. Kundla, and L. A Stroschein, "The Radiation Budget at Plateau Station, Antarctica, 1966-1967," in *Antarctic Research Series*, Vol. 25, American Geophysical Union, 1978, page 42-43)

I no longer can put my finger on our exact results, but in field discussions with Leander Stroschein and Mike Kuhn we gloried in our potential of recording the highest value and therefore the most accurate solar constant ever measured from the surface of the earth through the thin polar atmosphere. Such a number with credit given to us would have appeared in every textbook on earth. Before Dalrymple's laboratory could complete the analysis of all the radiation data, collected in the severe cold by instrumentation maintained with very frozen fingers and hands, from sunny Florida several Nimbus satellites were launched and every accurate reading of the solar constant observed from space above the air rendered any measurements on the earth's surface as only approximations full of error. The current accepted solar constant as determined by a satellite was 1370.6 Wm-2 [Watts per square metre] ±0.73 Wm-2, Nimbus-7, 16 Nov. 1978 to 31 March 1986.



CROSS SECTION—RADIOMETER

Dominating all of our energies was my balloon project or the Great Antarctic Temperature Inversion study. The net-radiometers had to be calibrated, first inside and then after about half an hour of climatizing to the outside temperatures calibrated again. Unexpectedly the transparent covering of the radiometers shattered the instant they were taken into the sub -80 °F air. If left broken, the radiometers would act as if they were turned into elaborate bead thermometers of the air. The covering, keeping the atmospheric air away from the bead thermistors permitted the ability to convert these bead thermistor readings of trapped air into the net-radiation measurements.

In desperation, I added a thin film of diesel fuel to the polyethylene faces of the net-radiometers. This gave them considerable stretching ability and they survived the extreme contractions of the cold air. When I returned to the States, the University of Wisconsin men had horror stricken faces, particularly Pete Kuhn who later moved to Boulder, Colorado. He and I bought several forms of diesel fuel and launched comparative studies from Picnic Point in Madison. Pete Kuhn never would say the addition of the diesel fuel ruined all the observations, and I proceeded to analyze the data as though the diesel fuel had no effect and Pete never denied my efforts. At Plateau Station I did not have a choice.

While each net-radiometersonde cooled the weather balloon had to be prepared. The balloons also became fragile at temperatures -90 ° F and colder. At the South Pole they had similar cold temperatures, but their balloons shot through the inversion layer at a rate of a thousand feet per minute. I wanted the balloon to stay in the inversion layer for as long as thirty to forty-five minutes, a dream I never achieved. This necessitated the treating of the balloons with diesel fuel as well. I would spread the large balloon over the main camp's living room, pour diesel fuel inside the balloon and also soak the balloon in a large bowl of diesel fuel. Only then was I ready to take this sick looking glob out to the balloon inflation shelter.

The balloon inflation shelter was a disaster. It was too small (ten feet by ten feet by ten feet) and I had no one to blame except me and my own inexperience providing the designers with dimensions too small. It was way too wide for the under inflated balloons we would launch. When filled to the inflation level I desired, with the least amount of helium that could still lift the instrument package, the balloon was never wider than about six feet but a bubble of helium at the top of the balloon made it stand nearly fifteen feet above the floor. That meant the accordion doors on the roof had to be kept open during the entire inflation period, nearly an hour. Inflating a balloon at essentially outside temperatures while moving around metal helium tanks and connecting and disconnecting metal valves not only was a bitterly cold task but a dangerous task because of moist flesh readily freezing to the metal parts.

A high speed chart recorder monitored the ascent and had to be manually calibrated at the frequent calibration signals sent from the radiosonde. Two theodolites, one under a dome at the main camp and one under a dome at the emergency camp, were used to track the balloon as it rose through the temperature inversion. Readings of elevations and azimuths to a light bulb glowing at the base of the launched balloon were barked into tape recorders.

All of this took many hands, with promises of help assured from all personnel. I would do all the preliminary work of calibration, but then I had to be in under the met dome in the main camp to track the launch of the balloon and net-radiometersonde. Bob Geissel, who trained with me at the research labs in Sterling, Virginia, manned the theodolite out at the emergency camp. Rob Flint assisted during the first several launches with the balloon inflation but quickly took over the entire inflation process freeing me for last minute calibration problems. Hugh Muir and a Navy volunteer, most of the time Jerry Damschroder but also Ed Horton and Bill Lulow and never Jimmy Gowan, would launch the balloon and net radiometersonde.

The launch required considerable physical effort at the extreme cold temperatures of the lowest levels of the inversion. The balloon was allowed to rise out of the balloon shelter, but then had to be recaptured and carried out a short distance from the camp to allow considerable room to run for the person carrying the instrument package which was attached by a long string of fifty feet to the balloon. The long string kept any air interference of the balloon from wrongly interfering with measurements taken by the net-radiometersonde. When the balloon was launched by a Navy man, Hugh Muir would run under the balloon until the ascent of the balloon had sufficient lift to support the instruments without letting them crash into the snow. These were always heroic runs that burned his lungs in the cold.

These launches frequently were done during the normal "day" hours and after a short time, Jimmy announced the Navy simply was too busy to assist during Naval work hours. What the men did on their free time was up to them. In yet another short time it became obvious these launches cut into the movie time and the drinking time. That was the end of the promised support of the

Navy.

The genius of Rob Flint gave us a fifth Navy person in the personification of a two-by-four. Rob built a very strong base that he buried deep in the snow as an anchor. Rising out of the snow was this two-by-four with a hook that held the balloon. The hook could be tripped from a long string held by Hugh Muir while he held the radiometersonde. It did not replace the desperately cold run, but it did replace the Navy. We painted a face on the two-by-four and gave it a rank higher than the Officer-in-Charge. I saluted this board before every launch.

What made these launches exhausting were the serial requirements. Whereas at other Antarctic stations they made one or two launches every day, at Plateau Station I was committed to study just the temperature inversion. At this small station with limited manpower I followed criterion that looked for exceptionally strong inversions and inversions in a state of rapid change. We would launch balloon after balloon without rest as long as the weather conditions of the event being studied remained. A list of times and launches for a particular series that gave publishable results some time several years later is given below.

BALLOON ASCENT SERIES #8

DATE	TIME (LST)	DEVISE
6 AUG	21:30	NET-RADIOMETERSONDE
6 AUG	23:18	PIBAL
7 AUG	00:25	NET-RADIOMETERSONDE
7 AUG	01:23	PIBAL
7 AUG	05:09	NET-RADIOMETERSONDE
7 AUG	05:50	PIBAL
7 AUG	08:42	NET-RADIOMETERSONDE
7 AUG	09:20	PIBAL
7 AUG	20:43	NET-RADIOMETERSONDE
7 AUG	21:24	PIBAL
8 AUG	01:09	NET-RADIOMETERSONDE
8 AUG	01:54	PIBAL
8 AUG	07:03	NET-RADIOMETERSONDE
8 AUG	07:53	PIBAL

Total Time: 35 hours

Disappointing was the fact that the inversion, though as strong as expected was far shallower than expected, and the longest time I could keep a balloon in the inversion was twenty-three minutes, but Hugh Muir had to run nearly to the Princess Ragnhild Coast before the balloon had enough lift to independently carry the radiometersonde.

Averaging all the data for a balloon series, which monitored a stable strong inversion, an excellent view of the inversion is shown above. While the original estimate of the height of the inversion was 3000 feet, for this series I measured the top of the inversion below 1000 feet and ninety percent of the inversion change occurred under 300 feet.

While I was gathering this data, Prof. Schwerdtfeger and his new student, Larry Mahrt, developed mathematical models for both the temperature profile and the wind profile of the inversion. Their formula as published is:

$$T(z) = T_h - \Delta T e^{-z^*}$$

, where

$$z^* = \frac{z}{\sqrt{k/f}}$$

.

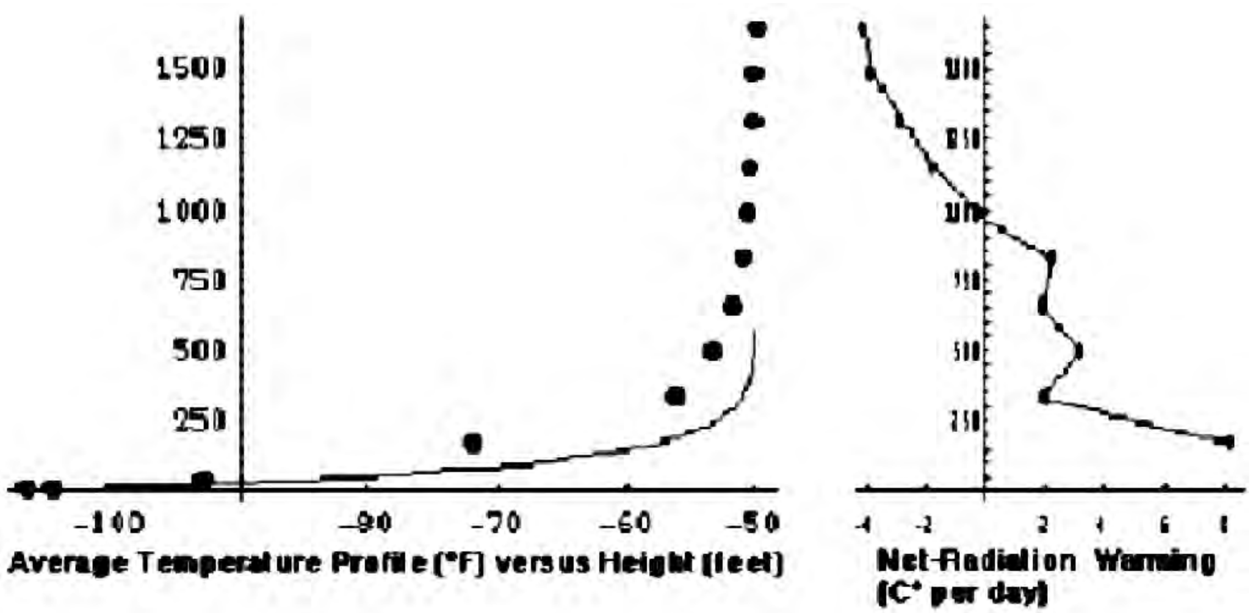
T_h is the temperature at the top of the inversion.
ΔT is the temperature difference between the top of the inversion and the snow surface.
z* is the independent variable in the vertical in nondimensional form.
z is the ordinary vertical coordinate with length dimensions for height above the snow surface.
k is the coefficient of eddy diffusivity.
f is the Coriolis parameter.

The Mahrt-Schwerdfeger formula calls for a temperature profile as an exponential function of the height expected in pure nocturnal radiational cooling conditions. Note that this theoretically simulated temperature inversion is even lower than the actual measured inversion. The profile of net-radiation shown with the same vertical ordinate displays an unusual warming in the lowest layers of the inversion.

With a full moon on the northern horizon and clear skies most of the time for this series, visibility varied from unlimited to approximately five miles because of the presence of ice crystals. During some of the thirty-five hours of the duration of this series, high cirrus clouds could be detected against the moon. The surface wind was generally less than five knots from the north and northeast.

As a disciple of Prof. Werner Schwerdtfeger, though occasionally a prodigal on this issue, I believe the heat of sublimation given off when moisture in the saturated air precipitates out as ice crystals is what added heat and raised the expected temperatures of the inversion in the lowest layers. Thus, this warmer layer was giving radiational warming values until the nearly isothermal region starting at a height of 1000 feet. The recorded radiational warming of -4 C ° per day (negative values mean actual radiational cooling) where much of the moisture would have come from is in good agreement with the more routine radiometersonde data at South Pole.

Again Schwerdtfeger won our professional debate, although at the time he did not use this radiometersonde data because of a fear of the added diesel fuel affecting the data. With all balloons

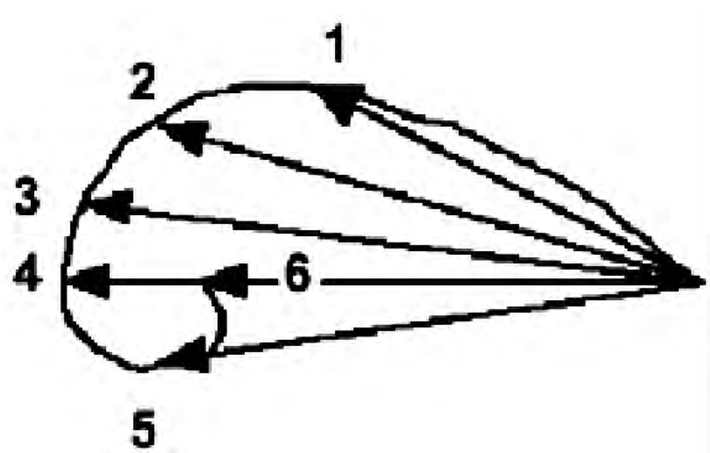


continually rising faster than was hoped for, having real inversion temperature measurements at higher levels than Schwerdtfeger's expected theoretical inversion, it was easy at the time to claim the fast moving balloons influenced the temperature interpretation making it appear that a particular temperature was at a higher level than it really was. Even if it supported Schwerdtfeger's other theories about ice crystals falling from a clear sky, at the time we were all cautious. But ice crystals were all over the place and the changing phase of H2O from a cold gas to a cold solid does explain all of the peculiarities.

As an active researcher I was most frustrated with the intense task of gathering immense amounts of data without seeing the answers as in some cases I have given the reader here. Some things, like how strong the temperature inversion was, or how far apart mirage targets should be placed to give meaningful results, could be calculated on the spot. The balancing of the radiation and heat budget was a task for computers in the comfort of a research office in civilization. Likewise, the wind structure of the inversion was mathematically too difficult to do anywhere other than with a main frame computer in the comfort of an office in the District of Columbia.

The two readings from each theodolite, elevation and azimuth from each tracking station a thousand feet apart every thirty seconds, actually gave more information than was necessary for a classroom problem on triangulation and positions in three dimensional space. The research approach I took back at Polar Met in Washington D. C. was to use and calculate every conceivable position to establish a volume of probability where the balloon was and with statistical smoothing techniques map out the most probable path the balloon took and from the balloon's changing positions calculate the wind speed at chosen levels. At Plateau Station all I could do was hope I had the right stuff.

The normal undisturbed neutral atmosphere on a spinning earth with friction produced an Ekman wind spiral for a hodograph. Let me explain. In the free hand sketch on the next page, let the wind near the ground in the Southern Hemisphere be mapped as vector #1, an arrow pointing toward the direction the wind is blowing with a length proportional to the wind speed. Then as you would rise to a certain height above the ground where there is less friction, the wind could be mapped again as vector #2 showing its longer length as a faster wind speed. Peculiar to the Southern Hemisphere is the fact that the spin of the earth affects air standing or moving steadily for a long period of time by turning the wind toward the left as you rise in the vertical.



Therefore at level #3 you can see vector #3 a little longer still than the lower level vectors and turned still more leftward.

Permit me now to jump to the top level, #6, where we see vector #6 on top of a longer vector #4 and to the right of vector #5. Each level is higher in altitude than the lower numbered level. When you place the starting point of each vector or arrow at the same point, you can see how these arrows' points sweep out a spiral. For neutral atmospheric conditions, where we face neither an unstable rising and mixing of air nor an overly stable atmosphere where we face sinking air such as in a strong inversion, these spirals are called Ekman wind spirals.

Their most fascinating feature is that these spirals show the wind increasing speed and turning to the left as you go to higher altitudes and as friction decreases but only to a certain level. Then the Ekman wind spiral shows the wind continuing its counter clockwise spiral to slightly slower speeds. In the atmosphere, as you rise higher and higher above the surface, the air is held back less and less because of friction; but in free flowing air, it overshoots and actually moves faster because of friction and must compensate and return to a slightly slower speed. Vector #6 represents the wind where friction of the ground has no effect and this wind is called the geostrophic wind because it is only influenced by the large regional scale pressure gradients in the atmosphere and the earth's spin.

All of us in meteorological research expected that the Great Antarctic Temperature Inversion would drastically alter the shape of the Ekman wind spiral. Disappointing to me was that at no single time or at a single place in 3-D space could one look up into the air and see an exact spiral. Everything had to be averaged seemingly to death. Weather, as a study of the movement of air, was a study of moving molecules, which moved in statistically innumerable ways apparently at random. Like the science of quantum physics, where the small scale events are not related to the large scale witnessable phenomena, micrometeorology never revealed the large scale effects except through averaging techniques.

It was haunting to me not to be able to "see" without averaging. The operational meteorologists who trained me before I became a research meteorologist had a certain disdain for averages. I remember mentors Larry Hughes and John Hovde from Chicago warning me about averages. An average is a collection of non-averages. There is one thing about an average that you can be certain of— few and many times none of the data that form an average are ever equal to the average.

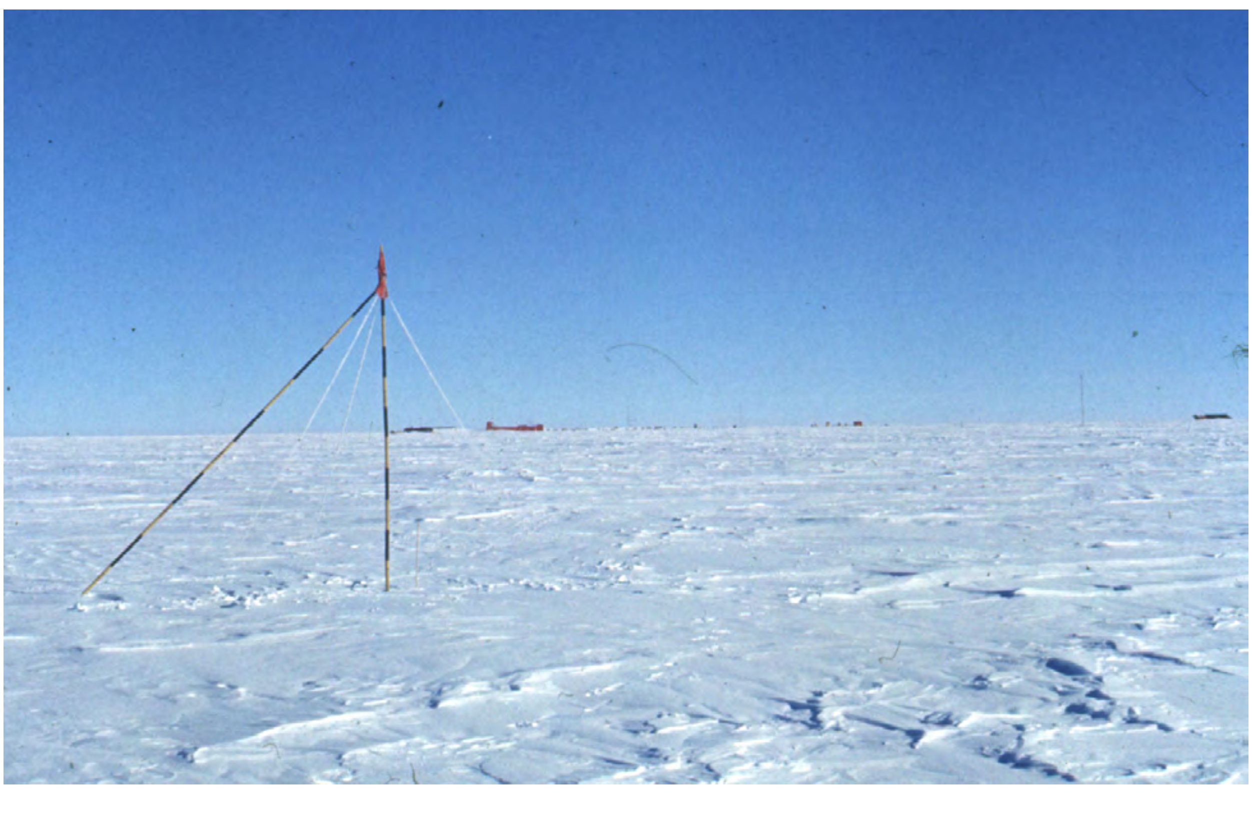
Top: Preparing for a balloon launch

Bottom: Marty Sponholz calibrating net radiometers
(Slide by Rob Flint)

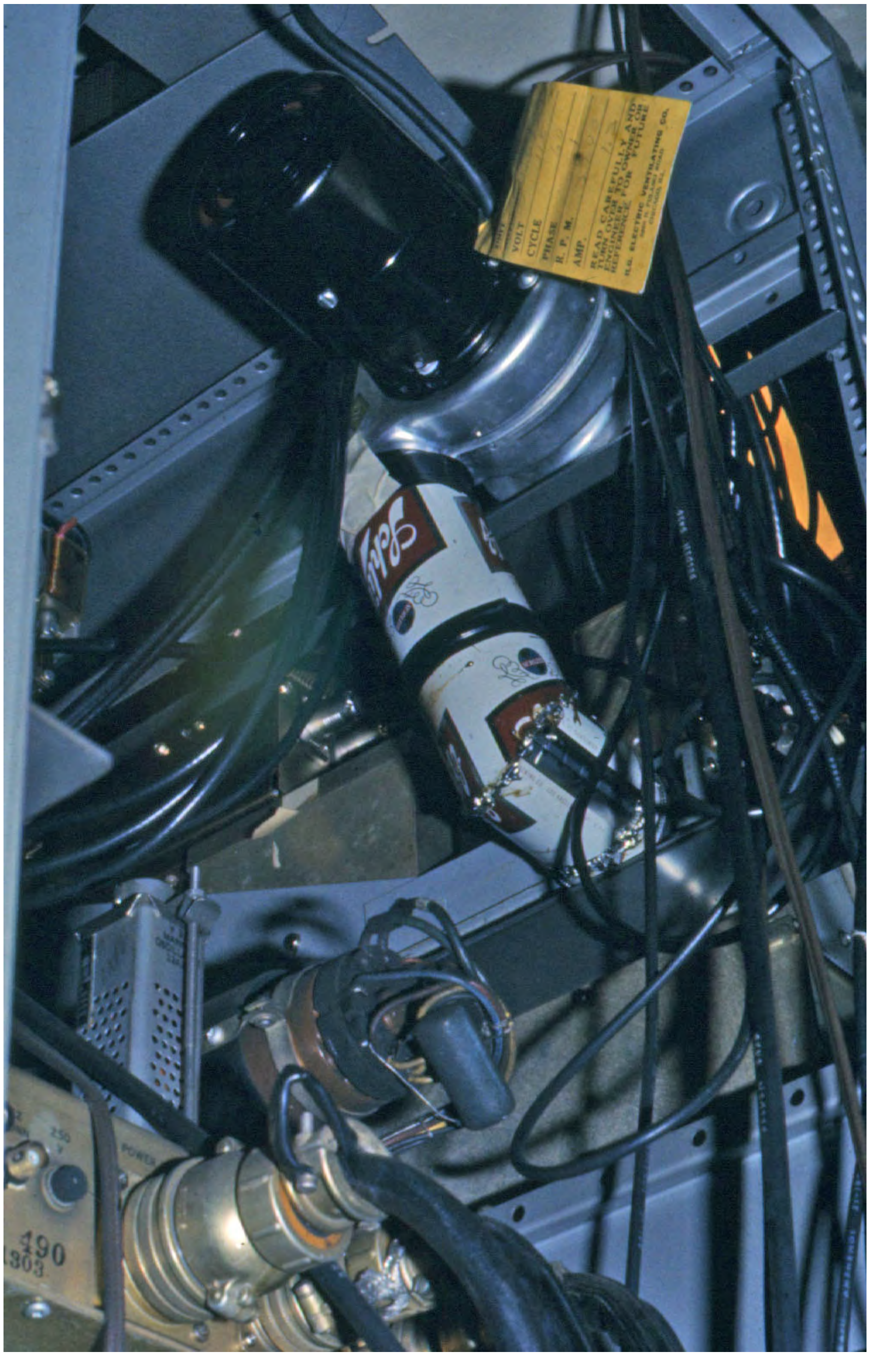
Effect of the extreme cold on the net radiometers

Top: Bob Geissel tracking a balloon in flight in order to compute the wind speed and direction by triangulation

Bottom: A bamboo triangle set up for a photographic study of mirages



Keeping a transit warm by packing it with hot activated pibal light batteries



Using any or everything available for repair of equipment at the isolated Plateau Station

CHAPTER 10
Return From The Ice

With the return of the sun, winter was over. We celebrated with an outdoor barbecue. Jerry Damschroder and others collected burnable trash and garbage for a bonfire. Bill Lulow specially made small breads for huge grilled steak sandwiches and we all took out to the bonfire what bottles of alcohol we still had left. Outside the temperature was -119 ° F so a cold beer for this "summer" picnic simply would not do. Beer too readily freezes. As the bonfire party continued, each of our bottles of spirits froze shut at the bottle's neck. The fire melted the snow underneath it and the fire slowly sank deeper and deeper. To barbecue our steaks we had to lean over farther and farther to reach the fire until Bob Geissel fell into the blaze. His pants caught on fire and as we pulled him out of the fire's hole, he fought us rather fiercely. We had to knock him down and roll him in the snow to put out the flames that were consuming his pants. He was angry with us because it was the first time he had felt comfortably warm all year.

The breads baked by Lulow froze rock hard and could not be eaten outside. The grilled steaks, though hot as they were when removed from the intense fire, quickly froze before they could be eaten. Each of us wore our "bear claws" to handle the steaks in and out of the fire and exchanged one steak that was frozen for the newly fired steak. As quickly as possible, each of us would scrape the burnt char off the frozen steak and toss it back in the fire while eating the char off another steak. It was gooood! In this manner Ed Horton accidentally mistook a piece of wood for his steak, ate the slightly warm burnt ash and even seemed to enjoy it.

We knew winter was over!

With the entire Antarctic continent opened by the emergency flight to Byrd Station, the thought of an early flight to Plateau Station became a possibility. Ed Horton's radio traffic increased and thus work for him suddenly exploded into nearly twenty-four hour days of urgency. My work switched from pure research to operational weather support for the Navy and attempts to forecast for a station for which there were no records. Jerry Damschroder assisted by Bill Lulow desperately tried to thaw out several barrels of antifreeze to begin the activation of the station's traxcavator. And the Doctor woke up.

After many false starts, Jerry started the engine of the traxcavator and immediately began work on the ski way. During the winter the ski way drifted over and the exposed snow surface not drifted over seemed to become softer. Jerry spent most of the sunlight hours on the traxcavator driving up and down the ski way to pound down the snow and harden it for the cargo flights and the new resupply season.

The sun still set every day the first half of October and with it the temperature dropped easily to -100 ° F. One night the traxcavator ran out of gas and stopped. As it cooled Jerry could not get the engine started again. All the fuel lines and all the heating lines and all the antifreeze fluid lines were at risk since most of these fluids froze at our nighttime temperatures. The traxcavator stood silent and dead in the middle of the ski way more than a mile from the main camp.

Flint and Damschroder worked out a plan whereby we might be able to start the traxcavator out at its stalled site since we had absolutely no way of towing it back to the camp. We had in storage a machine called a Herman-Nelson. It was a huge heating engine weighing more than a ton. It was on skids for towing it over the snow. Its great feature was that it had an internal engine part weighing about a hundred pounds that could be kept warm in the main camp, hustled out to the Herman-Nelson at the last minute in its warm state, and be effective in starting the full size cold Herman-Nelson. This machine then could produce enough heat to warm anything else.

The plan was to cover the traxcavator with a tent made of parachute shrouds from one of the first supply drops at the start of Plateau Station a year ago. Bob Geissel, a former Peace Corps worker in the fields of India and Nepal knew how to fashion a harness for seven men out of rope and we could man-haul in British style the one ton Herman-Nelson out to the traxcavator. Then, at the last minute, by a running relay we would run the hot engine parts out to the Herman-Nelson and heat would be available for the traxcavator.

Jimmy Gowan forbid us to overexert ourselves! I couldn't believe it. I exploded and chewed at him in a way no military person could. Overexerting ourselves for a mile? Afraid to overexert ourselves when two flight crews and a paratrooper were planning to fly these newly charted regions at temperatures never attempted before and risk their lives for our lives?

Overexerting ourselves when five Englishmen pulled on foot a one ton sled more than a thousand miles to be second to the South Pole? When these five Englishmen would not give up carrying many heavy rocks for study back in warm London even when it meant the cost of their own lives, was it overexertion? Did Jimmy know anything of this Antarctica where traditions of human courage and devotion and personal sacrifice for each other were melded in the spirit of the polar explorer? Were we explorers or not? Jimmy was proud to stand holding the American flag in front of flashing cameras on the first flight last December. How dare he hold back now when we might have to exert ourselves? Besides, Geissel only had seven stanchions in his harness. Jimmy could watch and give orders. He did.

Once we could assure McMurdo that our ski way was ready for them, the excitement of the reality of an airdrop filled us all. The sun still set a couple of hours centered around midnight. Over and over for many days when I would send weather info to McMurdo that our maximum at mid day was approaching -65 ° F the flight was go but the flight did not leave McMurdo until my night observations when the temperature was -100 ° F again so the flights were canceled.

These days I observed considerable ice fog but a visibility reading could not be accurate until I resurrected the visibility marker blown down during the winter. Rob and I took a long march out to our five mile marker after one of the flight cancellations at -105 ° F. It took us about six hours to walk in the soft cold snow and after a ten mile round trip hike we coughed up blood when there were no germs for coughs. Evidently we both had frosted our lungs. Our condition cleared up after several days and accurate visibility measurements did give me a grasp of the moisture in the air and a better probability for forecasting for our Navy friends in the airplane business.

The first aircraft of the current season landed at Plateau on 13 October at 1050 hours. The temperature was -73 ° F. The aircraft spent only 15 minutes on the ground without turning its engines off. Very unceremoniously Ed Seitz, a paratrooper and Navy seal, walked off the aircraft with emergency generator parts, we received mail and some fresh fruit and the aircraft roared down the runway with a massive self generated storm in its wake with fire blasting out of JATO bottles mounted on each side of the aircraft.

Bill Lulow received a year's supply of his wife's small town newspaper. He began to read them immediately. I received twenty-four issues of the *Northwestern Lutheran*, my church's newspaper. I did not read them immediately.

I did read immediately eleven wonderful letters from Wendy Fischer, who was a lovely girl and a shirttail cousin. She started writing to me just before I went down to the Ice and, in spite of my isolation and my inability to write to her, she never stopped writing. Her female humor gave all of us at Plateau Station joy and encouragement with our task. Wendy, if you ever read this, we all loved your letters. I hope my letters were a little bit interesting to you.

Once Ed Seitz arrived each of us Plateau veterans knew the time to leave was at hand. My balloon project had been over with the rising sun. Now, after 22 October, the sun no longer set and it was time to microfilm all data. Morale collapsed. It seemed to me that the presence of Ed Seitz was the cause of it all. Now I believe we suddenly knew we were free and didn't need each other anymore. Although resupply would not be regular for several weeks, each of us knew we would be going home. Ed Seitz did cause a sudden rift in the delicate Navy-USARP camaraderie held together mostly by the efforts of Flint and Damschroder. Now "shit-kickin" music dominated the sound system of Plateau with the many additions brought by Ed Seitz. USARPs were ridiculed for how their share of the camp chores were done as though we failed military inspection. Ed had brought needed emergency spare parts for our generators and provided additional expertise for Jerry Damschroder for the repair of our generators, but now it seemed repair deliberately occurred during important measurement times for the several projects still in operation. With my freshly received orders to wait until relieved by two men, Bob Dingle and Mike Kuhn, I suddenly began to hate the place. The new rift between Navy and USARP opened all the old wounds.

Violent verbal exchanges occurred between Geissel and Gowan and although a few of us would have enjoyed Gowan getting his due, when it became physical we reluctantly broke up the fight. Hostilities also broke out several times in the Navy ranks when the new men started arriving. The inability of Gowan to show leadership was becoming a blinding light. Yet with his high military rank given him because of his legitimate medical knowledge and skill, he was wrongly put in authority. I don't remember if the court martial he ordered was against the new cook or Jerry Damschroder, but the farce did occur. When witnesses needed to swear to their truthful testimony no Bible was found until I offered mine.

Gambling with real money became a regular addition to the nightly drinking binges. I watched a sailor roll the dice and lose an entire paycheck. Hell had frozen over and I was there. I could understand Robert Falcon Scott's words as he reached the South Pole and saw by Amundsen's tracks that the English were second, "Great God! This is an awful place . . . ." (Robert Falcon Scott, *Scott's Last Expedition: His Journals*, Smith, Elder & Co., London, 1913) When the only adventure you have left is to return, excitement and the bonding of men disappear. It was time to go home.

> "An unusual incident occurred on October 29 at 0719, when the entire camp was shaken by a severe subsidence, or snowquake. The tremor, which sounded like an explosion, lasted for approximately four or five seconds. The vibration was sufficient to settle the back door of the camp approximately half an inch. The station sustained no other damage, and no further settling of the foundation was observed. The center of the quake could not be located, but the tremor was picked up by magnetic detectors 700 feet north and 500 feet west of the station. It was also felt by a Traxcavator operator a few hundred feet to the southeast, and it dislodged a can from a shelf in the summer camp, 1000 feet to the west. The tremor seemed to pass from the southeast to the northwest through the camp. No surface cracks attributable to the quake were located. While a similar, but not so strong, subsidence that occurred last year was known to have been triggered by a landing plane, the agent that set off this one was not so obvious." (*Antarctic Journal of the United States*, Vol. II, No. 1, January-February, 1967, page 3.)

NNNN
RR RUHPMA RUHPMC
DE RUECCX 006 3331905
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UNCLAS NR 086 SSL PASS SPONHOLZ
DRAFT CLASSIFICATION

1. WEYANT ADVISES DRAFT BOARD HAS EXTENDED YOUR 2A CLASSIFICATION UNTIL JUNE 1967

2. LTR FOLLOWS.

BT

"Summer tourists" added to the confusion of my last days at Plateau Station. An airlift of the traverse vehicles to McMurdo Station for major overhaul started. Olav Orheim, exchange scientist from Norway Norsk Polarinstitutt, Oslo, Norway and now a professor at Oslo came to Plateau Station for snow surface studies. I exchanged data with him giving him data I measured from the Red Field and Black Field. He became a good friend for several years while I lived on the East coast and he seemed to commute back and forth to Norway.

We were the first Plateau men to winter-over. Hazing was in store for the second team. Each new man was met at the plane as he landed at Plateau Station. We were hardened by the past winter and in the summer temperatures now met the planes in Bermuda shorts. Then came the trick: "May I carry your bags, sir?" No self respecting polar hero would permit another man to carry his bags. It was about two city blocks to the main camp and of course 1000 feet farther to the emergency camp where most new men would bunk until us old timers were taken out. Unaccustomed to the sudden cold and more devastating, the high altitude, he either would pass out or gladly let you help him when he had to confess that he could not make it. He then was invited for a welcome drink and at our altitude he instantly became stoned. Enough said.

My first replacement one simply did not dare try to haze. Bob Dingle was a polar rat from Australia. He was a "Crocodile Dundee" before any American ever dreamed of such a movie, bouncing between the outback and Antarctica much of his life. I believe it was to be his eleventh winter on the Ice. After my tour and my complaint about the problems we were having with the balloon shelter, he immediately cut a hole into the floor and dug a shaft down to the needed length of the bottom half of the balloon. The balloons could then be inflated in warm air with the roof closed. This was an obvious demonstration of those immense problems with very simple solutions. Why didn't I think of that? Because I didn't.

Leander Stroschein returned with Mike Kuhn and I was free to depart. There was one hangup. The scientific data was more valuable than a scientist's life. Two microfilm copies of all data had to leave Plateau on different flights. Only when one of them arrived safely in Washington D. C. was I free to depart. After about eight boilermakers in toasts to all the suckers left behind, I was poured onto an LC-130F and emerged at the Harewood International Airport in Christchurch the next day.

There were several airplane changes, but I remember very little of them. Our ski-equipped airplane rolled out on a freshly cut grass field taxiing to a USARP hangar. The several of us emerging from different stations on the Ice after a year of featureless dead white snow drew in the incredible smell and while the airplane was still moving but with its tail gate down, we jumped out, rolled in the grass, ate some of it, shoved grass down each other's shirts and leapfrogged over every hedge in Christchurch on the way to the Zetland Hotel. Green was and is still the most fabulous color in all of God's Creation. It was 7 December 1966. It was New Zealand.

The excitement of heading home was tempered with a desire to see the world between Antarctica and home. In particular the lure of New Zealand pulled on the hearts of every polar explorer that passed under her flag of the Southern Cross. I spent several weeks visiting old friends, meeting many new ones, and exploring both islands before a military flight to the states fit my schedule.

A day or two was spent in the District, then I was on to Milwaukee for the bear hugs of my brother Ray and his wife Trudy and their children Scott, Debbie, Craig, and Brad. I met Wendy Fischer. Her father, a chemist at Schlitz, had moved from California to Milwaukee. And many friends gathered the many nights I was at home.

It was the oddest time of my life. I longed to be with my friends and loved ones. They were so different and I was so different. The bonding that had occurred among the eight of us struggling to keep alive, tipping beer after beer or wine bottle after wine bottle in one binge with Geissel in sheer loneliness, arguing with the Doc or pondering one predicament after another with Flint waiting for his solution were the only things in my mind. Yet no one was interested in hearing about them.

This of course was not true. Years later I had friends and relatives tell me that when I came home I was so quiet, like my Uncle Ray when he returned from war. So most backed off. Yet I was exploding inside with stories to tell. All the stories were too personal. Everything was an inside joke. People from northern states were arrogant about temperatures. “Well once you’ve felt twenty below it’s all the same.” “Nothing can be colder than the wind off Lake Michigan.” How could you explain that twenty below zero was a warm summer temperature. What did you tell a person who never left Milwaukee in her life about traveling eighteen thousand miles? What did you say to a person who only wants to visit shops and go to the mall?

Even the well-traveled friends could talk about little except airports and passing through customs. They all wanted to talk and I wanted to talk but what they seemed to want me to say and what I wanted to say didn’t ever emerge. It seemed that the only ones who understood were Kirby Hanson in Madison and Bill Weyant back at Polar Met. I understood the importance of wearing a penguin tie clasp. I quickly developed the defense mechanism of a pat answer to the question, “How was Antarctica?” I would answer, “Cold!” That usually satisfied most people who did not want to hear your answer anyway. Those who had more interest pursued me for greater detail.

Long after this expedition, people still introduce me as a person having gone to Antarctica. Indeed it was a privilege few have had. But no one seems to care about the five years of polar work connected with such a trip. No one takes measure of the risks and losses involved with such a trip except those who have been there. From those who went before me I heard the comforting question, “How was your winter?” With such a person and with some beer or wine and a lot of time I could answer and of course would be willing to hear and understand his winter as well.

By the end of January I was ready to report for Polar Met duty and take up my responsibilities of research on the data so painfully obtained. Back in Milwaukee, just before returning to Washington D. C. I fulfilled the American dream of a young man and bought a new car, my first car ever. Two years previously I had paid a driving school $7.00 per hour to learn how to drive and fearfully passed a road test in Madison and never drove again until my two brothers Ray and Dick helped spend my money on a brand new 1967 Pontiac Custom Tempest for $2800. In our celebration as brothers I’m sure we drank too much and certainly stayed out too late. Some time after 3:00 A. M. it was a very big deal for me to drive my brothers home. They had provided for me most of my life and now I, at the age of twenty-six, had a car and could drive. It was almost bigger than my accomplishment in the polar region.

I drove along the angled streets of Teutonia Avenue, to Atkinson Street, to Green Bay Avenue, and straightened out on Third Street to Tanna's house on Second and Wright Street. All the streets were deserted at that hour. All the lights were flashing yellow. It was a straight shot home with my brand new car. No one told me about a four way stop sign at the intersection of Atkinson and Teutonia and I rolled right through it to be stopped by Milwaukee's finest. I tried to tell the officer I lived in D. C. but I had Wisconsin license plates. I gave him Tanna's address. Foolishly I tried to explain why I carelessly missed the stop sign. I tried to explain that there were very few roads at the South Pole when it suddenly dawned on me that he might interpret my story as a measure of inebriation. He only laughed as he gave me a ten dollar ticket shaking his head claiming that it was the first new story he'd heard in a long time.

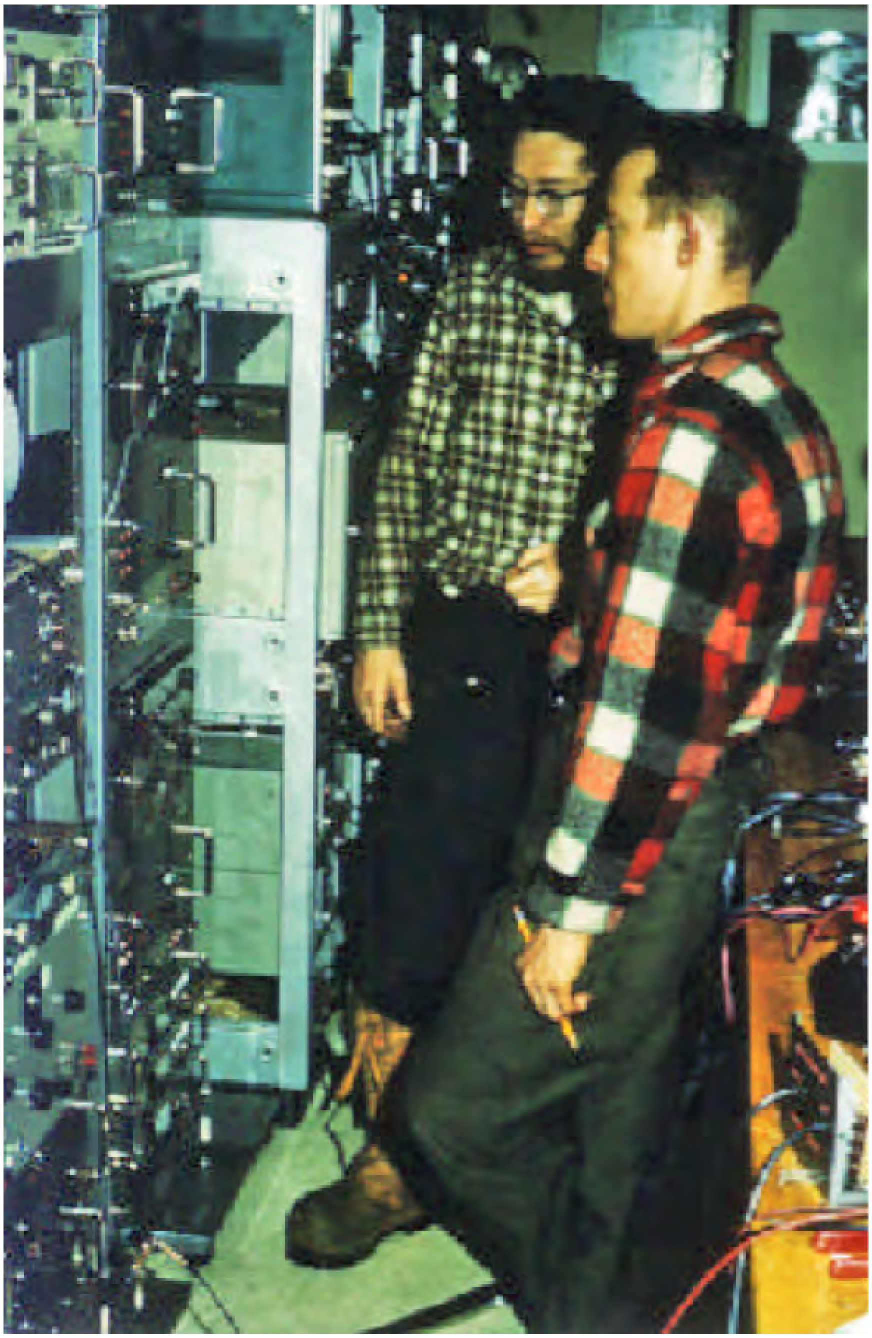
Returning from the very cold South had its strange effects on me. I recall not needing much sleep and feeling like a human dynamo ready to run all day and night with little or no rest. Coming down to sea level had its enjoyable moments. I am sure I greatly confused Tanna whose life style was unalterable for more than sixty years when I was found still awake from the night before as she had breakfast.

Being hardened to the cold, as I was, permitted me to visit friends in Milwaukee with little or no winter clothing. I remember standing on the corner of Third and North Avenue wearing Bermuda shorts and a silk Hawaiian shirt while the temperature was -22 ° F and not noticing the cold. A neighbor lady scolded me and tried to tell me that I was either sick in the head or on drugs and she insisted that I go home and get a coat. I didn't so she took a different bus.

Moving back to Washington D. C. was more exciting than the first time. I had none of the uncertainties. I knew I was a research meteorologist. And I loved it. It also didn't hurt to be sitting on the world's most sought-after weather data. It was time to study, develop mathematical models for my inversions and publish. I couldn't wait to get started. Gertrude Sohns was assigned to my study and I settled down at Polar Met for the data reduction process.

I lived for a while with a good friend from college days, Don Holz, first in a high rise apartment complex in Alexandria, Virginia, and then in a basement apartment near 18th and "S" Street Northwest; but the crush of people in a city was more than I, fresh from Plateau Station, could handle. I drove to the end of a commuter train line and ended up in Brunswick, Maryland. I followed the train track to one more town farther from D. C. which was Harper's Ferry, West Virginia, and rented a delightful apartment in a mansion called Laurel Lodge, owned by Mrs. Frank Shugart which overlooked the Potomac River.

Between reworking scientific journal articles and writing new computer programs, I rode the train to my Polar Met office where the inspirations of the evenings and late and later nights in Harper's Ferry could be tested by colleagues and main frame computers. The rapids in the river, the forgotten and dilapidated canal left from pre Civil War days, and the nearly unintruded scenery on the other side of the river made Laurel Lodge a green respite of comfort and inspiration. It was a place where I would become a science writer, a working mathematician, a computer programmer, a canoeist, a husband, and a father.



Hugh Muir, Aurora studies, exchange scientist from the United Kingdom, Arctic Institute of North America (Marty in the background) (Slide by Rob Flint)

Top: Lieutenant Jimmy Gowan, MD, USN;
Officer in Charge and medical doctor (Slide by Rob Flint)

Bottom: Chief Jerry Damschroder, USN;
Mechanic and heavy equipment operator (Slide by Rob Flint)

Top: Bill Lulow, USN, Cook

Bottom: Ed Horton, USN, radio operator

Top: Rob Flint, Station Scientific Leader, VLF studies, electrical engineer, Stanford University

Bottom: Bob Geissel, Earth magnetic field studies, geophysicist, US Coast and Geodetic Survey

**Marty Sponholz, Inversion studies, research meteorologist,
Office of Meteorological Research, US Weather Bureau
(Slide by Rob Flint)**

CHAPTER 11
D.C. Polar Studies

One of the most difficult situations I ever found myself in was a rift between the men at the University of Wisconsin and the leaders of the Office of Meteorological Research. Once I returned from Plateau Station I believe Lettau and Schwerdtfeger expected the Weather Bureau to turn all of the Plateau Station weather data over to them. I cannot say who all might have been involved from the Weather Bureau's side. Mort Rubin? Bill Weyant? It was Herb Viebrock who talked to me very privately. The gist of our conversation was around my responsibility to the Weather Bureau and questions of what might have been promised to the Wisconsin professors. I knew that Lettau and Schwerdtfeger did not want to be bogged down with the logistics of fielding a research team in Antarctica. Yet Lettau, for sure, conducted much research in Peru. The University of Wisconsin through the leadership of Charlie Bentley was the most active university group in the Queen Maud Land Traverse. Other Big Ten Universities conducted major work in Antarctica, most prominently the Richard E. Byrd Polar Institute at Ohio State University in Columbus, Ohio.

Overseas Operations and Polar Met, two offices of the Weather Bureau, provided all the field work for Plateau Station and they expected me to finish the job. The Plateau data was going to stay with the federal government. Perhaps after the initial publications the University of Wisconsin would be welcome to the Plateau data. Hearing this, I got to work.

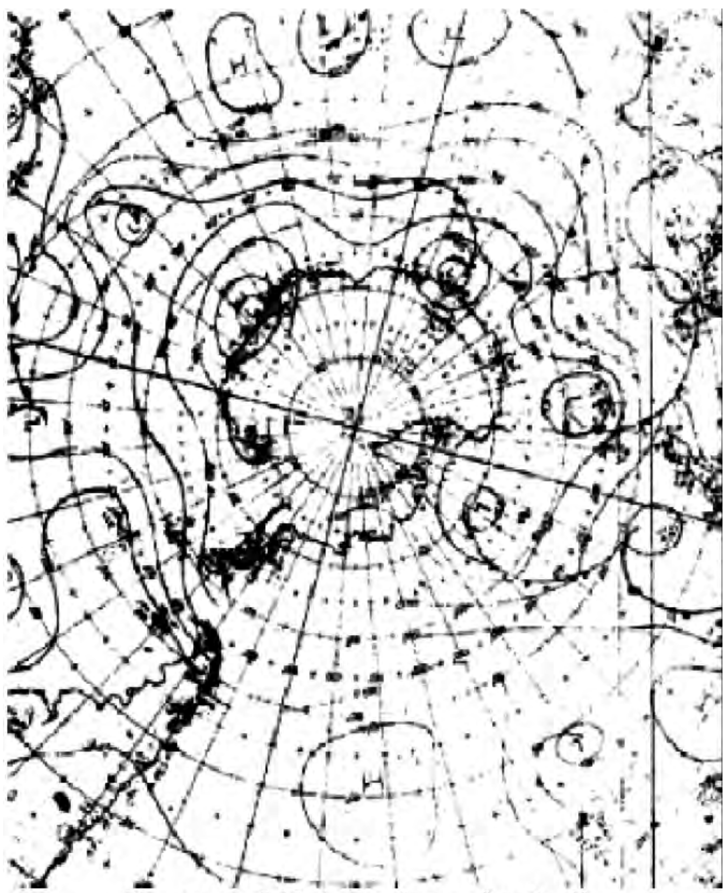
One of the biggest tasks was collecting all the supporting data to the inversion study. All attempts to receive coordinated weather observations from other stations in Antarctica while we were launching balloons proved futile. Here Fred Fopay, normally non-conversant with anybody, showed his value by knowing where to obtain any weather fact anywhere in the world for any time. Slowly, through his pursuits, I was able to obtain the supporting observations needed.

Insert: 18 March 1967. "The optimum force required implement the concept of operations and to exploit success is considered 4 and 2/3 divisions or the equivalent; 10 tactical fighter squadrons with one additional base; and the full mobile riverine force. The order of magnitude estimate is 201,250 spaces in addition to the 1967 ceiling of 470,366 for a total of 671,616." (Cablegram from Gen. William C. Westmoreland, commander of United States forces in Vietnam, to Pacific command.)

Thanks to Fred I learned that the Bureau of Meteorology of Australia maintained a history of the synoptic surface and upper air charts for the southern hemisphere. Fred compiled microfilms of these charts and I correlated them with the serial balloon ascents. Shown here are two charts related to the detailed and modeled wind profile discussed in the last chapter.

In the first chart, the surface synoptic chart shows an intense low pressure deepening off Prince Harald Coast just north of Lützow-Holm Bay. (955 millibars = 28.20 inches of mercury) As this storm intensified, its low pressure clockwise circulation extended up into the upper atmosphere's polar vortex of strong west winds [defying every undergraduate geography text]. This deepening surface low pressure pulled and stretched the polar vortex aloft to the coast so that at 500 millibars, as the second weather chart shows, a strong north wind carried moisture deep into the interior of Antarctica above the polar plateau and above the great temperature inversion.

A bigger picture was beginning to take shape with a great deal of personal excitement. This was the source of moisture to the interior. No appreciative weather system such as a frontal system or organized cyclonic system was invading to the extreme altitude of Plateau Station. The isothermal layer of the atmosphere above the inversion probably filled to saturation. The inversion provided the descending air flow bringing saturated air to lower and much colder levels. Some high thin cirrus clouds were visible in the night sky but not so dominant as to be the source of the ice crystals in the air. These were Schwerdtfeger's ice crystals from a clear sky. The net radiation data from Pete Kuhn's radiometersondes (Chapter on Research in Winter), added along side a graph of the temperature inversion for the same date, 7 August 1966, showed a net radiation warming at the lower layers as latent heat from ice crystal formation was released into the inversion.



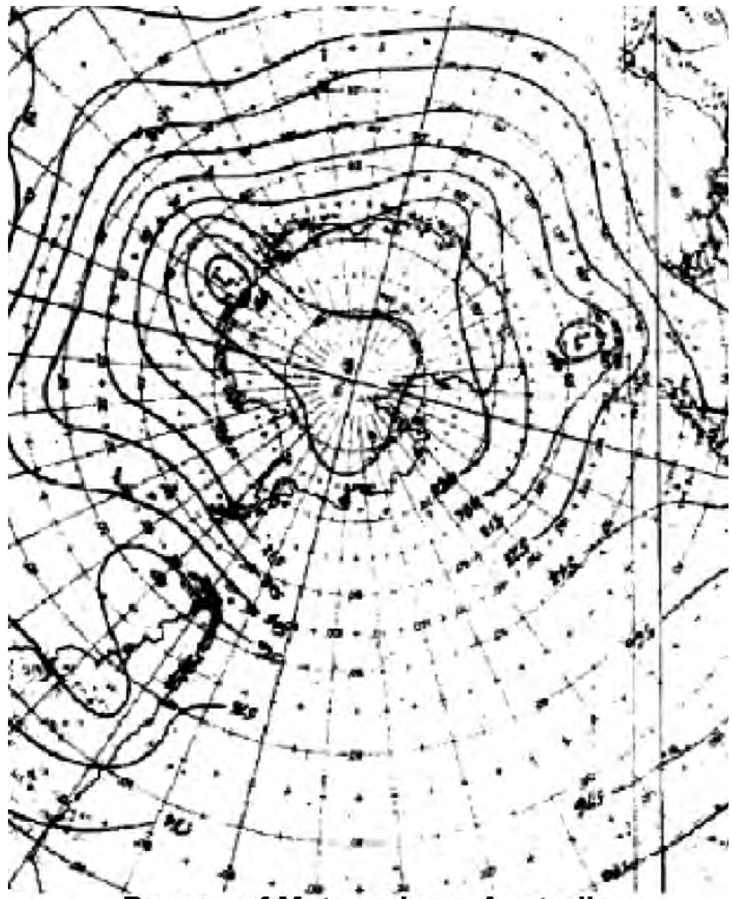
Bureau of Meteorology, Australia
Surface 00:00 Z, 07 August, 1966

The synoptic analysis received was so exciting and such an aid in piecing together what was happening on the polar plateau that it stimulated a new proposal. Never achieved at Plateau Station was a communications network between nearby stations to enable scientists to predict weather at their stations in order to carry out effectively timely observational events such as my serial balloon launchings. I wrote in my proposal:

"Preliminary analysis of some of the soundings made at Plateau Station (1966) have shown a low level jet at the top of the inversion. The most dramatic case found so far showed a wind speed of 5 meters per second ten meters above the surface (standard aerovane level). 200 meters above the surface the wind speed had increased to 12 meters per second at the top of the inversion and decreased to 4 meters per second 400 meters above the surface. If such a thin layer jet wind exists on a large scale over the polar plateau, it would not be seen by the normal balloon soundings made at Amundsen-Scott and Vostok due to their rapid rate of ascension."

"Suggestions concerning a study of the Great Antarctic Inversion on a temporal and spatial basis had originally been made by Professor H. H. Lettau and Professor W. Schwerdtfeger, both of the Department of Meteorology at the University of Wisconsin, in a memorandum to NSF November 1964. Their continued interest and guidance in the studies at Plateau Station and the Antarctic inversion would be helpful for working up a coordinated program between the three stations on the polar plateau. Considering the planned termination of Plateau Station after the winter of 1968, special coordinated soundings at Amundsen-Scott and Vostok for that year would take maximum advantage of the remaining lifetime of Plateau Station."

" . . . The meteorologist who carried out this type of program at Plateau Station during its first year of operation is willing to carry out the field work at Vostok and would also work closely with the meteorologist chosen for Plateau and Amundsen-Scott if such a program were approved. . . . M. P. Sponholz, 5 April, 1967."



Bureau of Meteorology, Australia
500 MB 00:00 Z, 07 August, 1966

Paul Dalrymple flew down to D. C. and assisted me with this proposal. Likewise Bill Weyant pushed his connections. Harry S. Francis, Program Director, International Cooperation and Information Program at NSF, was key to this proposal. He gave us a hearing and about a year later, too late for the connection with Plateau Station, I did get an invitation to join the Soviet Antarctic Expedition at Vostok. In addition to my college years of studying the Russian language, I filled the Washington evenings with Russian classes from the State Department and practiced translation by keeping Polar Met's notes on Russian Expeditions to Antarctica up-todate.

In 1967, before a proliferation of personal computers and before global communications via satellite all these interpretations had to be done on the basis of data brought together by staffs of people a long time and a long way away from the point in time and space where the observational project was conducted. How much better all of these interpretations might have been with instant access to all these data and data analysis.

It took several years even with main frame computers, not at all consumer friendly, to work through the millions of calculations. Programming in FORTRAN for the research scientist was a must. It never was enough to simply calculate the position of the balloon and the speed at which the balloon was carried along by the wind, but with the computer I needed always to calculate the most accurate or most probable position taking advantage of every possible measurement and weighting good data over against poor data.

Was this proper science? It certainly was normal science, but as I struggled with these methods of data fitting it struck me that a book on scientific revolutions I read while working in the Weather Bureau at Chicago on the University of Chicago campus exactly described the work that I now was doing. " . . . it is hard to make nature fit a paradigm. That is why the puzzles of normal science are so challenging and also why measurements undertaken without a paradigm so seldom lead to any conclusions at all." (Thomas S. Kuhn, *The Structure of Scientific Revolutions*, Chicago: University of Chicago Press, 1962) I was beating the data into submission following the paradigms outlined by Lettau and Schwerdtfeger. Lettau had defined katabatic wind flow as a short term local phenomenon not involving the coriolis force from the earth's spin. Schwerdtfeger laid down the path to inversion wind based on thermal winds caused by the slope of the icecap.

t was time to go to Madison, Wisconsin for the next step of research. At Madison, Pete Kuhn and his staff were eager to evaluate the net radiation data. There was little problem here. Pete Kuhn was with the Environmental Science Services Administration (ESSA) and its Atmospheric Physics and Chemistry Laboratory so that negotiation for cost and control of the data was easily taken care of by Bill Weyant from Washington D. C. At Madison, by being affiliated with both the federal government and the University of Wisconsin, Pete Kuhn had access to an IBM 1620 and a CDC 6600 computer to do a major amount of data analysis. During the many weeks spent on data reduction Pete and I performed several net radiometersonde launches from Picnic Point and monitored the temperature and net radiation over Madison and down wind from Madison up to 10 millibars, well into the

```
260000800009RS2600008096
LOAD DATA
TERMINATION OF DATA
TERMINATION OF DATA
PDQ FORTRAN C2
START
C       TEST PROGRAM AZIMUTH ESTIMATES
C       PLATEAU STATION
C       0.05 DEGREE INCREMENTS
        BASLN = 318.5
1       READ 5, LEVEL, ITIM, ESTRN, ZSTRN,
               EBW, ZBW
5       FORMAT(13X, 2I6, 4F7.2)
        STEL=ESTRN*.01745329
        ZSTRN=ZSTRN*.01745329-.00872664
        BWEL=EBW*.01745329
        ZBW=ZBW*.01745329-.00872664
        Z1=SIN(BWEL)
        X2=COS(BWEL)
        X3=SIN(STEL)
        X4=COS(STEL)
        RATAN=(X1*X4)/(X2*X3)
        NUM=0
        DO 36 N=1,20
        ZSTRN=ZSTRN+.00087266
        DO 35 J=1,20
        NUM=NUM+1
        ZBW=ZBW+.00087266
        VAL1=SIN(ZBW)
        VAL2=SIN(ZSTRN)
        VAL3=COS(ZBW)
        VAL4=COS(ZSTRN)
        RASIN=VAL1/VAL2
        TEST=RATAN-RASIN
100     ABW=ZBW*57.295779
        ASTRN=ZSTRN*57.295779
        HT1=BASLN*X3*VAL1/((VAL1*VAL4
            -VAL2*VAL3)*X4)
        HT2=BASLN*X1*VAL2/((VAL1*VAL4
               -VAL2*VAL3)*X2)
35      PUNCH 101, LEVEL, ITIM, EBW, ESTRN,
               ABW, ASTRN, HT1, HT2, NUM,
               TEST
101     FORMAT(2I5, 4F7.2, 2F8.0, I6, F20.8)
36      ZBW=ZBW-.0174532
        GO TO 1
        STOP
        END
```

stratosphere, to simulate the polar cold with our diesel fuel soaked radiometers. I never was quite sure how bad or how insignificant the diesel fuel treatment was. Pete Kuhn was always eager to publish and when he wasn't pushing me for a joint publication on the radiation part of the inversion study I guessed comparative experiments were not very good. In Antarctica, at -115 º F, with every instrument rupturing on exposure to that severe cold the only choice was to obtain the data by soaking the balloons and net radiometersondes with diesel fuel.

I met a very pretty girl while in Madison and learned she was attending a geology class given by my favorite teacher, Professor Laudon, in B10 Commerce. Six years earlier, when I took Geology 101 I enjoyed his method of filling six blackboards and running through several trays of slides all in an hour. I learned from this girl that he was still at it and it was OK to come to class with her. I did.

She represented the state of Wisconsin as a queen of the state's agricultural products and later even achieved runner up to Alice in Dairy Land. She was an amazing person to be with and talk to and then Prof. Laudon came on stage and began his lecture.

GONDWANALAND

I could not believe what I heard. Prof. Laudon was explaining with all certainty the continental drift theory. I was so overwhelmed by such a turnabout in the professor's fundamental views that I momentarily forgot the girl, and pursued my inquiries of Laudon. When I took geology about six years earlier he ridiculed the continental drift theory. The continents were fixed and immobile. North America grew in size around the very hard Precambrian rocks of the Canadian Shield. Each new evolutionary age added to the continents' sediments by ocean advances and withdrawals. New continents formed between island arcs as sediments filled in between. North America emerged between the Appalachian Islands and the newer Rocky Islands. Scientists were looking for new continents to emerge between the Pacific Island arcs. Indonesia was a recent emergence.

Ideas of the super puzzle, that continents once fit together and moved apart, when I had Prof. Laudon were taught as examples of a quack hypothesis. Prof. Laudon in 1961 made mockery and ridicule of such ideas. He taught that if North America moved, the young Rocky Mountains would have to be the older ones and the Appalachians shouldn't even exist. The mountains of Australia would be on the wrong side of the continent, most rivers of Asia would be going the wrong direction, and finally, the puzzle wasn't a very close fit.

Now six short years later whatever happened to these reasons? Certainly the Rocky Mountains did not change these last six years. Australia did not suddenly flip around these past years to give reasons for Prof. Laudon's sudden conversion. Whatever happened to all the reasons he gave that so certainly proved the opposite? At the end of class, completely forgetting the girl I came to class with and was sitting next to, I leaped up on the stage to catch the professor before he left and begged for an answer for his changed views. He ignored me and walked back stage and disappeared. I was intercepted by one of his graduate teaching assistants. In the conversation that followed it became evident that the graduate student didn't even know that Laudon ever taught anything else. The girl was gone.

The University of Wisconsin was always a dynamic campus where any and all ideas were freely debated. That did not change. Frequently during my stay that spring on the Madison campus there were many protest marches and demonstrations against the war in Vietnam. I knew the United States had a few thousand advisers in Vietnam when I left for Antarctica. I now was stunned at the large number of troops our country committed to this Asian country. I was even more taken aback by the lack of interest by the general public. President Johnson increased the American commitment ever so slowly so that few of the public realized it. Returning home from Antarctica where daily news was unavailable now gave me the shocking picture of this sudden and enormous commitment of young drafted men heading off to jungles without much congressional or national debate over how our national security was harmed by communists in Vietnam or how much the Vietnamese really wanted cutthroat capitalism.

I prayed for my friends, the Sea Bees of Plateau Station, and their work in Vietnam. The war was getting so large few young men would escape its scars, but thus far the build up was too gradual to be noticed by the general population. The protest song:

> "How many seas must a white dove sail
> Before she sleeps in the sand?
>
> How many times must a cannon ball fly
> Before they're forever banned?"

brought tears to my eyes and the inactive "silent majority" committed me to activism. Even my church denomination blindly supported this unjust war and was wrongly committed to a blind obedience to government when a democracy expects and demands a knowledgeable voting constituency. Our own Augsberg Confession (Article XVI, paragraph one) and the Apology (Article XVI, paragraph one) expects a judgment calling for service for "just wars." My grandfather left Germany to avoid the unjust wars perpetrated by Kaiser Wilhelm. I could understand a similar move to Canada during these times. In the following years, after many thousands of Americans came home in caskets and thousands more came home broken for the rest of their lives with no hope for change and even a seeming rejection of Americans by the Vietnamese themselves, the American voters changed America's direction.

Insert: 27 April 1967. General Westmoreland: ". . . this war is action and counteraction. Anytime we take action we expect a reaction." President Johnson: "When we add divisions can't the enemy add divisions? If so, where does it all end?" (Notes of a conversation written by John T. McNaughton, Assistant Secretary of Defense for International Security Affairs)

My visit and exchanges with Werner Schwerdtfeger and Heinz Lettau, my former teachers, were very cold. Conversations stayed primarily on the travelogue and the experience of living in the Antarctic. They only wanted the data from Plateau Station, which Weyant and Viebrock as my immediate superiors did not permit.

Likewise, Schwerdtfeger and Lettau offered no theoretical information. All of us knew too well that we no longer had a student to teacher relationship. I found this very hard. I felt I still was their disciple. In one heated moment I was accused of giving data to K. B. Mather and G. S. Miller of the University of Alaska. The Alaskans had recently published an article, “Wind Drainage Off the High Plateau of Eastern Antarctica.” They must have used government publications of the standard surface observations that are made available daily as it is collected under various international agreements.

I could understand the anger of the Wisconsin men. They were scooped on the wind flow by the easiest and wrong idea that simple katabatic flow with a coriolis force changing it was the cause for wind circulation out of the Antarctic. I too was scooped. The entire research system of the Federal Government was scooped. Even the NSF was a little embarrassed. They had spent all this money on my project to have two guys in Alaska read daily weather reports and publish results before the scientists could get home from the field.

This research world had its entanglements. I was hot with rage before meeting Werner Schwerdtfeger on this visit. On the very same day that I returned from Plateau Station Weyant informed me that Werner Schwerdtfeger’s nephew had convinced the NSF that his Australian University in Melbourne with another lecturer, Dr. Uwe Radok, be allowed to study the snow’s energy balance at Plateau and that all my data of the subsurface temperature be given to them. I never trusted Werner Schwerdtfeger’s innocence in this matter. In my view, Ed Flowers, Herb Viebrock, and I initiated the subsurface temperature and energy program and it was stolen from us. Maybe it was because of insider knowledge at Madison, knowing that I was doing this subsurface study, that the Universities of Alaska and Melbourne redid it all. For sure the international politics had its part. Plateau Station was in the sector claimed by Australia.

Insert: 4 May 1967. “As to Vietnam, it seems very doubtful that further intensifications of bombing in the North or major increases in U. S. troops in the South are really a good way of bringing the war to a satisfactory conclusion. As to the United States, it seems clear that uncertainty about the future size of the war is now having destructive effects on the national will.” (Memorandum for President Johnson from McGeorge Bundy)

Two graduate students patiently waited to see me. Walter Dabbert, a student of Lettau, and Larry Mahrt, a student of Schwerdtfeger, were well into the theory of the Great Inversion over East Antarctica. Their graduate status and degrees were dependent on the findings at Plateau. How could I hold back? I could have. For my own professional growth I should have. I didn’t. I was a young and naive researcher hardening fast.

At church the next Sunday I saw Nancy, the gal from geology class again, asked her to a play at the Student Union, *Medea*, an ugly story about a woman killing her own children, put on by the Wisconsin players. I had to leave shortly and return to Washington D. C. and knew such a romance was impossible. She visited me there and before the summer was over we were engaged to be married.

Returning to Washington D. C., disillusioned about research, I thought theory only followed observations. Lettau and Schwerdtfeger never stopped theorizing and they had every right to do so. That was their generosity. That is why so many of us wanted to follow them. Their minds were never slowed. But it was becoming obvious to me that it didn't matter what my data showed. If my data did not fit their theory it would be ignored. If it did fit their theory - of course, it was expected.

CHAPTER 12
An Administrative Interim

Seemingly out of nowhere, certainly totally without expectation, Harry Francis, head of the International Cooperation and Information Program at the NSF, was asking for me and asked if I could meet with him in his downtown office. I could not understand why and he could not say why on the telephone. A trip from the Grammax Building in Silver Spring, Maryland into D. C. to NSF took a little bit of time, most of thirty minutes to drive to the location and thirty minutes to find a parking space. Often I parked in a loading zone and received a parking ticket, but it was cheaper than an hourly rate in a parking building. (That was before Tow-Away.)

He told me I was invited to be an Antarctic Observer with the Japanese Antarctic Research Expedition number IX (JARE-IX) as defined by the Antarctic Treaty. I also would be the United States Representative in the East Antarctic coastal waters, particularly in the vicinity of Showa Base. I would be expected to join the expedition when it arrived at Perth, Australia sometime mid December of this year (1967). Could I perform research while with this expedition? Probably. Are you interested? My overwhelming excitement revealed my immediate response. Yes!

This news sent Polar Met into a tailspin. We had less than five months to write a proposal, have it approved, receive the grant, procure all necessary equipment, and study for this observational program primarily on the high seas between Australia and Antarctica. Herb Viebrock was our in-house expert on the oceanography and its interface with the weather above it, particularly in the Southern Ocean. Our frequent luncheon friend Feodor Ostapoff, Director of the Sea-Air Interaction Laboratory and recently moved to Miami, Florida, would be a God-sent gift of assistance for these hasty preparations. His laboratory also was an excellent source of equipment that could be borrowed before governmental acquisitions and the related paper work could be completed.

"PROPOSAL:

A. Name and Address of Institution:
Polar Meteorology Group
Institutes for Environmental Research
Environmental Science Services Administration
Silver Spring, Maryland 20910

Principal Investigators:
William S. Weyant,
Chief,
Polar Meteorology Group, and

Herbert Viebrock,
Supervisory Research Meteorologist,
Polar Meteorology Group.

B. Title: Exchange Scientist program aboard the "*Fuji*"

C. Desired Starting Date:
1 October 1967

D. Time period for which support is requested:
1 October to 31 December 1968 (15 months)

E. Description of Proposed Research:

At the Antarctic convergence or polar front in the Antarctic Ocean the Antarctic Surface Water descends to deeper layers to form the Subantarctic Intermediate Water (Gordon, 1967). This change is characterized at the sea surface by a sharp temperature gradient in the temperature regime between 2 and 6 C ° (Mackintosh 1946, Koopman 1953, Maksimov 1961, Ostapoff 1962, Houtman 1963) The presence of this surface temperature discontinuity has a profound effect on air masses crossing the convergence zone. For example: evaporation minima occur at or south of the convergence, while the sensible heat exchange is directed from the air to the sea only in this area (Viebrock 1962). Similarly, the ocean-sea ice boundary has an effect on the air crossing it. The associated detailed changes in the vertical structure of the lower layers of the air are unknown.

Also studies of the coastal katabatic winds have been made using largely only surface wind data (Mather and Miller 1966). There is a scarcity of vertical wind and temperature profiles along the Antarctic coast inhibiting a thorough examination of the vertical and horizontal structure and extent of the thermal wind effects. Using techniques similar to those utilized by Dalrymple, et. al. 1966 in analyzing his vertical profile data, the thermal wind effects can be separated from frictional and geostrophic effects.

Therefore as part of the exchange-scientist program, it is proposed to conduct a detailed study of the atmospheric boundary layer over the Antarctic Ocean from the Japanese ship "*Fuji*." The study has a twofold purpose: (1) to examine the effect of the Antarctic convergence and the ocean-sea ice boundary on the overlying atmosphere, and (2) to compare the data for the lower 1000 meters of the atmosphere over the ocean, over the sea ice and along the coast with similar information obtained at Plateau Station on the Antarctic plateau. An excellent opportunity is provided for a study of this nature by the course of the Japanese icebreaker "*Fuji*." The ship is scheduled to leave Fremantle, Australia on 16 December 1967. It will cross the Antarctic convergence in the Indian Ocean, penetrate the sea ice, proceed along the Enderby Land and Princess Astrid coasts, resupply Showa, return through the ice pack, recross the Antarctic convergence south of Africa and finally reach Capetown around 1 March 1968.

Pressure, humidity, wind speed, and temperature observations will be obtained up to a height of 1000 meters using a modified radiosonde transmission system. The sensors will be suspended from a set of four kytoons in tandem pairs raised and lowered with a long train and winch to obtain detailed vertical profiles. It will be necessary to use a shipboard winch. These data are transmitted to shipboard recording equipment at a frequency of 403 megacycles. A standard shipboard radiosonde receiver will be used.

Soundings will be made in series during selected three day periods, as the ship crosses the Antarctic convergence zone, as it enters and leaves the ice pack, and at various points near the coast.

F. Personnel:

The field program will be conducted by Mr. Martin Sponholz of the Polar meteorology Group, IER, ESSA. Mr. Sponholz’s salary will continue to be paid under NSF Office of Antarctic Programs Grant AG-102.

The principal investigators’ salaries will continue to be paid by ESSA (HV) and under NSF Office of Antarctic Programs Grant AG-93 (WSW).

There will be close technical and scientific liaison with the Sea Air Interaction Laboratory (SAIL), ESSA.

While on board ship the field meteorologist will require the aid of three other persons for winch operations, balloon inflation, and kytoon maneuver and retrieval. In turn he would be willing to assist in other programs.

G. Budget:

Summary of costs

a. Salaries		None
b. Equipment		
Wind sensors	2400.00	
Baseline check box	180.00	
Transformer	40.00	
Battery Tester	180.00	
Battery Charger	30.00	
Tools	100.00	
		2930.00

c. Expendables		
60 Radiosondes	555.60	
120 Batteries	276.00	
12 Kytoons	1530.00	
24 Bladders	192.00	
Recorder-Receiver Paper, spare parts	100.00	
Radiosonde modification parts	300.00	
Gas for inflation(Helium or Hydrogen)	1200.00	
		4153.60
d. Travel		1600.00
e. Shipment of Equipment		3092.50
f. Shipment of gas(Christchurch to Fremantle)		4200.00
g. Data Reduction (computer time)		500.00
Total Direct Costs		16476.10
h. Indirect Costs (6%)		988.57
		$17,464.67

In the several meetings I had at the NSF I discovered I would be carrying some difficult decisions of the United States Antarctic program. For one, the scientific leader of the Japanese Expedition was planning a traverse from Showa on Ongal Island in Lützow-Holm Bay to the South Pole and was asking for the United States to supply them with diesel fuel. With the South Pole being used as an icon for heroics the United States came to the conclusion that it was no longer their responsibility to bail out everyone that needed help going to the pole. I had to convey that to the Japanese.

There was the possibility that the *Fuji* might visit Molodezhnaya, a Soviet station, where an American scientist, Dr. MacNamara, appeared to be having a rough winter. I was told that he left the United States with liberal political ideals. A recent message received from the Russian station from Dr. MacNamara stated, “Wisconsin’s Senator Joseph McCarthy was right!” If the Japanese visited the Russian station, Dr. MacNamara might want to leave the Russian station with the Japanese. I had instructions to convey to the Japanese Self Defense Force that my American compatriot was expected to return from Antarctica at the schedule of his hosts.

A LETTER

National Science Foundation
Washington D. C. 20550
October 30, 1967

Mr. Masayoshi Murayama
Polar Section
National Science Museum
Ueno Park, Tokyo, Japan

Dear Masayoshi:

Thank you very much for your letter of October 24, 1967. I shall be writing to you again shortly with the specific information you requested. However, I wish to take this opportunity to thank you and Captain Honda for what I know has been a very special effort to accommodate Mr. Sponholz. I am rather disturbed that the appropriate information seems not to have reached you. As you may remember, we were directed last summer to make our formal communications in response to the invitation to send a representative with JARE IX through your Embassy here in Washington. At that time, we advised the Embassy that Mr. Sponholz had been nominated and that he wished to carry out a meteorological program aboard the *Fuji*. Apparently, somewhere along the line there has been a failure in communications. I apologize for not informing you directly at an earlier date. I think you will find that Mr. Sponholz is more than prepared to participate in every way in the Expedition. He has previous Antarctic experience, and I personally feel that you will find him not only a good scientist, but a good member of the team. He is looking forward to it very much.

I wish to clarify one point, and that is that Mr. Sponholz plans to make his observations while the ship is under way and his program does not require the continuous towing of kytoons. I am therefore confident that his requirements are reasonable in terms of the operating procedures which I have observed aboard the *Fuji*.

Please give my regards to Captain Honda, and we shall be in touch with you very soon.

With best wishes,
Sincerely yours,

Henry S. Francis, Jr.
Program Director
International Cooperation and Information program
Office of Antarctic Programs

END OF LETTER

More and more of my time was taken for service to Polar Met in general, to the NSF, and to the men with international visions of the Weather Bureau's higher administration. I was given many briefings as to what to expect from the Japanese and the Russians, what to look for and seek answers from. Open exchanges were encouraged for potential contacts with my counterparts in New Zealand, Australia, and South Africa.

The mathematics of the weather, my first love, was forced to take a seat farther and farther back in the bus. I was very concerned about surrendering the competitive field of research to my friends at the University of Wisconsin, yet I would be wrong if I did not recognize the priority of Prof. Lettau and Prof. Schwerdtfeger.

After hasty advance background checks on my activities and life that must have invaded the privacy of every person I ever met, I was granted the necessary security clearance and a passport for a diplomat. When I went to the State Department to take an oath related to my position as a U. S. Representative in the Antarctic, I was shocked at the details of my life, especially the details of my recent political activity, that was part of my record. In no uncertain terms the committee members that swore me to allegiance to the Constitution insisted I maintain the correct policy of the United States with respect to all of its foreign activities. I was to have no opinion on Vietnam of my own as long as I was in this position as Representative with the United States Antarctic Research Program. I was not a private citizen.

> "Transmission of TOP SECRET, SECRET or CONFIDENTIAL material to a Foreign Service post or through a Foreign Service post to an official of the United States Government shall be through the State Department's Diplomatic Pouch Service or through electrical means in encrypted form. When such transmission is made through diplomatic pouch the inner envelope shall be addressed by name, title and full address, and shall have stamped thereon the appropriate classification. The outer envelope shall be addressed to the Director, Foreign Service Division, Bureau of International Business Operations, including sender's return address, but shall bear no security classification."

Again I had to seek permission from my local draft board to leave the United States. This time someone from the State Department made the request on my behalf as the war in Vietnam began to heat up.

"Milwaukee County Local Board 44
Selective Service System
135 West Wells Street
Milwaukee, Wisconsin, 53203"

"Selective Service #47-44-41-192"

"Dear Sir:"

“Mr. Martin P. Sponholz, 2535 North 2nd Street, Milwaukee, Wisconsin has been selected to represent the United States as a Meteorologist in a U. S. Scientific exchange program with the Japanese Antarctic Research Expedition 1967-1968. Mr. Sponholz will beassigned toJapanese ice breaker *FUJI* to conduct a meteorological measurement program.”

“The U. S. Government through the National Science Foundation and cooperating agencies such as the Environmental Science Services Administration participates in scientific foreign exchange programs in the Antarctic. This is an important part of the international cooperation and investigation of the Antarctic regions under the Antarctic Treaty. The Environmental Science Services Administration conducts a program of Antarctic research using data from the measurement program.”

“The duration of the tour with the Japanese and in the Antarctic is approximately 5 months beginning November 1967, and terminating by the end of March 1968. We shall appreciate it very much if you will grant Mr. Sponholz permission to be absent from the United States for the period indicated above in order that he may perform this assignment.”

“Sincerely yours,”

The funeral of a young soldier where the mourners walk behind a horse drawn cortege draped with the American flag in Arlington National Cemetery sobers every witness. I escorted Helen Goddard, Chief, Administrative Services Section, OOPS, to her nephew’s funeral. I never knew the lad except that he had defended me in a foreign land without knowing me. Taps brought me to tears of sadness while I contemplated the gracious history my God gave this country that I now would represent without a weapon.

I was gripped with fear for the lives of the now more and more acquaintances that were in the military taking their 365 day tour of duty in Vietnam. I was proud of their bravery, their service, and their obedience to their country’s call. I was puzzled at the ever increasing involvement of our country in this land war in Asia. I was anxious over the risk I willfully placed my own life in for my country’s interest in this unclaimed and little known territory of Antarctica. The oath at the State Department made it clear that diplomatic service had its equal risks for my country. I was prepared to go. But no one would willfully be taking aim to shoot me.

Again it was orientation time at Skyland, Virginia, 18-22 September 1967. The thrill of this session was a major speech formatting policy by the Chief Scientist of the Office of Antarctic Programs, Dr. Albert P. Crary. I present his visionary speech here in full.

Long-Range Planning

Long-range planning is a priority requirement for any society faced with expanding population, widening gaps in standards of living, increasing congestion of urban areas, and dwindling resources. Although I am concerned here only with antarctic planning, many aspects of the problems that we face in Antarctica are indeed applicable to the greater and more urgent ones. Perhaps this is one of the assets of Antarctica - its availability as a contained proving ground where experiments in long-range planning may provide a pattern that will help solve problems on other frontiers. Can we set proper international conservation standards in Antarctica? Would these standards be suitable in other areas? Can we cope with exploitation by international agreement? Can the principles of the Antarctic Treaty be extended to other areas, such as the high seas? Can basic or applied research plans - national or international - be drawn up realistically?

Advantages and Disadvantages

Long-range planning for Antarctica has many advantages as compared with such planning for other areas. First, there are no pressing internal demands or private interests to contend with, and there is no need for "crash" programs. Second, relatively few management agencies are involved, and their responsibilities are well defined. Third, information, an essential ingredient of all planning, is well in hand for all antarctic subjects. And, finally, the logistics are superbly organized, and approximate cost figures can be determined for any new plans or changes in plans.

One important aspect of Antarctic planning should be noted: the plans are updated annually, giving the planners a chance to retrace their steps or modify their plans if necessary.

There are also disadvantages to long-range planning. First, the National Science Foundation (NSF) is not an operating agency and does not hire scientists to work on specific problems. Second, much of the work is basic research, which almost by definition cannot be planned too far in advance. Third, the research choices of the scientists are individual ones, and only by chance would they fall into a master plan in which all components progress simultaneously in logical sequences. For example, the study of a food-chain system in the ocean requires dozens of specialists concerned with interactions between the various links of the chain, but it is most difficult to conduct all parts of the study simultaneously. Also, although the limited flora and fauna of the antarctic terrestrial environment represents one of the simplest of ecosystems, we have not yet become organized to carry out a coordinated study of the system. Finally, there are always budget restrictions, but actually these should not be deterrents to good planning; rather, they should set a high premium on good planning.

Advisory Groups

Who originates U. S. Antarctic plans? Although it is generally believed to be the Chief Scientist of the Office of Antarctic Programs [An office Dr. Crary held from 1960 to 1967.] (and I would be only too happy to assume full credit for all past successful planning), this is wistful thinking. Most plans, wherever they may originate, go through a long series of study and consideration by many groups. Among these groups is the National Academy of Sciences' Committee on Polar Research (CPR), which was established in 1959 to advise the Office of Antarctic Programs on desirable research in the polar regions. The CPR has a number of panels on various disciplines, each treating a specific subject, and their recommendations are coordinated by the principal committee. The Committee's two-part publication, Science in Antarctica, issued in 1960, was of tremendous assistance. I have been impressed at this orientation session by the great breadth and complexity of biological sciences in Antarctica, and particularly by the exciting new ideas of biologists who are heading south for their first or second seasons. I would recommend to the CPR that it consider carefully a wider representation of biologists on its panels.

In addition to the CPR, there is an international body known as the Scientific Committee on Antarctic Research (SCAR), which is under the International Council of Scientific Unions. Dr. Laurence M. Gould is now president of the committee. SCAR has several working groups, which in turn have subgroups in many fields. I have been a little disappointed in some of these groups as far as planning is concerned, but I realize that some panels may appear to be ineffective because the various nations are generally too involved in their own working areas in Antarctica, while others have been effective because of the global nature of their problems. In the future, however, as knowledge of Antarctica increases, I look forward to greater use of these international scientific panels.

One difficulty that arises in connection with these advisory groups is that the number of scientists genuinely interested in the Antarctic is limited, and it is often difficult to find knowledgeable advisors who are not, themselves, involved in some manner, raising the specter of conflicts of interest. In general, this presents no great problem if the duration of membership on the panels and working groups is limited. I sincerely hope that a personnel rotation policy can be put into effect to allow more antarctic scientists to contribute to these planning studies. My advice to a potential advisor is to get on a panel, put his ideas in the records, and move on to let the next scientist express his opinion.

In addition to these outside committees, the Office of Antarctic Programs has an advisory panel with which we discuss all major antarctic decisions. The members at present are Dr. Laurence M. Gould of the University of Arizona (chairman), Dr. Richard M. Goody of Harvard University, Dr. Laurence Irving of the University of Alaska, Dr. Ernst Stuhlinger of the National Aeronautics and Space Administration, and Ambassador Paul C. Daniels, formerly of the Department of State. This small committee, whose membership rotates, has very wisely guided our major efforts in antarctic research. Long and detailed discussions were carried out with this group before our move into the Antarctic Peninsula at Palmer Station and our decision to construct the research vessel Hero.

There is also an advisory committee in the Foundation for the environmental sciences. This newly formed committee, which is largely concerned with the activities of the Division of Environmental Sciences (DES), has a great interest in Antarctica. Although biology is not included in DES, except in the Office of Antarctic Programs, [The DES includes the earth, atmospheric, and physical-oceanographic sciences sections and the Office of Antarctic Programs.] a biologist, Dr. John E. Canton of Michigan State University, is a member of the committee. Another member is Dr. Robert A. Ragotzkie of the University of Wisconsin, who will be remembered by many Antarcticans for his studies of the dry-valley lakes. The interest and advice of this committee will assist greatly in coordinating antarctic research with that in other areas of the world.

Then there is the National Science Board, which, in conjunction with NSF's Director, Dr. Leland J. Haworth, establishes policy for the Foundation. The members of the Board are people who have gained national distinction by their research of their championship of science. Thus, a great many university presidents and deans and industrial leaders become fully aware of our antarctic operations through the annual briefings given to the Board. Some members of the Board have visited Antarctica in the past, and others will in the future.

High in the Executive Branch is the Antarctic Policy Group, which was established to ensure that the national antarctic program conforms with overall U. S. policy. The three members of this group are the Assistant Secretary of State for International Organization Affairs (chairman), the Assistant Secretary of Defense for International Security Affairs, and the Director of NSF. The long-range (fiveyear) plans that are prepared annually are subject to approval by this group; thus, the logistic and international aspects must be satisfied before any major scientific innovation is approved.

Finally, there are the congressional committees that are concerned with the National Science Foundation. In the House of Representatives are the Committee on Science and Astronautics, chaired by Mr. George P. Miller of California; the Interior and Insular Affairs Committee, chaired by Mr. Wayne N. Aspinall of Colorado; and the Subcommittee on Appropriations for Independent Offices, chaired by Mr. Joe L. Evans of Tennessee. Many Senators have also taken special interest in the antarctic program and several have traveled to Antarctica to observe the projects and operations. Owing to the continuous interest by these committees and individuals, the antarctic program has received far more attention in Congress than the funds involved would appear to warrant.

New Ideas

With all of these august bodies backing up the antarctic operations, someone might wonder if the staff of the Office of Antarctic Programs really does anything or needs to do anything except unravel the difficult problems of budgets and logistics. In reality, however, it is this staff that must take the initiative to formulate new ideas, using the input from working scientists, the various committees, and its own information and experience in logistics and international problems.

There are two principal requirements for the long-range plan: We must introduce innovations in antarctic science regularly, and we must plan to remain within the logistic capability of the Department of Defense to support us with aircraft, ships, and personnel. In a way, we are living in a sort of dream world of science in Antarctica. The cost of sending each scientist to "the Ice" is something on the order of $200,000 per field season, and the taxpayer must be convinced that such a bill for research is worthwhile. How many scientists in the audience would be going to the Antarctic if it were up to each of them to raise $200,000 from his neighbors? If the program is to be worth the price, we must keep it dynamic. New and exciting research must be introduced every year. Nothing is more deadly and wasteful than doing the same thing day after day, year after year.

We also need all the support that we can get through public relations. We must have what our budget people call "grabbers," not only for Congress, but for the congressional constituent - the man on the street. Each year it is a painful task to locate these "grabbers." It may be of interest to note that the section on antarctic research in NSF's 1966-1967 annual report will probably contain items that are the work of two first-year men. I realize that science in the long run is not dramatic, and I am not trying to change science. I am only saying that somewhere, in all the work we do annually, there are things that are interesting to the public if they are explained properly. Meanwhile, we will keep the program dynamic by continually planning new projects.

Both the Department of Defense and NSF are working under level budgets. I see nothing wrong with this, and, in fact, as I mentioned before, we are learning that nothing stimulates long-range planning more than a level budget.

The failure to introduce something new each year and to get rid of the low man on the totem pole is universal in research funding and in government bureaus, but it is a problem that private industry has had to solve for its own survival. Everyone looks forward to a rising budget so that innovations can be introduced without the dreary prospect of cutting anyone from the list - so that a young Ph. D., as well as the mature scientist, can be supported. But the hard facts of life are that both cannot be taken care of with a level budget. Our position is that the budget for research in the United States has not reached an equilibrium. Good research is a very difficult trade and not one of the higher-paid ones. There is a certain, albeit changing, percentage of scientists for any given population, and a certain percentage of these who want to make teaching a profession should have basic research funds, including salaries for their graduate students. How well such an argument would apply to antarctic research, I cannot say, but I expect this question will be scrutinized as other NSF offices are forced to decline a greater and greater percentage of the proposals for support of basic research.

Innovations Recently Effected or Considered

To sum up, the staff of the Office of Antarctic Programs must plan something new every year. To do this, it must at all times have several new ideas going through the processes of evaluation for scientific merit, logistic cost, and international effects. Those that we have on tap and in the making at the present time are the International Weddell Sea Oceanographic Expedition, the airborne laboratory, submersibles, drilling through the ice shelf several hundred miles south of the barrier (to look at water, marine life, and sediments), and the East Antarctic U.S.- U.S.S.R.-France-Australia Glaciological program. Despite our efforts to advertise these new logistic and possibilities, we are never completely certain of the interest. I have come to appreciate that answers from scientists to NSF questions are somewhat like answers from Eskimos - there is a great willingness to please, and if NSF wants a "yes," it will get a "yes."

One successful venture appears to be the International Weddell sea Oceano graphic Expedition, and its development may be of interest for illustration. Several years ago, I was considering new areas that needed to be studied and decided that the Weddell Sea was an important one and that it might be explored by means of aircraft landing on the ice. For decades, oceanographers had said that the Weddell Sea was the key area for the formation of antarctic bottom waters. We checked the program out regarding logistics. With no air base in the area, there was a problem of landing C-47 aircraft. We checked it out internationally. Argentina was enthusiastic about a joint Weddell Sea expedition. We checked it out with the scientists at all U. S. oceanographic institutions. The only response was from my old arctic friend, Val Worthington, who said, in effect, "The antarctic bottom waters are formed in the winter and you are going there in the summer. Have fun." The logistics people suggested an alternative: exploration by icebreaker and helicopter.

We delayed the project for one year and were becoming discouraged when almost overnight the dam burst. The Coast Guard transferred to the Department of Transportation, rallied to the support of the expedition with a strong oceanographic team and the revamping of Glacier as a research vessel. Satellite photographs showed plenty of open water in March. Professor Håkon Mosby of the Universityof Bergen, Norway, organizedan Antarctic Bottom Water Committee in SCAR, and he is now providing sensors that hopefully, will operate for a year under the ice and be retrieved in the second phase of the work. Now we have more teams of interested scientists than can be accommodated.

To counter this example, I will provide another one -- a wintering-over station in the dry valleys. Considerable effort went into planning the logistics, international aspects, and research programs. Logistically, there was no problem. As an international venture, the program was excellent, with great enthusiasm shown by New Zealand and Japan. Scientifically, it looked good, and most people agreed that the idea was sound. In the end, however, we received no science backup and the project was abandoned. Incidentally, the New Zealanders are still enthusiastic about the project and plan to proceed without us.

What about such innovations as submersibles? Who wants them? This is a major problem in marine science -- many industrial concerns have invested in the development of submersibles without a heavy demand from scientists. It has always been my feeling that polar oceanographers who must deal with ice-covered waters have aneed for submersibles, but we have not been flooded with requests from scientists for their use. Should we get the submersibles first and then see what the scientists want to do with them, or should we defer acquisition until the scientific pressure builds up? My experience has been to get the hardware, hire an observer if necessary, and proceed; research requests have generally followed. In any event, planners are expendable.

Let us look at the antarctic stations. The construction of inland Byrd and Pole Stations represents a highlight in antarctic exploration. The installation of Eights and Plateau Stations were also tremendous achievements, but I would rate the closing of Eights an even greater accomplishment. (We also closed Hallett Station as a wintering-over facility, but this decision was eased some by the effects of a disastrous fire.) The closing of Eights Station allowed us to install Plateau Station and bring in new programs. We will close Plateau Station also, if for no other reason than to show that the closing of Eights was not an accident. I personally would not mind closing Pole or Byrd for a winter or two or even longer, although some people are horrified by the thought of even a temporary closing of Pole Station. I do not think this attitude is reasonable. Vostok Station has been operated for many years, but people forgot long ago that it was closed for one winter. The main thing is to be dynamic. We must continue to introduce changes, and one of the best ways to finance new things in the antarctic program is to close a station. For example, the main reason we are keeping Byrd, Plateau, and Pole Stations open during the winter is to achieve continuity of observation of upper-atmosphere phenomena; as desirable as this is, I do not think it would be justifiable in a cost-benefit analysis. The $200,000 expenditure per scientist per field year should probably be revised to $50,000 each for the summer scientists or wintering scientists at the coastal stations, and $750,000 each for the scientists wintering inland. Perhaps one of our weaknesses is that we do not review proposals with regard to the total cost of research and logistics. However, we do plan to begin this type of analysis very soon.

Criteria for Developing Programs

In conclusion, I offer the following criteria for good antarctic research programs:

1. They should be short and effective.

2. They should be dynamic. The objectives should change with time, which means, essentially, that only the best ones should be retained.

3. The investigator's ambition should not be limited to the things that he thinks can be supported. He should write to the Office of Antarctic Programs about his total requirements. These add up to potential plans.

4. Whenever possible, the investigator should coordinate his programs with those of other disciplines that are related in context or in area. Interdisciplinary combines are the solution when the logistic requirements are large.

5. If at all possible, the programs should be based on international cooperation; the work should be shared with scientists from other countries, with each country contributing equally to the support of its own scientists.

(The End of Burt Crary's speech to the field personnel of the United States Antarctic Research Program assembled at Skyland, Virginia, September 18-22, 1967. Reprinted in *Antarctic Journal of the United States*, Jan-Feb., 1968, pp. 10-14.)

The invitation to the Japanese Antarctic Research expedition was an exciting prospect and a great opportunity to return to the Ice. A drawback for this pending trip was my study of inversion winds was left standing. The trip south was worth it. Doing science in the real natural world, to me, was infinitely more exciting than studying it in dry books, though you had to do both.

A difficult task to learn but very enjoyable watching the achievements unfold was the entire process of logistics. This time I was involved from the beginning. This time I also spoke with experience. I, too, wore a penguin tie clip. I met people and asked them for assistance returning favors. At times those favors were only just a good sea story from the Ice. Again Polar Opps was most beneficial. And this time I also learned of the great assistance from NSF, in particular Harry Francis' office. His assistant, Walt Seelig, an old polar hand, made my move with all of the paraphernalia to Australia possible.

This was not easy. My kytoons needed a lighter than air gas. Hydrogen was too dangerous to be used on board a ship. Helium was the obvious choice, but it was classified as a critical chemical for the national defense. Moving helium outside of this country was illegal without a special license. I attempted to acquire one and received the proper paper work from the various offices of the Department of Defense and the Department of State. The bottom line that stopped my move of helium was that all the laws still listed Japan as an enemy or at least a security risk. Walt found a way. Oddly enough, once on board the *Fuji* I noticed that the helium used by the weather service men of Japan came from the U. S. Navy.

A LETTER

NATIONAL SCIENCE FOUNDATION
WASHINGTON D. C. 20550

November 7, 1967

AIRMAIL

Mr. William McGovern
Consul of the United States of America
Perth, Australia

Dear Bill:

We are fortunate, this year, to have Martin Sponholz of ESSA as the U. S. Exchange Representative to accompany the Japanese aboard the icebreaker, *Fuji*. Mr. Sponholz will be leaving here November 30 and expects to spend a few days in Melbourne to visit the International Antarctic Meteorological Research Center (IAMRC) and possibly the offices of the Australian National Antarctic Research Expedition (ANARE) prior to flying to Perth and thence to Fremantle to join the *Fuji* for her departure for the Antarctic on December 16.

While aboard the *Fuji*, Mr. Sponholz will carry out a program involving data collection of the lower 1000 feet of the atmosphere. This will be done by means of four kytoons (kite-balloon) that are inflated with helium, towed behind the ship and from which sensors are suspended that radio information on the atmosphere back to the ship.

In preparation for this work on board the *Fuji*, the equipment including ten cylinders of helium is being sent by air to Perth, where Mr. Sponholz will arrange for its transfer to Fremantle.

We have taken the liberty of sending this material to Perth in your care with the hope that it is not presuming on your past generous cooperation to our Antarctic scientists.

Best regards.

Sincerely yours,

Walter R. Seelig
Associate Program Director
International Cooperation and Information Program
Office of Antarctic Programs

END OF LETTER

It was the third Christmas season I found myself in New Zealand. New Zealand was a delightfully quiet country, not in a race with anybody. It had more than five sheep for every human and the people, called Kiwis, delighted in rugby, horse racing and beer. Their English, of course, was very British. Some said they were more British than the British.

Their wording was most striking. I remember being taken aback by expressions like, "I feel like the bottom of a bird cage." "I'll ring you up on the telli." I usually let an escort drive me lest I would be on the wrong side of the road. Valerie, always willing to drive, said on the phone, "I'll be glad to knock you up at eight."

Once I complained to the waitress at my dinner table at the Zetland Hotel, where I always stayed, that their usually perfect table setting was imperfect. Disgusted, oddly embarrassed, and very upset, my waitress appealed to Reggie, the hotel proprietor. He was now a very good friend and came to my table to inquire what my problem might be that caused such a trouble with one of his best waitresses. I assured him that there was no real problem but I had asked for a napkin. He then informed me that the proper word for the item I desired was called a serviette. Apparently I had just asked the waitress for female sanitary protection.

Everywhere I went beer was the chief beverage. The hotel I stayed at sported five taverns: a public pub in front of the hotel, a private pub in the back for password male members only, a separate tavern for women, a saloon where most racing wagers were settled, and the hotel lounge upstairs. Where ever I would go for a beer, once it was found out that I was a "bloody Yank," I never had to pay for the next beers. A beer was served in a small glass filled with a long garden hose with a pistol like tap. Everyone would stand around their beer, not touching it until considerable conversation was exchanged. Then without warning a person would say, "My shout" and everyone would chug their beer slamming the empty glass down hard enough so that the bartender knew he had to fill them again. "Another POME beer again then?" (Prisoner Of His Majesty's Empire)

Everyone was so generous. I was hiking over the open range hills along the Pacific coast of South Island and a sheep herder noticed me. He led me to a coastal cave in the rocks overlooking the violent surf, dug down in the sand and pulled out a bottle of cognac he was saving for a Yank. It was his way of saying thanks to the United States for sending troops to New Zealand during World War II to defend the coast from a feared Japanese invasion while their own soldiers were defending Britain in Europe.

I took a bus to Auckland and while crossing a desert in central North Island the driver saw a deer among the sagebrush. He shouted to all of his passengers, "Hold on mates" while he drove off the road and chased the deer down to kill it. After placing the carcass among the baggage, he returned the bus to the road and we continued to Auckland not losing a minute. The colonizing British introduced deer to these islands without predators. There was a bounty on deer.

I remember a lovely young family from New Zealand, Jock Grey, his wife and two young boys from Christchurch. They had me for Sunday tea once before I knew that "tea" meant a four hour eight course meal. They showed me a lot of the civilian life of normal kiwis, some horse racing, a bit of cricket, a summer fair, and lots of beer. The young lads were eager to see me return after my first winter and laughed when I could no longer tie a tie.

The real tragedy of international work is that so many good people help you and become exceedingly close to you and then when the journey is ended, you must say good-bye and rarely see each other again. After thirty years I must confess even losing the name of one beautiful couple I met on the way to Rotorua, a thermal region of New Zealand like our Yellowstone National Park and its many geysers. In Rotorua the geysers were right in the middle of the streets. This young man and his wife showed me all over the region. We went boating on a hot thermal lake, took in some Maori traditional dance shows, and of course drank a lot of beer.

Many American polar heroes went nuts over the beautiful women of New Zealand. I for one fell in love with their accent. More than just a few returning American sailors or scientists married kiwis. Some polar heroes led two lives with a wife in America and a lover in New Zealand. One had a heart attack in New Zealand but before he died, tragically, his wife, rushing to his bedside, had to run accidentally into his lover at his hospital bedside in Christchurch. In reality, polar men, whether en route to the Ice or returning from the Ice, simply were sexually hungry. I'll not claim to have lived without temptation myself, but I do remember Pastor Balge encouraging us in our college days of the importance of remaining loyal to your spouse even before you knew who your spouse was. That is the better act of true love. En route to meet the Japanese Expedition I was betrothed to Nancy. I was glad that my love to her was always true.

UNITED STATES GOVERNMENT
MEMORANDUM

December 6, 1967

TO: Office of Antarctic Programs
National Science Foundation
Attn: Mr. Seelig

FROM: Am Consul, Perth

SUBJECT: FUJI . . . . . Helium/Sponholz

Walt:

The ten tanks of helium arrived safely and were cleared yesterday. Wigmore and Co. of Fremantle (who will handle the FUJI again this year) will pick the tanks up from the TAA air-cargo office on Monday and take them over to Fremantle.

I did this without waiting for Sponholz since he is still among the missing in the East.

The Japanese Consulate General has called several times concerning the date he will board the ship, and just to give them an answer I have told them he would be ready to board the 10th on arrival. I remember in the past that the Chief of the Scientific section seemed to want his "boys" clustered soonest.

There is to be a large reception by the Japanese Consulate General at a Perth hotel and a shipboard reception in Fremantle. The Japanese Consulate General has looked to us (strangely!) for guidance in protocol and press/TV relations. Every effort to assist is being made. I'll have the new Captain of the ship (Honda) and the Chief Scientist up to the residence and to the office as in the past.

Several reports of unidentified flying objects have been made in the Perth area. I firmly believe it is Martin Sponholz and his helium inflated kytoon looking for Perth!

I must sling off in closing by announcing that we have had four days of 95 degree weather and that I spent four hours basking on a yacht at a fabulous sea and river cruise luncheon. We "feel" for you snow bound Washingtonians! Happy holidays.

Bill McGovern
American Consul
Perth, Western Australia

END LETTER

I paid tribute to the Avon River in Christchurch, New Zealand, walking its length within the town before boarding the next flight to Australia en route to the Antarctic and its greenless world.

7 December 1967 I arrived in Melbourne, Australia.

8 December 1967 I was a guest of the Department of Meteorology at the University of Melbourne and also the International Antarctic Meteorology Research Center. I discussed ways of exchanging data and raised the problems of getting live data analysis to the field stations in the non-operational seasons. It seemed the biggest hangup was our mutual militaries who dominated the communication systems. Rob Flint was proposing satellite up and down loops to computers back at Stanford. That would become the major communications tool of the future.

I would have to admit I was less than cordial with Professor Radok who I still believe stole our subsurface measurement program out from underneath us. That is the competitive way of science. I now was very guarded of my temperature and wind data.

9 December 1967 I arrived in Perth, and enjoyed a concert by the Seekers.

10 December 1967 The Maritime Self Defense Force Icebreaker *Fuji* arrived in Fremantle, the port city of Perth.

11 December 1967 I contacted the American Consular, visited the *MSDF Fuji*, and was invited to a reception given by the Japanese Consulate in celebration of the arrival of the *Fuji*.

12 December 1967 My meteorological equipment was taken on board the *Fuji*, I was given a tour of the ship and shown my quarters.

13 December 1967 I installed the meteorological gear in the Marine Geophysics Lab on the icebreaker, went to a formal banquet given by the Japanese Consular for the scientific party and the *Fuji's* officers. It was my first introduction to raw fish and chopsticks.

It was time to go South again.

CHAPTER 13
South Again

The voyage south on an icebreaker, though not as scientifically successful as the expedition to Plateau Station, gave to me the greatest understanding of this great white continent that swelled to twice its size in winter and then shrunk back to normal in summer. Engaged to be married to Nancy sometime the next boreal summer (I left the details to her, asking her to send me an invitation) I kept a diary for her. These are the descriptive parts of that diary leaving the mush that was so important to young lovers many years ago to the privacy of a good bonfire someday.

I have added description where I left it out of this long love letter thinking originally that Nancy would not be interested. In these cases I now mark the added paragraphs with the square brackets [ ] in order to give the reader the opportunity to interpret my memory.

A ship's log for my love, Nancy:

14 December 1967
ICEBREAKER "*Fuji*" in her berth at
Fremantle,
Port City of Perth,
Western Australia

Tonight is my last night on dry land. I find myself very much alone on a deserted beach of Fremantle with the waves of the Indian Ocean smashing the shore a little higher with each wave as the tide is coming in. This is not really a very good beach. It is all messed up with seaweed and a few dead crabs. Not far from me to the right are a group of old fishing sheds. No people. Well, one lad far off to the left is sleeping on the sand and, while walking over here, I passed an old man with a beard sitting on a crate, leaning back on one of those old sheds. It is not clear from my position if the shed is holding him up or if he is holding up the old shed.

The lighthouse at the harbor's entrance is also in view marking the river entrance from where the *MSDF Fuji* will be sailing out to sea in a short number of hours. My shoes and socks are off. I'm propped up against a boulder that is part of a dilapidated sea wall and am sitting on the soft sand along with a large number of sea gulls as the sun is setting. The ocean is an awe inspiring living thing. It has a most compelling lure. The sea's waves, with their rhythmic motion crashing onto the beach and moving in a smooth pulling fashion outward, beacon and my spirit says go.

What is in the sea? I don't know. As a little boy playing in the sand along Lake Michigan I easily would tire of building castles, but I never tired of just staring at the waves. A boy dreams of the sea. The mighty sea. The awful sea. And I guess nothing has changed. As you very well know

I'm still a little boy who loves the sea. At 9:00 A. M. tomorrow the *Fuji* sets sail. A few months ago when I was first asked to join this Japanese Antarctic Research Expedition (JARE) I spent a most prayerful evening and a sleepless night in debate with my heart. Then as the sea, the adventure, and the Antarctic unknown beckoned, I knew I had to go. Alone on this beach I am sure I must go. I want to go.

The sun has set. We sail tomorrow at the hoisting of the red and white "Rising Sun."

The first day
17:00
16 December 1967
35 º 12' South
109 º 28' East

On ship everything is very much like clockwork. Schedules are the absolute law here so I'm instantly thrust into a routine but will, of course, try to break it all every moment. The *Fuji* began Friday morning in somewhat of a hectic but well-ordered fashion as it prepared to leave its berth in Fremantle. I had breakfast with Capt. Honda and Mr. Murayama in the Captain's cabin. This will be an unbreakable routine.

A sailor comes and awakens me at 06:00 and checks at 06:30 that I will be ready for the Captain's breakfast. Right now I don't have the intestinal fortitude to describe breakfast but then that's jumping the gun a bit. I dashed off the ship to mail the last letters. When I returned, my work room, lab, and cabin were inspected to see that everything was well lashed down. It was, of course, more than needed, but the fear from the descriptions the roll this ship will take has made me quite cautious.

I then got all dressed up (well not really with vest but the traditional suit and tie). The departure was quite deliberate, slow, and with all the pomp and ceremony. All hands were on deck one hour before the ceremony. Many dignitaries from Australia, the Japanese Embassy, and the American Embassy were there wishing all of us well. The flag of the "Rising Sun" of Japan was slowly hoisted to the tune of their national anthem. This was followed by "God Save the Queen" in salute to Australia and the British Commonwealth and a short segment of "The Star Spangled Banner" in a salute to my country.

Streamers were tossed to the crowd and held by members on the ship and well wishers on the land. As the *Fuji* slowly eased away from the dock the streamers stretched out and eventually broke. Waving continued both on land and on the ship until they could no longer be seen. I must end my entry - I'm seasick!

The second day
07:00
17 December 1967
37 º 45’ South
108 º East

I survived the night and breakfast so far. Yesterday I don’t care to discuss. Today’s seas are a bit rougher as we’ve changed our course and now are headed almost straight south and expect to reach the ice by Christmas.

Plotting our position on the map each day seems to amplify our slow progress. Airplane travel has spoiled my view of travel. Even the slowest plane would now be welcomed. We are churning away at the fantastic speed of fifteen nautical miles per hour and bobbing like a cork all the way.

I try to spend as much time outside as I can. The fresh air and the beauty of the sea with a definite horizon to look at for a stable orientation sort of relieves the headache and nausea. The ocean is so blue - a great deep blue black. And where the wind and the ship churn it up a bit it goes from salt white into every color of the blue rainbow.

One good thing about getting seasick is that I got immediate attention and was served ice cream to settle my stomach. It’s a heck of a way to get ice cream but rather worth it.

The third day
07:00
18 December 1967
42 º 40’ South
106 º 48’ East

The third day I laid off the food as much as I could, just eating tasteful parts. Just what I eat is anybody’s guess. Much of it is quite foul tasting and gagging. Perhaps my seasickness is more a fear of eating. The day on the sea was a very warm and calm one. Only four and five foot waves and a gentle rhythmic roll of the ship.

I spent most of the day trying to get my instruments working and as could be guessed, it’s turning out to be one monstrous headache. Anyhow, the headaches of my work were enough to overcome minor problems like being seasick.

They show a movie here once a day but these movies appear just as bad as most American movies. In addition I cannot understand them, so, unless forced into it like the last movie about some Japanese hero, I’ll probably sleep.

Reports we’ve been getting from U. S. and Russian ships in the Antarctic are quite favorable, which is making Capt. Honda very happy. He lives by a schedule without fail and has even set the time of berthing at Capetown at 10:00 1 March 1968.

Today begins with a bit of foul weather and a mean looking gray sea, white caps and all, as we enter the roaring forties. The *Fuji* is taking its worst roll for my trip of about seventeen degrees or a sway of thirty-four degrees from side to side. If my little stomach survives today I guess I'll be ready for the screaming fifties.

The fourth day
07:00
19 December 1967
47 º 44' South
107 º 06' East

I survived yesterday quite well except, of course, I'm getting hungry and most of the food still is undesirable to me. One or two meals are fine but by now just the smell of the galley turns my stomach and gives me a headache.

Despite the bad wind and waves I attempted to test my kytoon system. After all kinds of frustrations with the language barrier and the Japanese desire to change my ways into theirs, I smiled and gave up. Bob Geissel told me about Orientals and "here lies the one who tried to hurry the East." It's so true. After about six hours of work that should have only taken about a half hour, not counting about seven hours I had put into the effort before I needed help, all failed. One kytoon was filled with helium, taken up on the helicopter deck, raised about five hundred feet by a fish line and deep sea fishing reel, all to be watched by most of the ship's company as the kytoon took one big nose dive into the turbulent sea. A $16,000 instrument was on the way to the bottom.

Of interest was the reaction of about thirty chaps all "lending a hand." They were quite sober faced and watched me very closely. I somehow knew they wanted to laugh but were too polite. So despite all my frustrations and in defeat, I deeply shrugged my shoulders, threw up my hands and laughed. Instantly they all roared.

[Three Japanese government scientists with meteorological research offices either volunteered or were assigned, I never knew. They were Ryoichi Ibe, Hiroshi Fukutani, and Michio Yamazaki. Also a meteorology professor from Hokkaido University took interest in my project and rarely missed a launch. These men were very faithful for the entire trip south until Showa base was resupplied.]

Inside I'm beginning to realize this is going to be a colossal flop. The experience and trip to me personally will, of course, be worth my struggle, failure or not. My government is not going to be appreciative of spending $16,000.00 for a worthwhile flop.

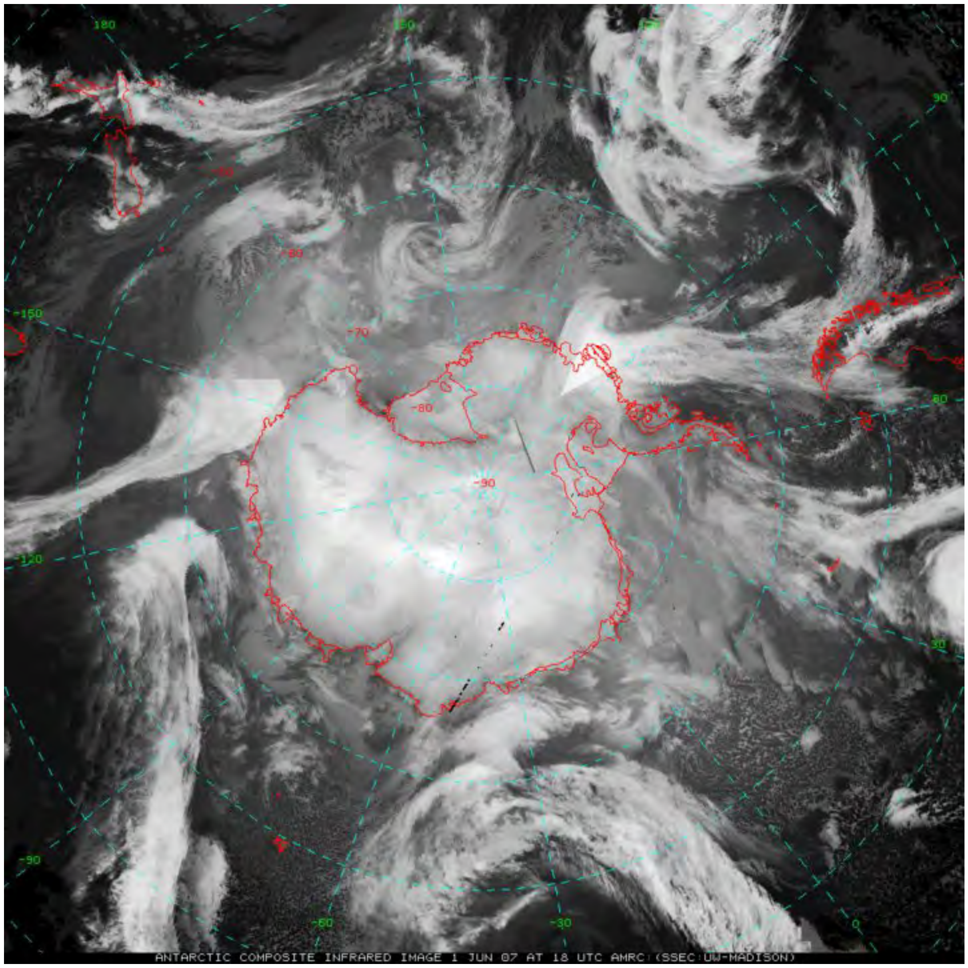
I suppose there have been worse mistakes but this whole thing is beginning to make me sick. And I'm told from now on the seas will get far worse than yesterday. Couple it all with the fact that I don't have anyone I can talk to, and this morning I'm perhaps as depressed as I hope I'll ever permit myself to get. I have no complaint. This is what I volunteered for and many others are in a far worse condition and even giving their lives for useless reasons.

The fifth day
19:00
19 December 1967
50 º 12' South
107 º 48' East

Today was a bad news day outside. High waves, much rolling, and rain. So being a fair weather meteorologist I did nothing.

The sixth day
07:00
21 December 1967
56.4 º South
106.9 º East

Sometime very early yesterday morning the *Fuji* crossed the Antarctic Zone of Convergence. This is a very interesting boundary in the sea.



ANTARCTIC COMPOSITE INFRARED IMAGE
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[It was a main objective of my research. The warm salty South Indian Ocean is the lighter or of the lowest density of the sea waters and rests on top all the way south to these latitudes. The colder, fresher or of much less salt concentration because of all the melted snow and ice from the mainland of Antarctica, and much denser ocean waters plunge beneath the surface and slide under the warmer ocean waters almost to the equator at great depths. On the surface this boundary is a dramatic climatic change and worthy of every risk and cost of equipment to measure and document these changes.]

[Outside, the thirty and forty foot waves crashed over the bow of the *Fuji*, and at times smashed against the windows of the Bridge. The helicopter deck was in a continual wash and the deck below, where I was expected to fill the kytoons with helium, was sealed with great sea wall doors and mostly under water as if the stern of the *Fuji* was a submarine. The winds were gusty to nearly sixty knots and the *Fuji* rolled continually as much as forty-five degrees to one side. In addition the *Fuji* pitched forward as much as thirty degrees, which brought much water over its bow and brought its two twelve thousand horse power screws out of the water with screaming sounds and vibrations felt in every part of the ship. All were tense. Weather research in these conditions was impossible. With a positive view I turned to the hope of capturing these weather data in calmer seas in the South Atlantic on the return trip. Any seaman could have told me, even before I joined the *Fuji*, that kytoon measurements in any of the high latitudes of the Southern Ocean were impossible. It never was calm here. That is exactly what the screaming fifties are all about.]

[These seas were not even known until 1578 when Sir Francis Drake comfortably sailed through the Straits of Magellan into the Pacific Ocean only to sail a little too far south into the screaming winds and waves which pushed his fleet back eastward through the unknown wide passage that now bears his name. A first description of these seas is given us by Francis Fletcher, a preacher on Drake's ship.]

> "For September 7 the second day after our entrance into the South sea (called by some Mare pacificum, but proving to us rather to be Mare furiosum) God by a contrary wind and intollerable tempest, seemed to set himselfe against us: forcing us not only to alter our course and determination, but with great trouble, long time, many dangers, hard escapes, and finally separating of our fleet, to yeeld our selves unto his will. Yea such was the extremitie of the tempest, that it appeared to us as if he had pronounced a sentence, not to stay his hand, nor to withdraw his judgement till he had buried our bodies and ships also, in the bottomlesse depth of the raging sea. . . ."
>
> "For such was the present danger by forcing and continuall flawes, that we were rather to looke for present death then hope for any delivery, if God almightie should not make the way for us. The winds were such as if the bowels of the earth had set all at libertie; or as if all the clouds under heaven had beene called together, to lay their force upon that one place: The seas, which by nature and of themselves are heavie, and of a weightie substance, were rowled up from the depths, even from the roots of the rockes, as if it had beene a scroll of parchment, which by the extremity of heate runneth together: and being aloft were carried in most strange manner and abundance, as feathers or drifts of snow, by the violence of the winds, to water the exceeding tops of high and loftie mountaines. Our anchors, as false friends in such a danger, gave over their holdfast, and as if it had beene with horror of the thing, did shrinke downe to hide themselves in this miserable storme; committing the distressed ship and helpelesse men to the uncertaine and rowling seas, which tossed them, like a ball in a racket. In this case, to let fall more anchors, would availe us nothing; For being driven from our first place of anchoring, so unmeasurable was the depth, that 500 fathome would fetch no ground: So that the violent storme without intermission; the impossibility to come to anchor; the want of opportunities to spread any sayle; the most mad seas; the lee shores; the dangerous rocks; the contrary and most intollerable winds; the impossible passage out; the desperate tarrying there; and inevitable perils on every side did lay before us so small likelihood to escape present destruction, that if the special providence of God himselfe had not supported us, we could never have endured that wofull state: as being invironed with most terrible and most fearefull judgements round about. For truly, it was more likely that the mountaines should have beene rent

in sunder, from the top to the bottome, and cast headlong into the sea, by these unnatural winds; then that we, by any helpe or cunning of man, should free the life of any one amongst us."

"Not withstanding the same God of mercy which delivered Jonas out of the Whales belly, and heareth all those that call upon him faithfully, in their distresse, looked downe from heaven, beheld our teares, and heard our humble petitions, joyned with holy vowes. Even God (whom not the winds and seas alone, but even the divels themselves and powers of hell obey) did so wonderfully free us, and make our way open before us, as it were by his holy Angels still guiding and conducting us, that more then the affright and amaze of this estate, we received no part of damage in all the things that belonged unto us."

"But escaping from these straites and miseries, as it were through the needles ey (that God might have the greater glory in our delivery) by the great and effectuall care and travell of our Generall, the Lords instrument therein; we could now no longer forbeare, but must needes finde some place of refuge, as well to provide water, wood, and other necessaries, as to comfort our men, thus worne and tired out, by so many and so long intellerable toyles: the like whereof, its to be supposed, no traveller hath felt, neither hath there ever beene, such a tempest (that any records make mention of) so violent, and of such continuance, since Noahs flood, for as hath beene sayd it lasted from September 7 to October 28, full 52 dayes."
(Francis Fletcher, *THE WORLD ENCOMPASSED*)

Continuing in my log: I was given a formal welcome aboard party since I now have sea legs. Masayoshi Murayama, the scientific leader of JARE and a famous mountaineer of Japan made a toast to a successful voyage for me. Zenbei Seino, deputy leader and a research meteorologist as I from the Antarctic Section of the Japan Meteorological Agency, made a toast to you [Nancy] and me for much luck and happiness and Captain Toshiharu Honda, Commanding Officer of the *Fuji* wished us many happy children. I drank to them all.

The rest of the evening each scientist took his turn at leading a song and when it was my turn I sang the Badger Fight Song. Only one chap understood the subtle change "if you want a little Badger . . . ." They all stamped their feet and clapped their hands to the rhythm. The decorations were many streamers and two huge flags, one of Japan and one of the U. S. A. Those stars and stripes sure looked good.

The seventh day
20:00
21 December 1967
59.1 º South
105.2 º East

We are considerably South now and are encountering our first icebergs. The sea is quite calm now and we expect it to be the rest of the way, with the worst over until the return to the

North again.

Each night I've asked about the movie and always get the answer, "A very good one; you must see." So, tonight, no exception, I'm not going to see it.

Tonight I've taught my second English class for the supply officer Commander Kayuo Takunaga. Nothing formal. Each night he prepares topics of discussion and we talk in English for thirty minutes to a full hour. I'm learning a lot about Japan and in the process he is improving his English. Poor chap, he's getting a touch of Milwaukee Deutsch accent and wrong English expressions.

Today, aside from being starved with the feeling of a full stomach facing Japanese food, I did manage to move forward achieving accomplishments with my instruments. I found several shorts in the systems, corrected bad connections and rebuilt one system from extra parts that I hope will work better than the standard systems. Here's hoping for a major effort tomorrow and the next six days to come until we reach Showa. This far south we're getting almost twenty hours of sunshine so I'll be able to put in a few good days of kytoon work. And since I don't eat much food I'll not waste any time.

This is not a good attitude toward their food, I know. To my Midwest American taste the sudden seafood diet, with all fish meats raw, the smells, looks, and tastes in most cases are repulsive. I am no longer getting seasick, even in the roughest seas but the strange foods keep me gagging. I'm hoping to get hungry enough. Then I'm sure the food will get better and better.

The only food I enjoy is the fresh food, but today they issued vitamin C and anti-scurvy tablets. Our fresh food supply is probably running out for us. I'm sure they have a store for the wintering personnel the *Fuji* has come to replace and evacuate. It was such a thrill to us of the American wintering team last year at Plateau Station when we received the same.

The eighth day
22 December 1967
61 º 30' South
103 º 36' East

Mentally, this trip I'm finding is the toughest road I've had to travel and I long for its end. [The cultural shock was wearing me down. Equipment failure added a great deal to my depressions. Missing Nancy, an enjoyable connection I did not have at Plateau Station, gave its own pain.]

The ninth day
23 December 1967
62 º 25' South
94 º 06' East

Today I must pick up the pieces of yesterday. The sea is calm but polka-dotted with icebergs. The splendor of the ice dominates the view all around. The contrast between the snow white tabular icebergs against the deep blue sea is magnificent. Our closeness to the continent is evident from the great number of birds now following the *Fuji* in search of an easy catch of fish in the wake of the ship.

With the *Fuji* entering this new sea condition, another project time for observation was upon me. With every determination I thought I had, preparations were carefully made. My wind sensors to this point had not given good results but early yesterday morning the kytoons were filled, all taken up on to the helicopter deck and launched. Every move was fully documented in about fifty different colored slide cameras by chaps coming out of the ship's woodwork. Needless to say, I had more than enough help and the three meteorologists assigned to my aid were quite inspired by all the excitement this launch created. So you might say I finally achieved my traditional vigor necessary to accomplish anything in these awful cold conditions.

Many minor faults with the instruments were still evident. The wind sensors never worked. The kytoons flew quite stable but the transmitter signals were poor. Suddenly, before any significant data could be collected, the weather turned foul. The captain slowed the ship for me, something he hadn't done for any of his own scientists, and more and more men aided to try to haul down the kytoons by hand when the wind pulled them too high with forces beyond the strength of my winch. After more than an hour with all human energies expended from every sailor and scientist available the instrument package beneath the kytoons seemed in easy reach when the line broke and we all watched another $16,000.00 fly away into the free and high atmosphere.

I guess the American taxpayer won't miss a few thousand dollars here or there but this failure leaves me with only one system left. I hope I can put a second system together with spare parts. Antarctic programs are designed to suffer loss and damage and always, somehow, some data is received. So far without working wind sensors I have nothing.

Nobody laughed this time. The cup of failure is a very bitter one. The Antarctic is cruel and cold!

The tenth day
24 December 1967
63.0 º South
83.5 º East

Yesterday was rice pounding day. It was quite a festival. The cooks prepared a large quantity of Japanese cooked rice. Wooden hollow logs were taken up on the helicopter landing pad of the ship and placed on bamboo mats. The rice was poured into the log bowls and pounded with huge wooden hammers. All of this was done ceremonially in a ritual dance with some of the participants in costumes. Eventually everyone on the deck took a turn but most of the pounding was done by the chief scientist, the Captain, the second commanding officer, and me. I guess we were representing chieftains of olden times. It was very much fun except, by always being involved in all the action, I'm missing out on many good pictures. The rice turned into a substance that in my experience I would identify as bread dough. They called it rice cake that is eaten as is with cinnamon normally on New Year's day. Since we will be hammering through the toughest ice on New Year's we celebrated yesterday.

Christmas Eve

Tonight I find myself very much alone. The two Christmases before this one have been the same with Antarctica being the principle reason for letting me very much alone with my God. [Christmas '65 I was enroute to South Pole Station before the big trip to Plateau Station. Christmas '66 I was en route home from Plateau Station and trapped in airports by overbooked airlines on the holiday and blizzards moving across North America.]

Later this morning I had a haircut. Three chaps worked together and somehow figured out how to cut it.

Earlier this evening out of polite courtesy I visited several "Christmas" parties taking place on the ship, but managed to slip away during the movie. [I was given strict instructions by people in the State Department back in Washington D. C. that the Japanese were very class conscious and that I should make friendships only among the scientific corps. This was nearly impossible to do. My research studies required the full cooperation of all the military, at times even disrupting the ship's plan of the day. The weather officers and helicopter pilots all spoke English and had to for their helicopter operations. Some were even trained at Great Lakes Naval Base north of Chicago. These military personnel were the best English speakers. The scientists were, of course, very interested in my research and because of their planned traverse to the South Pole via Plateau Station I had much to offer them. The enlisted sailors were harder to communicate with, but they did all the hauling and heavy installation of my equipment and I was always grateful with smiles and a polite exchange of bows.]

The Japanese have become very westernized since World War II and have copied many traditions from Americans. One of these copied traditions was the celebration of Christmas. Yes, America has taught her well. Christmas is for eating, stuffing one's self, drinking until one can't anymore, and occasionally shouting out Merry Christmas without any spiritual meaning. What would Shintoists or Buddhists know of Jesus Christ as Lord and Savior?

[I did know my official place. I was Antarctic Representative of the United States with JARE.] I first attended Captain Honda's Christmas dinner, was given the chair at his right with both flags, Japan's and America's, behind our table. A huge roasted whole turkey was served making hashi (chopsticks) almost useless. Now what? Captain Honda used a military knife and sawed off one leg. Captain Matzushima, the second in command, also used a military knife and took the second leg. I was next. I poked free a small piece of nearly blood red meat with my hashi, won a great laugh and applause for now being a little efficient with hashi. I toasted our mutual peaceful exchange of work in Antarctica, bowed and excused myself to the scientific corps. My visit to the officers' mess was well received.

Christmas dinner for the scientists was about the same. My chair was in the place of honor between Murayama and Seino. All ate heartily and we played a few games of caroms. Most players limited themselves to about thirty seconds before the board was cleared and if they did not win by that time, it was a draw. Sensing that individuals were compelled to play with me at my novice speed where I needed to look where I was snapping my fingers, I correctly faded away.

I sought privacy that Christmas eve but before that was allowed, an enlisted man, obviously in the wrong part of the ship, handed me a card with a nativity scene but could not express himself in English. I followed him to the enlisted hammocks and crowded sleeping quarters to be greeted with a few beers from Sapporo. We sang mostly a number of Christmas songs; those present listened. I felt it was a genuine meeting of Christians but none of us could find common words. When my presence became known, of course, many others joined in and brought much more beer and soon our party was not much different from the officers or the scientists. I thanked them all for the cold, wet dedicated work they gave my research study and wished them all a Merry Christmas.

[Nonetheless I did prefer seclusion on this sacred holiday night.] I went outside on the main deck where I could be alone. Out on the deck looking back at the long white foam trail our wake left in the sea filled with tabular icebergs, it was very quiet and cold. The wind threw salt spray back at me; and, in time, my coat, nose, and ears had icicles hanging from them. This wet cold, though only tens of degrees below frost, seemed to cut through to my skin faster than the dry cold of Plateau Station.

Out over the sea itty bitty dark blue black birds about half the size of a sparrow were flying close to the water in between the waves in order to stay out of the cold wind. Where were they headed? What were they doing in these waters? Were they looking for fish? Were they flying to another iceberg to nest? With deliberate determination a wandering albatross with more than a twelve foot wingspan followed our ship for more than five hundred miles and remained about twenty yards behind our stern to the port side. He seemed as lonely as I. After several nights of talking to him, I now consider him a good English speaking friend! Well, an excellent listener. It is amazing how God's creation has planned for the care of all these, even out here where it seems so desolate.

The bright daylight of the midnight hour brings to mind the shepherds on this night long ago. What a wonder that night must have been to be stirred by such a brilliant light and beautiful anthems by angels. It is no wonder they trembled. But how joyful it must have been. They believed and hoped that someday the Lord would keep His promise and send a Savior. And, oh, that night He had done so. Jesus Christ was born. What a blessed time to have lived and oh how blessed we are now to know this has come to pass. Truly a peace with God rests on the earth. The Savior has come. It is truly a Holy night. It always must be. It always will be.

After awhile an officer found me alone on the deck. He came out and encouraged me to come into the ship for the many parties. I politely bowed but refused. He came out several more times and our bowing repeated. It was cold. I was tempted. But I wanted to be alone with my God. He finally asked me, "Are you a Christian?" I never before was asked that my entire life. Was I a Baptist, or Catholic, or which variety of Lutheran, but never if I was Christian. I had to stop and think if I really was. Then I finally answered, "Yes I am." He deeply bowed, walked backward into the ship and I was never bothered again. In fact, several hours later, when I did become cold again after a long warm surge while singing to my albatross and my God all the Christmas hymns I knew, and I went back into the ship, every corridor between the deck and my cabin was suddenly silent and remained silent the entire next day. The Japanese, whatever their religion, honored my worship time and my God. I was given His birthday for personal worship. It was one of the most meaningful days of prayer in my life.

The eleventh day
Christmas Day
25 December 1967
64 º 08' South
73 º 04' East

Today was a bad one. Most members recuperated from last evening. To most members, grief came with the bad weather. We've met somewhat of a blizzard out here in the open sea. The ship's speed has been reduced since radar and snow don't go together for aiding iceberg detection. Visual sighting of the icebergs in the blinding snow at times seemed more accurate than the electronic devices of the Captain's tools. The high winds added to the returned rolling of the ship that made a few Christmas cheers of the previous night less cherry for many.

I spent the day with concern over my instrument system, particularly the wind measuring devices. I'm near giving up hope on ever making the wind sensors work.

I'm also beginning to become concerned over myself. I've lost twelve pounds in the last five days and now hit the scales at 130 pounds.

The twelfth day
26 December 1967
65 º 15' South
57 º 20' East

We have sighted the great white continent today and are now steaming off the coast of Enderby Land with her mountains visible through telescopes. We are expected to reach the pack ice in a few hours. The helicopter pilots are itching to get into the air for reconnaissance flights and I'm hoping to try another blast at the kytoons when we do reach the ice. I rather troubled the troops at the Captain's breakfast this morning. With my desire to make kytoon observations while moving through the pack ice, it does interfere with helicopter operations. Research about weather seems to have a low priority in any man's military; yet weathermen are expected to be correct with their forecasts without fail.

The captain now will be limiting my operations to only nonscheduled times. The scientific leader also informed me that my help may be limited as their own research will be taking precedent. Where is Flint's two-by-four now?

The thirteenth day
27 December 1967
66 º 22’ South
45 º 50’ East

The ice pack we were to run into never came. Later helicopter reconnaissance showed no pack ice to speak of all the way to Showa. It is good that the *Fuji* won’t get stuck here in the ice for a long trapped winter but also we will be steaming into Showa in about two or three days and I won’t be able to get any pack ice data.

Today was a long day with many setbacks but some small gains. Over long hard hours and with much manpower, I finally received clear wind data through my radio transmitters from the kytoon instrument system. I will turn this research into a project that will focus on wind and temperature profiles near the Antarctic coastline.

I feel most sorry for the poor chaps that have been assigned to help me. I am cutting into their free time and there is so little I can do to help them in return. I have joined in with the weather officers learning and teaching polar weather during their now twenty-four hour intense weather watch. We have twenty-four hours of sunshine and the helicopter pilots will be in the air around the clock. [I was back across the polar circle, pumped up, flying high, and loving every exhausting hour. I was even getting hungry and started to eat my rice and some fish heartily.]

[An incident occurred during one of several lectures I presented to the scientific corps on the *Fuji* about the United States Antarctic Research Program. I was describing the size of McMurdo Station and received many questions pulling me into giving much information about “Nuki Poo,” the nuclear power plant maintained by the United States Navy. I certainly had no fear of betraying any secrets about nuclear power. I simply didn’t know any.

“Nuki Poo” was designed as one of Eisenhower’s “Atoms for Peace” projects and was supposed to provide unlimited nearly free heat energy to this largest station on the coldest continent. During its entire lifetime “Nuki Poo” never produced stable and reliable quantities of heat. Either it produced too much heat or not enough. The Navy began to rely more and more on normal diesel fuel burners.

I suddenly was verbally trapped with cameras suddenly whirling and recorders taking everything down as I was compelled to answer why it was that a peaceful heating system was so difficult for American scientists while the atom bomb was so easy to make. Remembering whose flag I was a representative for but also on whose ship I was sailing, I stammered for a bit. My personal antinuclear views would have been the easiest to speak but I was not an individual here.

I remember being part of a protest group in Milwaukee giving retired President Truman a hassle about dropping the bomb and vaporizing innocent families, nonmilitary men, women, and children of the cities of Hiroshima and Nagasaki. President Truman silenced our loudest protesters by engaging us all in asking if our fathers or brothers were in the military. I had two brothers and an uncle in uniform during World War II. Truman reminded everyone at his speech that the children of the fathers en route to Japan would never have been born and they would not have the privilege of the protest. “I ordered the bombs dropped on Japan because they were bad. I’d do it again. We were at war.” End of subject.

On board the Maritime Self Defense Force *Fuji*, which carried at least one officer who was a frogman put ashore at Pearl Harbor a couple of days before December 7, 1941, to give radioed directions to the invading bombers, I began to explain that my brothers, Ray and Dick were in the U. S. Navy en route to Japan. I made jest and dragged out a story about my Uncle Edgar’s outhouse on a farm near Ixonia, Wisconsin grappling for thoughts to express a view of our two counties at war. Uncle Edgar, a very humble man never known to brag or even tell of any achievements, displayed in his outhouse several plaques presented to him during the war when he was a civilian working in a defense plant. These plaques clearly showed how “innocent civilians” simply were not innocent when nations were fighting each other in a global conflict. Considering how armies are universally raised by a draft or forced conscription, and I couldn’t even be on the *Fuji* without the permission of my local draft board, I’m not so sure one can claim soldiers as guilty as civilians are innocent. What does a draftee personally do in his routine life making him a worthy target more so than the mother or father at home making the munitions or wrapping the supporting food for the soldiers?

I found the strength to tell all my shipmates that we were at war. Both sides greatly lost. I told them I never could make apologies for my country’s choice of weapons while it was being fired upon. It was the responsibility for all of us in the scientific community to wage the peace as we were doing immediately right there sailing south.]

The fourteenth day
28 December 1967
67 º 20’ South
41 º 30’ East

At last the instruments are all working fine. Every system is ready to go. My helpers and I are probably exhausted from some of the kytoon launches we have recently achieved, but we remain very enthusiastic over the prospects to come. We have entered some thick pack ice and an interesting study could be made. The Japanese Navy is repairing helicopters all day. They are working in shifts around the clock so we can’t even hope to out-last them. [I was corrected a thousand times by my Japanese friends. Japan has no Navy. “We are with the Maritime Self Defense Force.”]

We are being given a rest at the end of this round of the meteorology program. We may visit Showa today by helicopter, Capt. Honda, Mr. Murayama and me. Perhaps the day after tomorrow the ship will get there.

Some pessimism exists with the prospect of nothing to do until 20 February. I’m sure no one in D. C. realized that the icebreaker would stay at the base so long. The interest in travel with the *Fuji* was with the hope of ninety days of sea duty. Two weeks in and out of the ice is going to leave me with only seven days for the whole affair for kytoon ascents. The weather has been poor,

at times violent. The Navy operations during the good weather of necessity had to be too busy.

I guess if the ice conditions had been worse, all activities would have been at a somewhat slower pace and the Navy's schedule might not have been so crammed. It looks as if I'll get many pictures now.

The fifteenth day
29 December 1967
67 º 52' South
41 º 05' East

My complete frustration over my inability to obtain as much kytoon data as I wanted because of Naval operations is overshadowed by the excitement of breaking the winter isolation of Showa by helicopter. It was just like the day at Plateau Station when my winter of isolation ended, only this time I could see the wintering party from the outside. Maybe they didn't speak English, but these fourteen men finishing the long winter reacted the same way we did. Man, I must have really been raunchy.

Also, we're stuck! The *Fuji* met its thickest ice in its history. Hummock pack ice, in places stacked as high as the main deck, stopped us dead in our track. The winds and currents also closed our broken ice path from behind. We are going nowhere! Up to this point, it took the *Fuji* the last eight hours to progress 300 metres. We still have about sixty nautical miles to go. It could get interesting. Anyhow, it gives me more time to launch my kytoons and gather data.

The sixteenth day
30 December 1967
67 º 52' South
41 º 05' East

If it were not so early in the summer I'd begin to worry a little about our wedding next August, but right now the *Fuji* remains motionless. The pack ice I mentioned yesterday was exactly the same when I woke up this morning and is exactly the same tonight. We expect to be stuck here a number of days and are hoping for a storm to shake the ice loose. Warmer weather wouldn't hurt.

Idle moments were spent watching the gathering colony of Adelie penguins who have come to laugh at our predicament in their ice. They are just the most fascinating playful birds in the world.

The seventeenth day
31 December 1967
67 º 52' South
41 º 05' East

No movement!

The eighteenth day
1 January 1968
67 º 52' South
41 º 05' East

Happy New Year. This time my headache is not due to the sea, and I cannot blame it on sushi. I'm recovering from somewhat of a hangover and mostly exhaustion. I enjoyed a most restful seventeen hours of uninterrupted sleep. Yesterday many of my prayers were answered. I had excellent kytoon soundings all day long. Everything worked well.

We are also excited about an invading blizzard bringing much contrasting weather from the tropical north. I joined many of the reconnaissance helicopter flights that surveyed the ice between us and Showa. Some of the distinctive icebergs were "bombed" with red dye to show favorable routes once the coming blizzard loosens the pack. Also, I went along on a sea surface traverse to observe the Japanese efforts at dynamiting critical ice jams.

The penguin colonies appear to be breaking up - a sure sign that the blizzard is coming. One group of penguins were the majestic emperors. Admiral Honda claimed that now the emperor penguins were having a conference as to whether or not we would be given permission to go forward to Showa.

Yesterday, while meditating prayerfully on the helicopter deck all alone, I noticed a new white flag with two red cherry blossoms. That meant Captain Honda was promoted to Admiral. I was not told, but by the activity on the ship I figured there would be an officers' party celebrating. Formalities probably precluded an invitation to me. I dug out an ancient pair of worn-out dark blue socks. They were a pair that sort of crawled under my heels in my shoes when I walked a lot. I cut the best sock into a blue flag, pasted two white stars on it [a symbolic U. S. Navy admiral's flag] and taped this flag on the neck of a bottle of Japanese beer. I needed a personal touch. I steamed off the Japanese beer label and replaced it with and "honorary Schlitz from Milwaukee" label. As an uninvited guest, I crashed the party. My admiral's flag went over as a smashing success with Admiral Honda and won a great many cheers from the men of the Japanese Self Defense Force.

[During the long hours of drinking while celebrating the coming new year, between songs and games, conversations got louder and louder and suddenly an English voice, English too clear to be friendly but probably well rehearsed, asked loud enough for all to hear about my personal views on Vietnam. I had been sucked into the question of nuclear power several days ago. I was not caught off guard. I also could identify the Japanese newsmen on board. I spoke not a word of my anti-war activity in Madison. I simply stated that I believed they all knew my country was engaged in military activity in Vietnam that indeed was a war to the participants, and I prayed for an end to the hostilities in such a way that would support the Vietnamese people's desire to govern themselves. I couldn't answer any better than that since both they and I were at sea together and out of communication with the day-today happenings in the world. I'm not so sure this "correct" answer was a truthful answer but it was the best I could give.]

Today the blizzard blows. Tomorrow we try to sail again.

The nineteenth day
2 January 1968
68 º 14' South
39 º East

With the *Fuji* virtually stationary, we are moving with the drift of the pack; Admiral Honda has ordered an airlift to Showa. All food stores and light equipment will be shuttled to Showa by helicopter. All Self Defense Forces are very busy and tense. I didn't speak very long to Admiral Honda so I'm not sure if we are abandoning hope of ever getting to Showa by ship or not. We are still very tightly locked in the ice.

At lunch, Nancy, I was presented with your 21.5 birthday cake.

Day #20
3 January 1968
68 º 40' South
39 º East

The *Fuji* is propped up on the ice partly out of the water. We wait for the ice to melt. The airlift continues. I took a ride on one of the helicopters today and inspected the meteorological facilities at Showa performing my role as U. S. Representative to the Japanese Antarctic Research Expedition.

Day #21
4 January 1968
68 º 40’ South
39 º East

Again with pathetic and futile efforts we tried all day to ram our way through the ice from a different spot about a mile father away from Showa. Admiral Honda hoped that this new spot would provide an easier way after the storm a few days ago. Efforts went very well for about two hundred yards, but now we are worse off than before. For no gain the *Fuji* backs up two miles and rams the solid ice front that is 3.5 metres thick. Making matters worse, another 1.5 metres of snow cushions the impact and no advance is made. The back and forth ramming operations are now twenty-four hours, stopping only for landings and takeoffs of the twenty-four hour air lift.

Zensin bisoku
Zensin hansoku
Zensin kyosoku

Ryogen tash

Kosin hansoku
Kosin kyosoku

Ryogen tash

Day#22
5 January 1968
68 º 40’ South
39 º East

[In angry frustration I wrote:] Mark this day as the end of the kytoon observation or at least all planned programs. The last and perhaps most important of the planned observations were kytoon flights during the final approach to the continent. Our long wait while the *Fuji* was stuck in the ice allowed me the time I prayed for to get all systems working after long hours, sleepless nights, and frustrations of the four other Japanese meteorologists assisting me.

Everything checked out well even in flight; so today we have found a successful spot which the *Fuji* managed to break through after thirty-six hours of ramming and battering. But now still heavy fast ice [the frozen ocean that holds fast to the land as opposed to hummocked or large chunks of ice piled high by wind and current and frozen together] will continue to strain the engines of the ship. This produces tremendous fluctuations in the electrical power source and makes it impossible for my receiver and recorder to interpret the signal from the transmitter of the radiosonde hanging down from the kytoon.

Slowly ahead
Half speed ahead
Full speed ahead

Both engines stop

Half speed reverse
Full speed reverse

Both engines stop

Since the ship's engines will be that strained from now until we reach Showa base, and the return trip will be a mirror of the same, and knowing that the Antarctic convergence zone is always violent (Admiral Honda claimed this year's passage was near calm) I now must face the fact that I've failed. To fail so hopelessly really humbles a man. Sort of like failing a test, only now it's so much more that a person can fail or lose than just a course or a couple of credits. Had it been a failure at the forecast table, the lives of people in an aircraft or a ship would have been at stake.

Nothing lost but a few tax dollars, some personal pride, and probably the loss of faith that others may have had in me. Failure does leave me so alone.

[Thirty years later I can add that this is the essence of polar work, a continual feeling of total failure rapidly replaced by euphoria only to crash once again. Fridtjof Nansen, while struggling over a decision to depart from his ship the *Fram* and race to the North Pole wrote:

> "This expedition to the north, then, is provisionally decided on. I shall see what the winter will bring us. Light permitting, I should prefer to start in February."
>
> "Sunday, November 18th. It seems as if I could not properly realize the idea that I am really to set out, and that in three month's time. Sometimes I delude myself with charming dreams of my return home after toil and victory, and then all is clear and bright. Then these are succeeded by thoughts of the uncertainty and deceptiveness of the future and what may be lurking in it, and my dreams fade away like the northern lights, pale and colorless."
>
> " 'Ihr nacht euch wieder, schwankende Gestalten.'"
>
> "Ugh! These everlasting cold fits of doubt! Before every decisive resolution the dice of death must be thrown. Is there too much to venture, and too little to gain? There is more to be gained, at all events, than there is here. Then is it not my duty? Besides, there is only one to whom I am responsible, and she . . . ? I shall come back, I know it. I have strength enough for the task. "Be thou true unto death, and thou shalt inherit the crown of life.' "

"We are oddly constructed machines. At one moment all resolution, at the next all doubt . . . . Today our intellect, our science, all our "Leben und Treiben," seem but a pitiful Philistinism, not worth a pipe of tobacco; tomorrow we throw ourselves heart and soul into these very researches, consumed with a burning thirst, to absorb everything into ourselves, longing to spy out fresh paths, and fretting impatiently at our inability to solve the problem fully and completely. Then down we sink again in disgust at the worthlessness of it all." (Fridtjof Nansen, *Farthest North*, New York: Harper & Brothers Publishers, 1897)]

Day #23
6 January 1968
68 º 40' South
38 º 48' East

Setback after setback but each new day a new hope. Someone just doesn't want me to fail this trip. Each time I abandon hope, the next day or even the next hour I'm always given another chance. I've learned a lot in the last prayerful night. I'll not ever give up hope again. Then fail or succeed, I'll know I'll never quit. This afternoon I learned that the bad electrical conditions of last night were only temporary and most problems were corrected by midnight. I wasted a good night. But also, while I had given up, the *Fuji* again met bad ice conditions and again we appear to be delayed one more day.

This umteenth second chance can only be a gift from Above. Sometimes I wonder if a person would pray as fervently and as earnestly during good times as he does during bad times if the bad would ever come. Sinful man that I am I don't learn very well.

Day #24
7 January 1668
68 º 40' South
38 º 48' East

Successful kytoon soundings were taken nearly continually from most of last evening throughout all of today. I'm going to try to get about six hours of sleep and put in another thirty.

Day #25
8 January 1968
68 º 40' South
38 º 48' East

The *Fuji* is progressing about four miles per day. We have a stop now because of some main engine damage. Five kilograms of dynamite give no impact on the ice. A trail party is surveying on foot for weak ice two miles ahead of the ship. What first appeared to be a very easy year for an icebreaker has proved to be the worst ice conditions Admiral Honda has handled.

Zensin bisoku

Zensin hansoku
Zensin kyosoku

Ryogen tash

Kosin hansoku
Kosin kyosoku

Ryogen tash

Day #26
9 January 1968
68 º 40’ South
38 º 48’ East

A day that can end in sleep.

Day #27
10 January 1968
68 º 54’ South
39 º 00’ East

For me, my mind is a problem. Depression of the worst I’ve known has set in. The worst blues at Plateau have been surpassed. The one year in isolation is collecting its toll on me now. It did teach me to be a self analyst, but, of course, that never solves any problems. At Plateau Station Bob Geissel perhaps was most sensitive and emotional; second perhaps was me. Rob Flint presented steady solutions. That might explain why so often we loaned each other our patient ears, time, and strong drink. Problems were never drunk away, but they definitely were talked to death.

On the *Fuji* I have no such outlet. The last conversation of any kind with length and depth where I was free to talk as I pleased was perhaps with you [Nancy] on the telephone just before I flew out of Travis Air Force Base in California or Jock Grey with his wife and children renewing what happened in New Zealand over the last year and the progress his two boys were making in elementary school.

The language barrier is a real one. Most of the time talking is nearly impossible. [The Japanese are so polite that they never would verbally disagree. Yet if they did disagree they simply would not assist with my request or respond to my plans. Though many men here have sacrificed much for my comfort and for my research project, my work, dependent on the changing weather, did not fit well into rigid schedules. I was always assured of help. Too many times major operations were underway where it was wrong of me to expect assistance. But they would never tell me in advance. Some of this was language, some was culture.]

Perhaps the worst now is my own state of mind with no one to confide in. Even prayer [with my weak faith] only [seems] to intensify my frustrations. These next two months could be hell. I have learned a little of the reason so many of my Antarctic predecessors, despite the lure and their return time after time, have each time cursed this place.

Day #28
11 January 1968
69 º 00’ South
39 º 06’ East

Today, as in many of the past days, we spent backing up two miles, charging, smashing, maybe breaking another twenty yards of ice, maybe not, and backing up again. Sometimes unable to go any farther, a tractor train with several sleds and a party of five go out on the ice with drills to find a thinner place. When they return, we back up several miles and angle off in a new direction. We make a little better speed for a short time and then are back to charging and backing repeatedly again.

Slowly ahead
Half speed ahead
Full speed ahead

Both engines stop

Half speed reverse
Full speed reverse

Both engines stop

Showa was sighted the first time today from the ship. The last frontier is not Indians meeting you on the beach, or natives coming out of the jungle, or a trapper’s shanty, but a bunch of radio antenna towers.

Day #29
12 January 1968
69 º 00’ South
39 º 30’ East

We went ashore on the coast of Antarctica today - Prince Olav Coast across the Strait of Ongal from Showa Base. All day I joined the crews for much physical labor so I am tired and really enjoying my rice beer. Most of the Japanese went to bed. That’s just not the Milwaukee way.

The heavy equipment and traverse vehicles for Mr. Murayama’s trek to the South Pole early next October to December were off-loaded on this coast. Tomorrow eve we may get to Showa.

Day #30
13 January 1968
Showa, Antarctica

I am tired, exhausted, sunburned, and frost bitten. It's fantastic to be in the Antarctic again and on solid ground. [Different from Plateau Station, Ongal Island was true ground - mixed sand, gravel and striated bedrock were the stuff of the exposed ground.] We steamed into Showa today amidst tons of fireworks blazing in the twenty-four hour sunlit sky. All rocket blasts were answered by long, loud, low toned blasts on the *Fuji*'s mighty horn. We celebrated by eating soybeans, dried octopus and beer.

When the beer was gone, we constructed a road which by tonight and over the next several days will be used to truck and man-haul tons of equipment into camp about a mile from the ship. I was begged to come for a night snack, which I usually had earlier avoided not appreciative of raw fish or squid. I gave in after much pleading. They celebrated with hot dogs. I devoured eight. The story about the number of hot dogs that I ate reached legendary proportions in Japanese.

Day #31
14 January 1968
Showa, Antarctica

I just finished a very long day working with a construction crew. I am now getting hungry as they get hungry. I am learning their grunts. I tire as they tire. It's funny. My brothers were trained to kill these chaps. I am building a station in an unclaimed land with them. Who will our children learn to love and hate?

The Navy [Japanese Self Defense Force] only handles the *Fuji*. All construction work and all work on the land are done by the scientific party or other civilian workers. I have no way of knowing if some of the civilians are nonscientists such as paid construction teams. My guess is that they all are of the scientific corps. I have always attempted to work as much in the hard labor of the scientific team as I can while not compromising my own program. Many times I do miss assignments simply by not knowing what is going on.

Day #32
15 January 1968
Showa, Antarctica

I just learned that we've got ten to fourteen days left at Showa before the *Fuji* takes off on a surveying mission mapping many places on the coast. This is just another piece of information that seemed to have been planned long ago by the Navy but not conveyed to the scientific corps or to me. Admiral Honda has been most cooperative and has answered all of my questions, at least when I could find the words to express what I needed to ask. Hang the NSF or State Department's directive to speak or deal only through the scientific corps.

After breakfast a short nap, then check the Navy's weather charts, do some personal reading, remodel my kytoon sounding system and calibrate it and rewire the remaining supply of radiosondes.

By 10:00 I joined the Admiral and Mr. Murayama to visit the traverse party returning from Plateau Station. They now were within helicopter range and for this exploring party we would be the first group of their countrymen that they would see in a year. It was a welcome reunion for many. [On the plateau near our coast I took note of the very strong down sloping cold winds coming from the interior. At Showa no strong katabatic wind effects were noted. This was a puzzle until I finished the analysis of my kytoon soundings.]

After lunch I was back at the construction work. I am learning all about mixing concrete, making gravel when you don't have any, bending huge iron rods for concrete reinforcement, and building forms for the concrete. I had the most fun getting wet separating smaller stones from larger ones in our gravel maker as well as heating iron hot enough to hammer it into desired shapes. The rhythmic work, without the need to do much mathematical calculations, permitted me to break into a lot of whistling and singing.

A late supper. Nearly all the scientists are exhausted. For myself tonight and my helpers I hope we will launch kytoons and kytoons and more kytoons. I plan to launch a kytoon every four hours for a three hour flight until we can't anymore.

Day #34
17 January 1968
Showa, Antarctica

Physically exhausted and really hungry.

The only way to describe Showa is to call it a cesspool. It is the most decrepit and depressing place I have seen outside of some slums of Chicago or New York City. This station was built in 1956 as many other U. S. and other foreign stations were for the IGY. However, the Japanese abandoned Showa in 1962 and apparently that is when the station was let go to pot. Showa was reopened again in 1965 but little was done for the station's outward appearance. The Japanese leadership today is doing its best to greatly improve things.

A few new buildings were added, but the litter, glass, junk, garbage, and human waste are piled high in heaps and are scattered everywhere. Skua gulls, a scavenger bird of coastal Antarctica, appear easily adaptive to the human garbage and waste piles, but the filth has left some of these birds diseased and many dead birds lay about, skeletons of old and rotting flesh in the hot

Martin Sponholz, Tetsuya Torii, Masayoshi Murayama, and Toshiharu Honda

summer sun.

Some of the old buildings barely hang together, and are so small and cramped that even shorter Japanese must crouch. I think all this place needs is a few saloons and cheap whorehouses and we'd have a recreation of the filthy mining towns of the Old West of the U. S. so falsely glamorized in American movies and TV. In the winter the deep snow covers it all way above the roof tops and the Creation can look at itself again. During the summer, the hell man can turn something beautiful into is so exposed.

[It is difficult to describe Showa in a negative way when the Japanese were so caring and helping with my research and my personal care. I also never was in a position to inspect our own stations the way I had freedom to do on this Japanese expedition. Green Peace has documented like problems at most Antarctic stations including McMurdo Station. Scott Base near McMurdo, established and maintained by New Zealand was the only station Green Peace praised for taking all waste matter back to New Zealand. Our own American program pushed all waste, including nuclear waste, out to sea the early years after IGY.]

Day #36
19 January 1968
Showa, Antarctica

Nancy, you were given a real cool scarf tonight from Dr. Torii, Leader of JARE 8. It is an Antarctic map printed on a dark blue scarf. It was presented to me at a formal dinner that introduced me to the Eighth Expedition now preparing to leave.

Construction at Showa has reached a more sophisticated level than a rookie to real labor like me knows how to do. So I have some free time to take pictures and wander around a bit.

Day #38
21 January 1968
Showa, Antarctica

The past several days I have been inspecting those many research programs of the Japanese and toured their field sites here on Ongal Island. The Japanese research program is quite thorough involving many subjects of science I have never heard of before. I took a long lingering look at the station's flag poles standing side by side - the "rising sun" and "old glory." The stars and strips fly for the country I officially represent. It's a grand flag. Walking back to the ship from Showa, about two miles, across Ongal Island over exposed rock and sand I sat on a large rock left by a receding polar cap. I sat on the large rock in the cold air and hot sun letting my face both freeze and get sunburned as I meditated and prayed. Antarctica is a great and lonely place.

Day #41
24 January 1968
Showa, Antarctica

Late tonight we welcomed aboard the men of JARE 8. We will set sail in a few days, not homeward yet, but out to the open sea. Admiral Honda is worried that winter might come early this year so we will anchor in open water and finish the rest of our summer effort via helicopter.

Day #45
28 January 1968
Showa, Antarctica

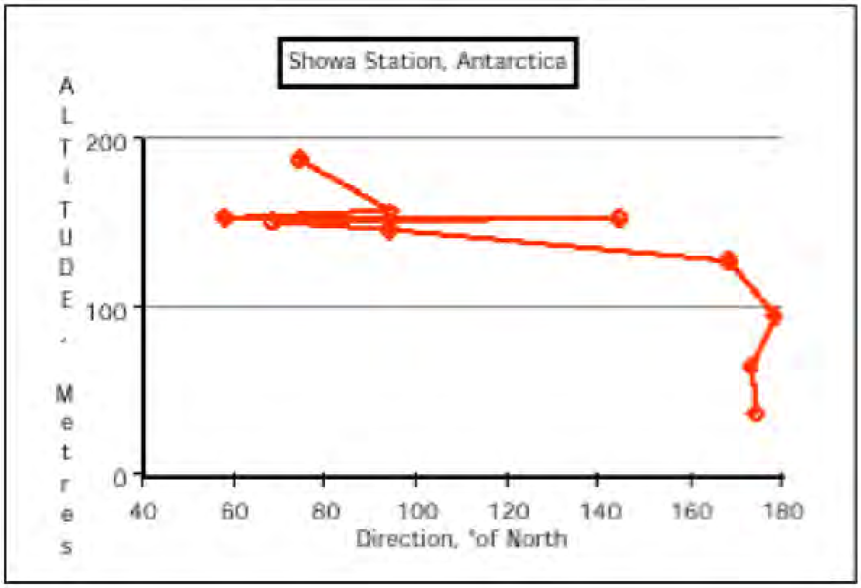
Work at Showa base today came to a grinding halt. Sixty to seventy miles per hour wind, -10 º F, and snow mixed with boards, nails, and loose sheet metal. Everything on the *Fuji* is lashed down, not for this storm, but for the open sea scheduled for tomorrow.

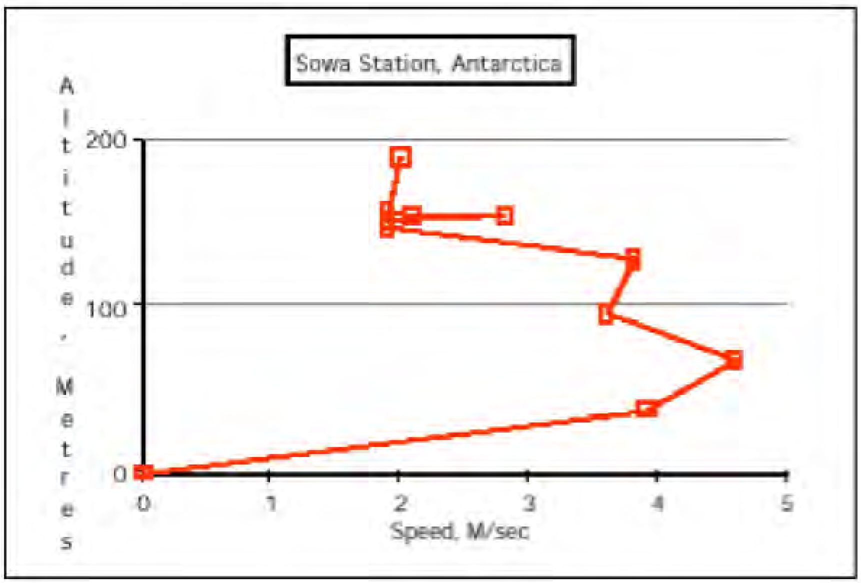
Day #46
29 January 1968
Showa, Antarctica

Yesterday's storm proved too much for the *Fuji*. We are still at Showa. Today it's fairly calm and I'm in the midst of kytoon observations.

Day #47
30 January 196869 º 12' South
39 º 30' East

[Some wind profile results shown here give a hint of a lifted "katabatic" at a height of 150 metres above the surface. Herb Viebrock was first to draw my attention to such a lifted wind shear first observed by an Australian Expedition in 1912. My kytoon observations do not show extreme wind speeds as Mawson observed, but this was in a later part of summer when temperature contrasts between the interior on the high polar plateau and the sea coast were not so severe.]





> "In the early spring, while we were transporting provisions to the south, frequent journeys were made to higher elevations. It was then established that even when whole days of calm prevailed at the Hut {the main camp of the Australian expedition near the coast at Cape Denison} , the wind almost without exception blew above a level of one thousand feet. On such occasions it appeared that the gale was impelled to blow straight out from the plateau slopes over a lower stratum of dead-air. An explanation was thereby afforded of the movement of condensation clouds which appeared in the zenith at these times. A formation of delicate, gauzy clouds developed at a low altitude, apparently in still air, but doubtless at the base of a hurricane stratum. Whirling round rapidly in eddying flocculi, they quickly tailed away to the north, evaporating and disappearing." (Sir Douglas Mawson, *The Home of the Blizzard*., Vol. I, page 113, 1915)

After yesterday's, or rather most of last night's kytoon observations, I went to bed. I slept through breakfast and never heard us leave Showa or crunch our way through the pack ice.

I also missed Dr. Torii's departure by helicopter to do field work on a snow-free mountain, but I did wake up in time for lunch - rice, raw eggs, raw eel, egg mash from tuna and seaweed. I ate mostly the rice and sea weed, and, as usual, my appetite abruptly ended with a deep gag. [Actually I did begin to accept the Japanese food, even enjoyed a few dishes, and was gaining weight with a returned appetite once I was involved with strenuous physical work at Showa.]

The *Fuji* anchored off the shore of Lange Hovde and a geology and biology field team was put ashore. I went along for sight-seeing and returned to the *Fuji* with the Navy support crew while the scientific field team will remain for about three days.

With work finished at Showa, my English student has returned and is becoming a very good friend.

Day #48
31 January 1968
69 º 15' South
39 º 36' East

The southern most advance of the *Fuji*.

Day #49
1 February 1968
69 º 12' South
39 º 24' East

Today I received the first rumors of news involving my country since last November. I don't know what has really happened or what is going on, but I heard Saigon was captured by the Vietcong. American troops are losing on all fronts and the mighty American nuclear ship the *USS Enterprise* was sunk by North Korea. I hope this is all rumors. My mind is much troubled. The time is for prayer.

[I did not doubt that if it were true that the *USS Enterprise* was sunk, my country would go to war. As it turned out, the language barrier was my greatest trouble giving me this most pessimistic view. It was true that on Tet, 31 January, a major holiday in Asia, the Vietcong and the North Vietnamese started a major coordinated offensive that struck the American embassy in downtown Saigon, believed untouchable before, and many major centers throughout all of South Vietnam.

The *USS Enterprise* was not sunk or even attacked. A much smaller ship, the *USS Pueblo* was seized and all of its crew were captured and jailed as spies on 23 January. The United States did send a naval task force to the region that included the *USS Enterprise* and eventually the crew of the *Pueblo* was released.]

Day #50
2 February 1968
Showa, Antarctica

This afternoon I watched two polar heroes dive for biology specimens in this very frigid water. Their collection was very interesting, but I am still shivering thinking about chopping a hole in ice several feet thick so they could dive and swim in the water.

We steamed back to Showa base late this afternoon and this evening we had a barbecue with much drinking of sake and beer, taking turns leading everyone singing long past the midnight sun. I bid the wintering-over personnel a "good winter," gave my parka to Mr. Murayama, and said farewell to the many scientists with JARE 9.

Day #51
3 February 1968
69 º 00' South
39 º 24' East

Despite a blizzard the *Fuji* bashed its way out of its self-made harbor of ice and sailed away for this season. I must take back many of my regrets. I have always believed that if it hurts a little to leave behind friends and acquaintances in order to continue forward, then at least it's been worth coming. It was quite sad leaving behind these twenty-nine men. In our intense and hard pressure struggles with research work on ship at sea and construction on land, the close feelings and friendships bonding together were not noticed until it was time to say good-bye.

Dr. Kikuchi, a professor of meteorology from Hokkaido University, and I were the closest. He and several of the meteorologists that were wintering-over planned to try kytoon observation at Showa. Where we failed on ship perhaps they will succeed on land. [In my experience I passed on to them that the problems with launching free rising balloons is that they pass through winter inversion too rapidly. Kytoon ascents, captured at the ground level, gave the desired controls that did not permit such a swift passage through the inversion but gave you complete control of exactly the speed or time you desired to stay at a given level. At my suggestion Dr. Kikuchi became exchange scientist at the American Amundsen-Scott station in subsequent years and did considerable meteorological work on moisture on the high plateau of Antarctica.]

Everyone had to say good-bye to me. I could only be polite. The saddest was knowing a few of these lads might have been very close friends but our only communication could be a friendly smile. It is hard to describe. It's a feeling, a love, a friendship, a bonding. When or where, if ever, our paths might cross again no one knows. It was hard waving good-bye from the deck of the *Fuji*. As the *Fuji* gave its final farewell blast on its horns my heart went out to these men we left on Ongal Island at Showa base. Many of these men were married; some had children waiting in Japan. Their year will be long and lonely.

Day #52
4 February 1968
68 º 54' South
39 º 00' East

Everyone is in very high spirits today. Yesterday before going to bed, while wandering around the ship, I ended up in a good old fashioned bull session with the Supply Officer and a helicopter pilot. They both spoke English well and our session lasted many hours on until 04:00.

Breakfast at 06:30 came awfully early and I loved it.

Day #54
6 February 1968
68 º 42’ South
38 º 54’ East

The *Fuji* several minutes ago left the pack ice and now will sail east in open water to Molodezhnaya to pay a visit to the Russians. We will not be reentering the ice but instead will do all surveying of coastlines by helicopter. The fear of being trapped in the ice and being required to remain another year until the next summer is now greatly removed. The pack ice is flat, always hummocky, but just before the pack ice ends as our icebreaker cuts through, it suddenly becomes loose and moves with the water as waves. It acts like an ocean of oatmeal mush. It looks solid enough to walk on but it moves as the waves of water. This is a very weird sight. And then the *Fuji* lurches free into the bright blue open Indian Ocean.

Day #55
7 February 1968
67 º 12’ South
44 º 00’ East

Today we made radio contact with Molodezhnaya. The American there, Dr. MacNamara, and I on the *Fuji* had to do all the communicating. There was no one on the *Fuji* who spoke Russian and no one at Molodezhnaya who spoke Japanese. English was the common denominator for these nations in Antarctica.

Tomorrow we will visit the Russians by helicopter so the *Fuji* will remain on station out here at sea. I will send up a few kytoons.

Day#57
9 February 1968
67 º 54’ South
42 º 00’ East

Sobered after the Russian welcome, I have a much clearer head today. Yesterday was a great day. I met with MacNamara, the U. S. Exchange Scientist with the Russians at Molodezhnaya. The poor chap has lived there already for fourteen months and has still two months to go. I was the first American MacNamara has talked to since he got there. And since he was the first American I’ve spoken to since I left Perth, we both became instant friends.

The welcome banquet was shish kebab with COOKED MEAT and I ate about three complete meals. For me it was fantastic! For MacNamara, he was sick of Russian food. The following banquet of Japanese cuisine served at a visit of some of the Russian personnel to the *MSDF Fuji* was a feast for MacNamara.

Perhaps the most interesting thing of this visit was its lesson to me. Many times a person makes a decision but rarely sees what might have happened if the opposite had turned out. I never would have regretted being married to you a year sooner and not going to Vostok, Nancy. But this short visit to Molodezhnaya convinced me that the Lord has put us on the correct path.

MacNamara had no radio communication except once per month with the U. S. Navy at McMurdo for five minutes. At the Russian station there are two leaders, a scientific leader and a political leader. Political lessons are given every day in spite of the isolation of this place and the cold war is fought daily against the one American. No help is provided for his research project and often hindrances are added. Basically for me, with a strong need to communicate, to share an exchange program with the Soviet Antarctic Expedition would have been hell; for MacNamara it was hell! With a winter at a Russian station being one of the few exciting things left to do in the Antarctic, I can now, with all confidence and without a feeling of compromise, think of a dedicated life as a father married to you, Nancy, and raising our children from our home and not from a glacier separated from you and our children. I love you.

Day #58
10 February 1968
68 º 12’ South
39 º 48’ East

Today was a very sad day for the Japanese Expedition and tomorrow I will be attending a funeral ceremony for a brilliant young scientist who froze to death about this same time in 1960. Today first, his body was found by the new members at Showa Base. The remains of his body were cremated and the Japanese funeral will be held tomorrow with a simultaneous ceremony on the ship and at Showa. I’ll be flown back to the base tomorrow morning for the ceremony. Five members of the returning party, all who had been with the chap that died in 1960, were taken to Showa today.

The *Fuji* has returned as near Showa as it could without entering the ice again and we will “stand” in memory for a day or more. His death was the most common of all the deaths on the continent. He was lost in a storm. Most of us down here have been lost for periods of time. Why one is allowed to find his way back and another not, is and only can be, by the grace of God. The fact that it has happened to most of us, all tonight are bound up in emotional loss whether we’ve known the lad or not. Antarctica is still a cruel savage place.

Day #59
11 February 1968
68 º 12’ South
39 º 18’ East

A short funeral service [a Buddha service] was held today at Showa. A helicopter took Admiral Honda and me to the ceremony. The final ashes were also taken on the helicopter and a military ceremony took place as we landed back on the *Fuji*. All were very somber. I, of course, could not understand a word, but no reference was made to Christ and for me this made the entire ceremony so much more tragic. I've never been to a funeral where the sign of the cross was not made or some reference made to Jesus. Quite frightening! Why have I had it so easy? I, born and baptized into the one true faith, am so blessed by the grace of my Lord and only by His grace.

We left Showa base for a final time, and again saying "Tally Ho," I shook the hands of every member of the wintering over party. Leaving by helicopter we circled Showa three times and flipflopped the "wings," which was difficult for a helicopter as loaded as ours. It was our last wave of good-bye to the twenty-nine Japanese chosen to winter-over and our pilot almost over did it.

I attempted a kytoon ascent this evening but high winds over the open sea made the effort too risky so we stopped.

Day #60
12 February 1968
69 º 12' South
39 º 00' East

The final countdown before the run home has started. The helicopters were dismantled today and prepared for sea passage. About four days remain for oceanographic studies along the Prince Harald Coast and the Riisen-Larsen Peninsula before the dash across the screaming fifties and roaring forties northward.

No kytoons. Fifty miles per hour wind, swollen seas, and dangerous ice flows all around.

Day #61
13 February 1968
68 º 12' South
37 º 00' East

The sea rumbles on. We are in a blizzard on the far southern Indian Ocean. The wind is nearly sixty-five miles per hour. The temperature seems warm at -10 º F. And the ship is taking rolls of thirty degrees to sixty degrees from side to side. Sleeping is an interesting effort requiring bed belts. Since this storm occurred somewhat unexpectedly, throughout the ship not everything was fully secured or lashed down. Banging, crashing, smashing, and breaking sounds of one thing or another were heard throughout the ship and seen wherever you could walk. About every ten minutes a really big roll would make you grab onto the bed for dear life and two seconds later have a chair come crashing into your rear end.

To my delight, my stomach was unaffected and in fact the inability to sleep made me hungry. When the storm started, several officers, remembering my seasickness on the way south, offered me any assistance. [Of course there is no assistance. It was a way of letting a "sand crab" know that we were out on the real sea now.] I got even. At the storm's peak, when they seemed a little less than chipper I offered them a beer.

Day #62
14 February 1968
68 º 12’ South
33 º 00’ East

What a miserable day. The storm is over but high winds, snow, rain, and salt spray fill the air. The ship’s aerovanes however recorded less than twenty knots so I tried to make kytoon observations. Well? The bloody bastards [the devil and his angels] nearly pulled my two helpers and me over the side with the wind so strong. The aerovanes are no doubt iced up and not giving true measurements. Dr. Torii, “big face in Tokyo” and the leader of the returning JARE 8, gave excellent encouragement to us all.

Day #64
16 February 1968
68 º 20’ South
11 º 40’ East

Things are quite improved on the ship [between the scientific corps and the Navy]. This perhaps is due to the influence of the returning scientific leader, Dr. Torii. [This is not to take anything away from the brilliant logistics leader, Mr. Murayama, who was a survivor and mountaineer, but Torii had a greater sensitivity toward the needs of the scientists and was less interested in getting along with the Navy and more interested in pulling from nature her difficult measurements.]

I have been given permission to enter the radio room at will. It previously was off limits for top secret reasons. [In Antarctic waters everything is supposed to be free and open exchange but sovereignty on a national ship no one was going to challenge.] Why I now was permitted entrance I do not know. With access to the ship’s radio most rumors I had to deal with before have been cleared up. But the world seems so much worse than when I left before. What is sickening now is that the news from the Voice of America tells quite a different story [about Vietnam] than the BBC, or Radio Australia, or even the Canadian Broadcasting Company. The American people are not hearing it all. In the coming election it already appears she won’t have a choice. [At this time, from my perspective, President Johnson and Richard Nixon were a cut of the same bureaucratic establishment.]

I heard once again “western” music from Germany.

Day #65
17 February 1968
68 º 18’ South
01 º 00’ East

With all of the bad weather, strong winds, and high seas lately, kytoon observations are at a standstill. I’m a little lazy and have chosen not to spend needed time to copy weather records from the ship’s weather shack. I will still have considerable idle time once we’re north of the Antarctic convergence zone.

Last night was a good drinking fest celebrating the end of the helicopter operations. The pilots and crew obviously are more fun than the scientists on this ship.

Today we are headed South again and may risk entering the ice in an effort to visit SANAE, a South African station on Fimbul Ice Shelf off the Princess Martha Coast.

Day#66
18 February 1968
69 º 34’ South
03 º 15’ West

[We reached the southernmost penetration by the *Fuji* during this expedition.] The *Fuji* sails in some poorly charted waters now. Admiral Honda had hopes of mapping these coastal regions, but we are plagued with very thick fog. We carefully penetrated southward toward SANAE station, but failing to make contact with the station by radio, and confronted with thick and newly formed ice, Admiral Honda gave the order to sail north.

Day#67
19 February 1968
64 º 42’ South
03 º 20’ West

The *Fuji* sails northward at its full cruising speed making all kytoon observations impossible unless the ship stops for an oceanographic station. We do make such stops every three degrees of latitude, which occur at odd hours. Three days ago that occurred at 07:00, two days ago at 04:00, yesterday at 03:00, today at 02:30 and again at 23:00. The stop is for four hours so two hours before and the full four hours of the stop it is “panic city” for me and my faithful helpers. Now I am waiting for the next stop, but the weather lately is so uncooperative.

Day#68
20 February 1968
61 º 15’ South
02 º 50’ West

This standing by waiting for the wind to diminish on a sea where it is not expected to diminish is frustrating. Very early this morning, before breakfast, I enjoyed a polar scientist’s universal complaint. The seas were so violent that even oceanographers could not obtain their data. All the scientists in terse Japanese, I guessed, were not too complimentary of their Navy. [Just like my complaints at Plateau Station except there was no place to anchor Flint’s two-by-four Navy substitute. Dr. Torii enjoyed that story since he had become a good friend of Rob Flint’s on previous Antarctic work.] In these waters spending time with and having been invited in on some of the decisions with Admiral Honda and his second in command, Captain Matzushima, I do not challenge the military’s decision. They face the responsibility of trying to rescue mistakes in the polar seas that only risk more lives.

In these waters the *Fuji*, like any ice breaker, is quite helpless without a keel. So we roll and pitch and roll much more. My stomach amazes me. But I have lost my appetite again. Lifelines have been stretched everywhere on the outside decks. Gigantic quantities of water spill onto and sweep over the decks with loud pounding forces. Most of the time the scientists are simply not permitted out on the iron ice-coated decks. A hopeless cold swim surely would be waiting.

In all these seas it amazes me that my albatross still follows without rest. The violent weather seems not to faze him at all. Whether the waves are three feet or fifteen feet, he flies over and in between them all. Yesterday, the first time during the entire trip, two giant white albatrosses were flying in the wake of the *Fuji* where previously there was only one. All the officers on duty on the bridge dove for their cameras or field glasses, amazed at the sight of these two big birds out here in the world's worst seas. The two birds encircled the ship many times, seemingly in pursuit of each other.

I figured with winter coming on these great birds seem to have the right idea. They know it is time to go north and have sex.

Day #70
22 February 1968
54 º 00' South
03 º 38' East

This morning we passed Bouvet Island. It belongs to Norway but is completely uninhabited. We were perhaps its only visitor in three years. Most interesting to me was our failure to find it at first pass. Navigation, thought to be exact, has its problems with the extremes of the sea. High waves, supercooled rain, icing, fog, icebergs, and almost always thick overcast sky leaves an island such as Bouvet hidden in the mist except to the thousands of southern birds. Its snow capped mountains with glaciers and rock cliffs plummeting more than hundreds of feet to the sea under a low ceiling of clouds gave us a view of "never never land."

I'm fully alerted to the crossing of the Antarctic convergence zone some time tonight. It remains a number one objective of my research to obtain detailed vertical profiles of wind, temperature, and humidity across this zone. This has not yet been achieved by anyone else.

Day #71
23 February 1968
50 º 10' South
04 º 24' East

Everywhere all the time high seas. I have a headache mainly from the high temperature of the ship and lack of fresh air. The waves are crashing over both decks of the *Fuji* so no one is allowed outside and all the hatches are tightly sealed. The pounding of the waves continues now for more than two full days. No kytoon soundings. I patiently stand by for the wind to die down.

The weather maps prepared by the ship's weather officers indicate that the foul weather will not break. Perhaps my kytoon work is complete.

I dozed off in my bunk a few minutes last night only to be flung out of it by a rather large roll of the ship. As I attempted to awake and stand I was again knocked off my feet by a chair I failed to secure before I lay down. Our rolls are not the worst, but the waves viewed from the bridge are fantastic and fortunately for us they hit us from our stern.

We passed a whaling fleet, one factory ship and six catcher boats. All were unidentified and flew no flag. The waves were twice as high as the boats. Most of the time they could not be seen being down between waves.

Day #73
25 February 1968
42 º 10' South
10° 50' East

Well, that's it! The end of one kytoon program. [My last kytoon sounding took place south of Bouvet Island. There was no longer any reason to remain operational in these hopeless seas.] The *Fuji* continues to roll and pitch, now even reducing the appetites of the seasoned seamen like the Admiral. The Admiral is at a disadvantage. His cabin is high on the ship, three decks above the water line. He must get most of the motion amplified. I suspect he'll sleep below the water line tonight.

With the end of my kytoon program, I picked the chap I thought disliked the kytoons the most and asked him to help me deflate the kytoons and pack them. I'll probably have a little party for my helpers, but I'm not as pleased with this group of helpers as I was with the team that now remains at Showa. But that is history.

[The three meteorologists that assisted me with the kytoon program after the departure from Showa were Isada Ono and Hideji Nakanishi of the Japan Meteorological Agency and Sadao Kawaguchi of the Japanese National Science Museum.]

The data collected will be coldly scrutinized. Poor data will be thrown away and the observer severely criticized for blunders, errors, and observations he should have made. Since I'll be the first to write a report using these data I'll be able to chuckle a bit as some excellent data is rebuked while other faulty data becomes part of a new theory. That is research.

Despite all of my complaints and frustrations, even despair at times, I still believe it was a valiant effort I am proud of. Its worthiness might raise debates, but definitely it was a good effort with overwhelming experience gained for me personally and for future polar studies that will follow by many others. In this respect I am satisfied.

Day #75
27 February 1968
36 º 10’ South
16° 00’ East

Most of my equipment is crated and ready to ship to Washington.

The sun shone today giving magnificently warm weather. The frigid Antarctic is nearly forgotten history. Only the best times will be remembered and told. It was the same for my expedition to Plateau Station. On this second expedition to Antarctica I do remember some of the deep depressions I had and others had at Plateau as I experienced some of the same sadness on the *Fuji*. This time, feeling most sad, I had left the most lovely person behind in Wisconsin. Now the joy of being together again has captured my every thought. I can think of nothing except mail from you, Nancy, as we approach Capetown.

Insert: 27 February 1968. “Enemy losses have been heavy; he has failed to achieve his prime objectives of mass uprisings and capture of a large number of the capital cities and towns. Morale in enemy units which were badly mauled or where the men were oversold the idea of a decisive victory at TET probably has suffered severely. However, with replacements, his indoctrination system would seem capable of maintaining morale at a generally adequate level. His determination appears to be unshaken. . . . For these reasons, General Westmoreland has asked for a 3 division-15 tactical fighter squadron force. This force would provide him with a theater reserve and an offensive capability which he does not now have. . . . To contend with, and defeat, the new enemy threat, MACV has stated requirements for forces over the 520,000 ceiling imposed by Program Five. The add-on requested totals 206,756 spaces for a new proposed ceiling of 731,756, with all forces being deployed into country by the end of CY 68.” (Memorandum from Gen. Earle G. Wheeler to President Johnson.)

Day #76
28 February 1968
Outside the harbor of Capetown, South Africa

Early this morning we arrived outside the port of Capetown. Sighting land was a grand sensation. No city on earth has such an impressive God-given scenic backdrop as the city of Capetown beneath Table Mountain. This near tropical moist land gives thick moist clouds, low on Table Mountain, that look like a table cloth that drops over the sides and descends to the toy city on the floor.

So much of a little person’s life is affected by the international. I just want to go home. War between Egypt and Israel has closed the Suez Canal so all ships must travel the extra nine thousand miles around Africa making the Port of Capetown over crowded. So we slowly sail in a large circle until our berth in port is available.

Last night and tonight the sky is magnificent. It’s true that I long to see the Big Dipper and it remains a puzzling surprise to see Orion upside down. The southern sky is magnificent. I can see the center of our galaxy from these Southern Hemisphere latitudes. Several other galaxies, the Magellanic Clouds are also dominant in the southern sky. Most of the stars I do usually see are not visible this far south of the equator so that I feel and know I am a foreigner even by the night sky.

Most comforting to me, as a Christian, is finding and identifying the Southern Cross. Is this an imagination of man or truly a sign given from our Creator? The Southern Cross is made of four dominant and brilliant stars. There is also a small red star, which distinguishes the true Southern Cross from easily mistakenly identified false crosses, in the position of Christ's pierced side. It has been these stars in the South, that constantly beckoned me to God's Holy Word in the Bible while I was in the interior of Antarctica at Plateau Station, off the coast of Antarctica exploring with the Japanese, or on the high seas.

P.S.
7 March 1968
Pan American Airlines
Somewhere over Ghana

I couldn't really end this little diary to you without a short description of my departure from the *MSDF Fuji*. I stayed this past week in my quarters on board the *Fuji*. The first night into port I was provided a fine hotel suite by the American Embassy, but I found the hard roads, the non-moving bed and everything about the land overwhelming. I had a severe case of land-sickness, the reverse of seasickness and asked for and was granted permission to remain on board the *Fuji* until I was prepared to leave for the States. In the harbor, although the ship did not roll and pitch, it did keep a slight motion with the tide and the flow of the harbor. Obviously I needed to be rocked to sleep. Today, the time for departure, the American Embassy was prepared to drive me to the airport, but the Japanese insisted they would drive instead.

This morning, well before breakfast, I was escorted as expected to the Japanese Embassy car, but instead of taking the shortest path out of the *Fuji* from my bunk room to the main outside deck, my guide took me on a rather long circuitous route emerging outside on the helicopter deck. Awestruck and in tears I stood at attention to the exit ceremony given to me or rather to my country. Three national anthems were played, that of South Africa in whose port we stood, that of Japan on whose ship we stood, and that of the United States for which I stood. The Japanese flag was lowered to half mast for sixty seconds out of respect for our lost fellow explorer and then smartly raised again as the military and I stood at attention and the scientific corps bowed.

As I was led in review past the officers, each smartly saluting, the American flag was slowly lowered and folded by a military guard. It was very hard to say good-bye to Admiral Honda. The scientific corps likewise was lined up to bow and say goodbye and as I walked down the gangplank to the Japanese Embassy car and turned to wave a last goodbye, I was overwhelmed by the sight I could not see before. Hanging from every possible place of the ship were the entire crew, every single sailor waving goodbye. Many were shouting “Nancy, Nancy and Marty.” The whole ship knew you sent me a wedding invitation and that we will be married 15 June and now I know it.

Indeed, good-byes are hard. Choked with emotions and with moist eyes I knew the only regrets I had were that I had some frustrations at the low points of this expedition. In the car taking me to the airport were the Japanese Ambassador, Dr. Torii, and Mr. Seino. We have many friends in Japan. I will never forget them. [“I could never express enough my gratitude to those of the 8th and 9th Japanese Antarctic Research Expeditions for all they have done to assist my research from the *Fuji*. My sincere thanks to the weather officers and crew men of the *Fuji*. Breakfast with Admiral Honda, Dr. Torii and Mr. Murayama advanced my understanding of the expedition and permitted the excellent opportunity for an exchange of ideas concerning our common interests in the Antarctic. But special thanks must be saved for Mr. Seino who coordinated all the necessary groups that made my project possible. Friendships I made on the *Fuji* will be cherished always.” (Report of the U. S. Exchange Scientist - JARE IX)]

Winging my way home to my beautiful sweet girl in blue. A matter of hours from this scrawl and you will be in my arms with your lips touching mine.

Marty.

End of my log kept while on board the *MSDF Fuji*.

The Belgium Expedition to Antarctica and the South African Antarctic Expedition returned to Capetown during the week the *Fuji* was in port. Our governments encouraged all of us to get together to discuss our findings and specific and general national goals for our mutual expeditions in Antarctica. The four countries - South Africa, Belgium, Japan, and the United States (represented by me) - met in Capetown but without a formal interpreter. It was a long conference of babble. English was the mutual language with which most did quite well with technical material, but with discussions of future goals I’m not sure if the dreams of the Belgium Expedition or the Japanese Expedition were presented as clearly as possible or if they were left unclear on purpose.

In a briefing meeting given to me by the American Consular Richard Sithers and different people such as the Scientific Attache and the Military Attache of our Embassy, I was drilled on Antarctic history and verbally tested on the Antarctic Treaty and then encouraged to do my best to sell the South African scientists on the importance of Bouvet Island rather than maintaining SANAE (South African National Antarctic Expedition) at great expense to themselves.

That is exactly what I did. In all of my talks on the weather research I did on the *Fuji* and descriptions of research in progress about the Great Antarctic Inversion conducted at Plateau Station, I stressed the importance of understanding the weather of the Antarctic Ocean and the importance of the sub-Antarctic islands of which Bouvet Island was one in the South African Sphere of influence. Inversion winds in all probability held air and moisture in and had no effect on the sea while the sea had great effect on the weather of the entire Southern Hemisphere. South Africa could play a major role in these studies if it sought to set up an observatory on Bouvet Island rather than at SANAE.

American policy at that time was trying to isolate South Africa for its cruel apartheid rule of its people. They rigidly classified their population into five social strata. The white race was on top with no restrictions. Next come the "paid" white such as the Japanese who bought a license to have white status. At the middle level were people from India, second from the bottom were coloreds or people of mixed race, and at the bottom were the black people not allowed to live in the white cities, not allowed to learn how to read, nor freely travel about their own country. Even an American movie or stage play like "South Pacific" with its mixed race romances was faced with public banishment. If South Africa could be encouraged to leave Antarctica it would keep apartheid policies away from thus far a very politically progressive and open continent.

For several years that is exactly what South Africa did. When the *Fuji* failed to hail SANAE, the South African expedition had already abandoned their very costly operation on the Antarctic continent. Willingly they looked to the establishment of a weather observatory on Bouvet Island. I was awestruck in the years that followed thinking I had such an influence, and I did, although never alone. The Antarctic community was and still is very small. Individuals play important roles.

Many years later, if South Africa was to be kept out of Antarctica indefinitely, that could not be done. South Africa started in Antarctica by making a secret claim of the territory of Antarctica south of its border in 1948 and in fact was granted sovereignty by Britain over the sub-Antarctic islands of Marion Island and Prince Edward Island. Their claim, if made, counters claims of Norway in this region.

Norway established Maudheim at 70 º 19' South, 2 º 22' West for the IGY and in 1960, when they left, South Africa took it over renaming it SANAE. When Admiral Honda tried to visit their station they were occupying SANAE only brief periods during favorable seasons. Bouvet indeed looked more economical.

In 1969 South Africa renewed its Antarctic interests not only by reopening and rebuilding SANAE but also by opening Borgmassivet with four men inland some 236 miles. Fear of South African activities in Antarctica proved prophetic. South Africa detonated a nuclear device (possibly with Israel) just north of the Treaty zone but southeast of Bouvet Island 22 September 1979. Although just skirting the Treaty zone, the nuclear explosion still occurred deep within the Antarctic convergence zone causing a severe threat to the delicate polar ecosystem.

Antigua demanded for South Africa an "immediate expulsion from the membership in the Consultative Group" of the Antarctic treaty in the meetings of Nonaligned States 4-7 Oct. 1983 of the United Nations' discussions of the Antarctic treaty.

List of participants to Capetown meetings
Antarctic Research Discussions
5 March 1968

Mr. T. A. Bosua	Meteorology, Weather Bureau, Pretoria, South Africa
Prof. N. D. Clarence	Ionosphere, University of Natal, South Africa
Mr. G. C. Coetsee	Geomagnetism, Magnetic Observatory, Hermanus, South Africa
Mr. M. J. Coetsee	Department of Transport, South Africa
Mr. H. Decleir	Geomagnetism, Belgium
Mr. J. P. Deruyck	Photogrammetry, Belgium
Mr. J. J. Derwael	Surveying, Belgium
Mr. S. A. Englebrecht	Director, Weather Bureau, Pretoria, South Africa
Mr. Y. Fukui	Biology, Ministry of Education, Japan
Prof. J. A. Gledhill	Ionosphere, Rhodes University, South Africa
Mr. T. F. W. Harris	Oceanography, University of Capetown, South Africa
Dr. F. J. Hewitt	Vice-President, South Africa
Mr. R. Higano	Oceanography, Hydrographic Office, Japan
Dr. T. Hirasawa	Aurora, Tokyo University, Japan
Dr. T. Hoshiai	Biology, National Science Museum, Japan
Mr. S. Ikedo	Geology, Ministry of Education, Japan
Mr. Y. Ishida	Cosmic Rays, Fukushima University, Japan
Prof. S. P. Jackson	Vice-chairman, South African Committee for Geomagnetism, Aeronomy and Space Sciences; University of the Witwaterarand, South Africa
Miss J. Kahts	Science Co-operation Division, South Africa
Mr. H. Kashiwadani	Oceanography, Hiroshima University, Japan
Mr. C. S. Kingsley	Geology, Geological Survey, Pretoria, South Africa
Mr. D. G. Kingwill	Director, Information and Research Services, South Africa
Mr. R. J. Kirkland	Surveying, Trigonometrical Survey, South Africa
Dr. M. Kruger	Medicine, Pretoria University, South Africa
Mr. J. M. Loots	Physiology, Pretoria University, South Africa
Mr. W. Loy	Geology, Belgium
Prof. J. K. Mallory	Oceanography, University of Capetown, South Africa
Mr. T. Matsuda	Geology, Ministry of Education, Japan
Mr. F. A. J. Mocke	Meteorology, Weather Bureau, Pretoria, South Africa
Mr. K. Nagasawa	Geophysics, Tokyo University, Japan
Mr. D. C. Neethling	Geology, Geological Survey, Pretoria, South Africa

Mr. I. Nishimuta	Ionosphere, Radio Research Laboratories, Japan
Mr. M. Nishino	Ionosphere, Nagoya University, Japan
Mr. M. Ose	Ionosphere, Radio Research Laboratories, Japan
Mr. A. W. Poole	Ionosphere, Rhodes University, South Africa
Mr. J. A. Retief	Geology, Geological Survey, Pretoria, South Africa
Mr. E. . F. G. Rousseau	National Institute for Building Research, South Africa
Mr. Z. Seino	Meteorology, Japan Meteorological Agency
Mr. M. P. Sponholz	Meteorology, Environmental Science Services Administration, United States
Mr. J. L. Steyn	Cosmic rays, Potchefstroom University, South Africa
Mr. P. C. L. Steyn	Meteorology, Weather Bureau, Pretoria, South Africa
Prof. P. N. Stoker	Cosmic rays, Potchefstroom University, South Africa
Mr. H. Tominaga	Oceanography, Nagoya University, Japan
Dr. and Mrs. D. Torr	National Institute for Telecommunications Research, South Africa
Dr. T. Torii	Geochemistry, Ministry of Education, Japan
Dr. T. van Autenboer	Geology, Belgium
Dr. A. van der Merwe	Medicine, National Nutrition Research Institute, South Af-rica
Mr. A. J. van der Walt	Physics, Potchefstroom University, South Africa
Dr. O. R. van Eeden	Geology, Geological Survey, Pretoria, South Africa
Mr. J. S. van Rhyn	Meteorology, Weather Bureau, Pretoria, South Africa
Mr. A. M. van Wijk	Aurora, Magnetic Observatory, Hermanus, South Africa
Mr. R. W. Vice	Director, National Institute for Telecommunications Research, South Africa
Mr. R. Watanabe	Oceanography, Hydrographic Office, Japan
Mr. W. C. Watson	Geodesy, Trigonometrical Survey, Pretoria, South Africa
Prof.J.M. Winterbottom	Biology, Percy Fitzpatrick Inst. of African Ornithology, University of Capetown, South Africa
Mr. Y. Yoshida	Glaciology, Hiroshima University, Japan
Prof. P. B. Zeeman	Airglow, Stellenbosch University, South Africa

One other small step in international politics that I took for my country was to arrange for a visit of American Embassy people, namely the American Ambassador, the American Commercial Attache and the American Military Attache to the *Fuji*. I had no idea of the importance of this visit at the time. When the visit did take place I thought the Americans were overdoing the visit but historically, I learned during my debriefing sessions back in Washington, D. C., it was historically a momentous occasion.

In a discussion at the American Embassy where I was making arrangements to return to the States, so much interest was expressed by several of our people that I asked them if they would want a tour of the *Fuji* while she was still in port. Well, sure, if that can be arranged, but they were all sure that it simply would be too difficult. No, just come over. The Ambassador said he would send a car over to pick up the formal invitation if it could be arranged. I never understood why an invitation, much less a formal invitation, was needed to visit a ship. I promised to get permission from Admiral Honda at our breakfast the next morning.

Without any hesitation, at breakfast I asked, “By the way, you don’t mind if a few friends from the American Embassy come for a tour do you?” I told Admiral Honda that the Ambassador said some foolish thing about sending a car for the invitation. I could just give them a phone call. No. The Japanese Embassy would probably send the invitation. Whoa! What was all this about? The rest of the breakfast went in haste without further conversation. The moment I left, Honda jumped up to his private suite. Before I could return to my cabin, whistles were going off all over the ship.

At about 10:30 a sailor informed me the Americans were coming. I could join the Admiral on deck. Oh. Sure. I got out on deck and noticed signal flags flying all over the place. The biggest Japanese and American flags were prominently displayed. A red carpet extended from the gangway. All the officers were lining up in their dress white uniforms. Admiral Honda wore a super military cap with all sorts of markings on it, his coat was loaded with medals, and he wore a sword! I was wearing shorts and a tee shirt. I snuck off to change into a vested suit.

It was an incredible ceremony with both national anthems. The American Military Attache wore his sword as well. Much later I learned, the *Fuji* was one of the largest Self Defense Force ships of Japan. She was entirely Japanese built and built specifically for a national project. She was the beloved ship of all the Japanese countrymen getting major publicity at home in Japan. She carried a full Admiral for her commander. Then I learned why all the hoopla. This was the first willful invitation by Japan to its former enemy to visit one of its chief national flag ships on an equal footing. Amazing! I was given the business on board the ship early in the expedition for being the nuker and now Admiral Honda was using this time as a major demonstration of friendship between our two countries. There was no scientific data as valuable as this.

For the rest of my service with the Federal Government I had trouble keeping separate the desire to get involved with matters of state and personal research. I loved research and the thrill of discovery. Yet there were frequent despairs over natural events that would not yield to theory. Always there were frequent attacks, and many times personal, against new theoretical ideas. On one hand I felt inadequate primarily because of my humble upbringing dealing with the public and hidden forums of diplomatic service however small it was. Yet at every turn in my professional career I was pushed into the thick of it all. As a young man with choices still before me (or so I thought) I returned to Washington, D. C.

MSDF Icebreaker Fuji at a self made ice dock resupplying Showa Base
January 1968

Top: Emperor Penguins
photographed from the *MSDF Fuji*, December 1967

Bottom: Emperor Penguins tobogganing on the pack ice,
Lützow-Holm Bay, December 1967

Top: Adelie Penguins

Bottom: Ice bergs moving through the pack ice

Kytoon soundings across the Antarctic Convergence Zone

**Top: Japanese scientists from JARE 9 assisting with the kytoon soundings,
Left to right: Michio Yamazaki, Hiroshi Fukutani, Ryoichi Ibe and Katsuhiro Kikuchi**

**Bottom: The cerimonial making of rice cake, ceremonially dressed (center) is
Masayoshi Murayama, Leader of Japanese Antarctic Research Expedition,
on the helicoper deck of the *MSDF Fuji***

Top: Off loading a traverse vehicle January 1968

Bottom: Japanese Self Defence Force at work

Top: Japanese Antarctic Research Expedition establishes a route with supply depots for the traverse to the South Pole the next year

Bottom: Showa Base, Ongal Island, Antarctica January 1968

Top: Farewell to the winter Party at Showa Base

Bottom: Table Mountain and Capetown, South Africa

CHAPTER 14
Sunset

I came back to my country that was in a most confused state. As a nation we were hopelessly hemorrhaging in Vietnam and fighting ourselves at home with racism as a demon on the rampage.

I couldn't wait to fly home to Milwaukee and drive down to Racine where Nancy was a science teacher at Starbuck Junior High School, and oddly after initial hugs and kisses, we faced each other as very different people. That is the toll polar field work extracts. The intense painful work of trying to obtain impossible data from a severe climate and a dangerous geographical location in isolation was not understood at all except by the polar rats who call this kind of work their own. Each time I went South it turned me inward to myself so much that it was very hard to open up even to loved ones I should have trusted. Again I found people like Bill Weyant or Paul Dalrymple or other military personnel as the only people who understood me.

Bob Geissel, who had spent two years somewhat isolated in the Peace Corps and then a year at Plateau Station, blew up and resigned the Coast and Geodetic Survey when he saw not much was happening with the data he collected. He spent his year's salary on an ocean going sailboat, lived with a girl named Marie on his boat and docked at Buzzard Point Boat Yard on the Anacostia River of the District of Columbia. When finances grew tight, they ate a steady diet of potatoes and onions. The last I saw of Bob and Marie was a night we spent waxing eggs for their ocean trip to the Caribbean. Losing such good friends was another painful hurt of polar work.

Becoming reacquainted with Nancy was not easy. I was committed to my polar studies and she was committed to teaching. Northwest Orient Airlines improved their stock rating between my return from the *Fuji* and our wedding. Nancy most frequently took a plane to Washington, D. C. soon after school was out in Racine on Fridays and returned as late as possible on Sunday nights. An airline stewardess asked her if she commuted to Wisconsin every week.

Insert: 31 March 1968. "Tonight I have ordered our aircraft and our naval vessels to make no attacks on North Vietnam, except in the area north of the demilitarized zone where the continuing enemy build-up directly threatens allied forward positions and where the movements of their troops and supplies are clearly related to that threat. The area in which we are stopping our attacks includes almost 90 percent of North Vietnam's population, and most of its territory. Thus there will be no attacks around the principal populated areas, or in the food-producing areas of North Vietnam. . . . I shall not seek, and I will not accept the nomination of my party . . . " (An address by President Johnson to the nation.)

Historically, to be planning a wedding and starting a family in 1968 was the very wrong thing to do logically. The times were so uncertain. The unending war in Vietnam would not go away. As a nation we neither had the courage to fight all out putting our own nation at risk nor the courage to sue for peace. I believe we simply were wrong trying to maintain dictatorial powers in the South while dictatorial powers of the North likewise wanted control. This was not a war of vital interests to the United States. Protests in the streets grew more frequent, larger, and more violent. A mild mannered speaker, Senator McCarthy of Minnesota, won a Democratic primary against President Johnson which brought Senator Robert Kennedy into the race against the President in his own party.

Marches for civil rights also grew in number and violence as the movement began to hit the real issues of bigotry, poverty, capitalism without a soul. On 4 April 1968, while preparing a demonstration for the impoverished garbage collectors, Martin Luther King, Jr. was assassinated in Memphis. American city after city burst into flames with riots and protests. From the Polar Met office in the Grammax building in Silver Spring, Maryland we watched sections of D. C. burn.

With compassion for a black man who worked for Polar Met as a technician, I tried at great risk to drive him downtown between burning blocks and dodged military police jeeps at times at high speed down alleys. The bus station was closed and we had to sneak back out of the city now under martial law. I never was so scared. Once we escaped and were past the beltway, I gave up any personal plans and drove Sam to his home in Harrisburg, Pennsylvania.

It was a measure of my own bigotry. I was a professional meteorologist with a very high salary, and this man was working for us at this government office, an equal opportunity employer. Yet, I did not know Sam's last name, nor did I know that his wife and children lived so far away because Sam could not afford housing in the D. C. area suitable for his family. Taking him home I learned both about him and myself.

As long as I was in Pennsylvania I continued driving to my friend, Don Holz' place in Philadelphia, but it too was a city about to explode. The mayor of Philadelphia did a marvelous thing. Instead of ordering his police department to "shoot to kill" as the Chicago major did, the Mayor of the City of Brotherly Love lived up to that name by ordering all public buildings open and encouraged everyone to come downtown to mourn the loss of a great American. The remainder of the night Don Holz and I sang the protest songs of Black Americans arm in arm with them in prayers for hope.

Thirty years later, when my church body throughout its lily white schools refuses to recognize Martin Luther King Day, I am reminded of my own bigotry again and realize in my part of the Christian Church, we are all still very racist. Maybe only in Heaven it will be right, and that cliché is not good enough.

Near Easter Nancy visited me again at Laurel Lodge and we attended the Union of Geophysical Research Convention in the District of Columbia now marred by being under siege. Military armored carriers were everywhere. Soldiers were on every corner with either automatic weapons or rifles with fixed bayonets. At one scientific presentation, a paper on the history of the atmosphere on Mars, one scientist angrily asked why we were so wealthy and concerned with air on Mars when the air in our city was polluted and poor people were dying of lung cancer and lead poisoning. In a rare demonstration of emotion many cheered and the Martian session was over.

After these meetings, and with armed military escort, Nancy and I purchased our wedding rings at a store near Eleventh and “G” Streets Northwest. Some time in May I received another telephone call from the State Department. I was invited to join the Russians at Vostok as guest scientist. There was a potential of a fellowship at the Soviet Polar Institute in Leningrad for as long as three years after my tour at Vostok. I might be able to take Nancy with me to the Soviet Union. Plateau Station was scheduled to be closed before I would be at Vostok so that a major objective for doing meteorological experiments and collecting low level weather data would be impossible. Marriage was looking a lot warmer.

In corresponding with Rob Flint, he wrote to me about satellite communication between scientists in the field and scientists with their computers at home with the power of near instant analysis. As it turned out, he did go to Vostok and maintained a career with Polar work, always managing a strong independent life to keep strong relations with his wife and children over the many polar years. Chuck Sterns of the University of Wisconsin also was involved with Flint in years to come as they developed robot observers that were placed in the most isolated and severe places of the Antarctic to communicate with satellites and computers. I have always been thankful to know that many of my ideas and ideas of others with which I had input were correct. Today the French still are exploring the interrelationship between katabatic and inversion winds.

More and more riots occurred. It was amazing that this democracy still intended to carry out its election. Then, on 6 June, Bobby Kennedy was killed. There simply were too many “lone gunmen.” I never believed that. There were conspiracies by men in high places without a doubt. What was happening to my country?

On 15 June 1968 Nancy and I were married and our first born son, Paul Martin, was soon conceived. Paul was born on 18 March 1969. Bob Geissel no longer had to worry if we were radiated and sterilized by all of the radiation of the Southern Lights.

The project performed on the *Fuji* had many loose ends left undone and now I was working on them in a backward fashion because of the haste with which I had to meet the Japanese before the trip. I was becoming quite good at manipulating the myriad of government offices that impinged on my research. The hula hoops I had to jump through or get others to jump through to move helium to Australia and put on a former enemy military ship was small potatoes when compared with the bureaucratic needs and paper forms required before I could fly kytoons at the Weather Bureau’s Experimental and Testing Station at Sterling Virginia, only a mile from Dulles International Airport.

Nothing was as “governmentally bureaucratic” as my effort to finally calibrate the wind sensors used on the *Fuji*, or at least those sensors that I still had not lost at sea. While at my old classmate Don Panzenhagen’s home, I met a military officer from Andrew’s Air Force Base who was in charge of a research team that used a wind tunnel. Ideal. This wind tunnel was just ten miles around the beltway. He had a staff eager to assist. We even had a lot of mutual science worthy of exchange. He would arrange for security clearance. My security checks were still up-to-date and valid. No problem.

The time came to move my equipment from my office in Silver Spring, Maryland to Andrew's. As I was loading my car's trunk while parked in a no parking zone in front of the Grammax Building, Bill Weyant came and asked what I was up to. I told him. I apologized for not telling him too far ahead, but it was all arranged. Well, he needed to make a few calls just to make sure.

By noon I was still parked in that no parking zone. It was getting harder to fake loading after four hours. Bill had checked with his boss, Lester Machta, Deputy of the Air Resources Laboratory. Lester Machta had to check with his boss, Allen Shapley, Office of Programs, who in turned checked with Bob Culnan, ESSA Liaison Officer, and maybe Weyant's question climbed to George Benton, Director of the Research laboratories and on to the Military Advisor to the Administrator of ESSA. I have no idea how far into the Department of Commerce and perhaps over to the Department of Defense, but no one would say "yes, I, a scientist in the Department of Commerce, could use a wind tunnel in the Department of Defense. At the end of the day Weyant told me that I perhaps should cancel my plans at Andrew's Air Force Base until we received a more definitive answer. As I drove home to Harper's Ferry, I littered Interstate 70 with many small pieces of a parking ticket from the Silver Spring Police Department.

The final brilliant administrative ruling came about a week later. I could not use a wind tunnel across departmental lines. I could not use a Department of Defense wind tunnel unless a Department of Commerce wind tunnel was not available. I spent another month locating Department of Commerce wind tunnels. One was in Norman, Oklahoma at the National Severe Storms Lab, and a second one was found at the National Nuclear Reactor Test Site in Idaho Falls, Idaho. On the government flow chart Idaho Falls was the closest wind tunnel. I had to air freight nearly a thousand pounds of equipment and spend a week in hotels at high per diem. Herb Viebrock came along.

A life time thrill for me was representing ESSA at SCAR's (Scientific Committee on Antarctic Research) International Symposium on Antarctic Glaciological Exploration. Nearly the entire global community of glaciological scientists was represented at this ISAGE conference held on the Dartmouth College campus and near the Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, New Hampshire. Amazingly I knew most of these scientists either by having met them previously or by reading their works or both. Likewise most of them knew me.

There were scientists from Australia, Austria, Belgium, Canada, Denmark, England, France, Japan, New Zealand, Norway, South Africa, Sweden, Switzerland, USA, and USSR. I was on a high mountain and was looking at all the kingdoms of the world and their splendor as I knew it for polar research.

Those to tease at the conference were three pair of honeymooners, Burt Crary and his new wife, Olav and Billy Orheim, and Marty and Nancy Sponholz. Much attention was paid to Mrs.

Crary and her little secrets about the Chief Scientist of the National Science Foundation. With all the wealth and prestige of Burt's position, his clean, white well-pressed shirts were only white and well pressed from his tie to his lapels. The rest were worn to less than a few threads.

The glamor of science became quite heady. There was wine, great banquets, and praise from all over the world for the promises my research efforts were providing the glaciological community. It was also a time to be attracted to new positions of employment and higher wages. Collin Bull of the Polar Institute with Ohio State University discovered Nancy had a degree in biology and offered us a tempting position for research as a married research team to glaciers in the Palmer Peninsula. We both declined his offer without giving the reason (Nancy was pregnant with Paul), which only made Collin pursue us all the more.

It was quite evident that Werner Schwerdtfeger's theory of inversion winds was making a major impact. I more than enjoyed being part of these discoveries in the making. Whereas most glaciologists suggested ice ages were brought on by a planetary long term cold climatic change, a wind system that held the cold and moisture within the icecap shielded it from the planetary climatic changes or at least insulated it from planetary warming periods except for perhaps exceptionally long and hot periods.

This, of course, also meant the ice ages more than likely and Antarctica very definitely had a life much longer than ever imagined. This was hard for me personally to swallow. I was taught in Christian day schools all of my precollege life. I was also taught science and the Bible both lead to the truth and that, of course, they never could contradict each other. That science just might stray from certain truth was the least of my concerns. I knew many of the modern taverns where new scientific ideas were derived.

I was stunned at the almost total lack of interest in religion of any kind by so many of these scientists who now were my friends by virtue of the camaraderie established through frost bite, risk, and survival. Most of them also wore penguin tie clips. Their lack of interest in religion of any kind reminded me of Robert Falcon Scott's first failing attempt to reach the South Pole, 1901-04 Great Britain National Antarctic Expedition. Scott, Shackleton, and Wilson reached 82 º 17' S and severe weather and lack of supplies forced them to return.

> "It was a Sunday and Wilson, propped up in his sleeping bag, held a kind of church service, reading the psalms, epistle and gospel for that day. One of the psalms happened to be number forty-six, *God is our Hope and Strength*. "Therefore will we not fear, though the earth be moved," it ran, appropriately, "and though the mountains shake at the tempest." Afterwards Scott insisted on a chapter of Darwin, which was his way of scoring off Wilson. Wilson was religious, Scott the reverse. Scott had brought the *Origin of Species*, in Shackleton's words, "to while away such days as these." It was the bible of the agnostic. To please Scott, or in deference to his rank, it was read aloud by Shackleton and Wilson in turn."
>
> "This was Shackleton's introduction to Darwin, reading aloud in a tent on the edge of the unknown. "As natural selection works solely by and for the good of

> each being," Shackleton read out, "all corporeal and mental endowments will tend to progress towards perfection." That was reassuring doctrine to hear while the snow hissed on the canvas of the tent, and nature with her little finger stopped the march." (Roland Huntford.*Shackleton*. New York: Fawcett Columbine, 1985, page 92.)

One reoccurring problem kept emerging from discussions of paper after paper. The top layers of the icecap clearly show seasonal layers with differing density for summer and winter. Even pollen grains blown in from great distances clearly mark seasons of pollination that were occurring in more northerly continents. Snow gave way to compressed ice at deeper layers and different densities of snow change into seasonal differences with air bubbles trapped in the ice. At approximately three thousand feet down all bubbles disappear. There still exists more than nine thousand feet of ice below this level in Antarctica. The level of disappearing bubbles occurs at the same level in Greenland. The very ice core from Greenland was preserved at CRREL for all of us to examine. What caused this mysterious disappearance?

I asked, "Could the layer underneath be frozen flood waters from the time of Noah? Mad hysteria ensued! It was the joke of the convention. For days after, at every evening cocktail hour I had scientists from all over the world slapping me on the back for breaking up the intense theoretical debates. The laughter was redirected when I privately confessed to several that I believed that there was a Noachic Flood. When a dust layer revealed itself deep within the Byrd ice core and under the regions of the bubbles, as rumor of my beliefs spread throughout the convention many scientists went out of their way to point out these ashes were probably from Noah burning trash and Sponholz would know.

These volcanic ashes embedded deep within the ice sheet are to me as much a puzzle as the lack of bubbles. But why this personal ridicule? Many years later the most acceptable scientific explanation for the lack of bubbles seems to be that at the extreme cold temperatures and high pressures so deep under the snow, a gas is dissolved by the solid ice molecule by molecule and remains undetected until the ice is melted and analyzed chemically. I certainly don't have an exact and certain scientific proof of the Flood, but I don't have a scientific explanation for the true resurrection of Jesus at Easter either. I believe He rose from the dead as He will call me to rise on the Last Day.

The mountain top view of the pinnacles of scientific understanding of the world all around me were majestic. I learned to worship my Lord, the God of all, and serve Him only. I returned with Nancy to our home in Harper's Ferry confused with much of the glamor of science taken away.

Duties remaining in Washington, D. C. covered a wide range such as training men for Antarctica as a pay back to Charlie Roberts and the many others of OPPS who were so helpful on my two expeditions. When Ray Herr became swamped with grant approvals at NSF, I occasionally was asked to provide judgments on proposals. Some Russian translation work always plagued me. Once I needed to scramble for ice thickness and strength data to be radioed to a pilot in trouble past the point of no return headed toward Antarctica. There were many government hearings of every kind and nature.

Shortly after Plateau Station was closed after it's third year of operation, its last scientific leader, George S. Rubin de la Borbolla, demanded a NSF hearing accusing the U. S. Navy of sabotaging scientific work. In addition, Tom Frostman, the third year meteorologist nearly suffocated of carbon monoxide poisoning and it took some time for the medical doctor to revive him. Not much scientific data came out of Plateau that year.

The Navy versus civilian scientists has been a problem since the start of our republic. The very first U. S. Exploring Expedition, 1838-1842, led by Lieutenant Charles Wilkes started with his strong dislike for civilians.

> "All the duties appertaining to Astronomy, Surveying, Hydrography, Geognosy, Geodesy, Magnetism, Meteorology, and Physics generally to be exclusively confined to Navy Officers. No others were so well qualified to perform them. And the lesser departments of science - zoology, geology, mineralogy, botany, conchology - to be filled up as far as can be done from among the medical corps attached to the expedition. Only if medical officers of sufficient learning could not be found were civilians to be appointed, and they were to be placed entirely under control and direction of the Commander of the Expedition." (Much of this quotation is attributed to Charles Wilkes, in *The Great United States Exploring Expedition*, by William Stanton, University of California Press, 1975, p. 63)

After nearly a half day of hearings with George doing most of the testifying, me giving similar anti-Navy feelings and Dalrymple testifying of his many years of both bad and good relations with the military, the number two bureaucrat, Phil Smith, waltzed in, spoke nothing but bureaucratese for thirty minutes and concluded nothing could be done. Logistics in Antarctica simply were not possible without the commitment of a major military operation. I couldn't stand him, but he probably was right. I'm still very glad Rob Flint invented a two-by-four Navy replacement that made our year at Plateau Station a very successful one.

Pure research projects, of their very nature, are only temporary. Once discoveries are made and knowledge passed on through publications the research scientists move on as well. We knew that the sunset of polar met was imminent when Lester Machta, Director of Air Resources Lab, Don Pack, the Deputy Director of ARL, and Mort Rubin, then with ESSA Headquarters visited our entire staff to assure everyone a smooth transition to new professional positions.

Bill Weyant was the first to depart taking a position with a professional bridge circuit. Actually, many of the professional scientists were already doing research on non-polar projects. Herb Viebrock and Bernie Lettau's research turned to global problems. Likewise, Bob Becker's work became most concerned with the stratosphere, but he joined his wife's food catering service during the day and established a pizza place for nights and weekends.

After I returned from my voyage with the *Fuji*, I could provide Martin Predoehl with many photographs of the sea and could also connect them quite accurately with latitude and longitude.

He became more and more interested with early verification of satellite observations. This whole field was about to explode and change the entire view of meteorology.

The inversion study was still unfinished but had been given a setback not having any data from Frosty's year. And Herb's and my convergence zone project with the kytoons was the only new polar program. It was a good time for sunset for post IGY projects.

The government was most generous to make sure adequate time and place could be provided that research projects were seen to completion. Herb, loyal to Polar Met to the end, took what was left of the oceanographic studies from the *Fuji* for final publication and continued meteorological research associated with the National Institute of Health.

Pack and Machta gave me great encouragement; they told me I had the highest reputation in the government for getting data out of impossible places. They would have provided a place in their Atmospheric Trajectory Branch if I needed an office to complete my inversion study. I was more than surprised that Dr. Johannessen, Associate Director, Meteorological Operations (2nd in command of the Weather Bureau) paid me a very personal visit. He had traveled with me to New Zealand while I was en route to the *Fuji*, and I debriefed with him about some of my experiences with the meteorological agencies in Australia that I visited.

With Dr. Johannessen's encouragement for me to pursue a PhD in meteorology the dye was cast. I would be going back to school on a fellowship. I would be leaving the Weather Bureau but not resigning. Dr. Johannessen even suggested that there might be a reconstituted polar studies' agency in the government if I still loved the Poles when I returned. Talent was hard to come by. Talent for hardship places was more than rare and the world was ready to pay a good price for those talents.

Nancy, first born son Paul, and I returned to the University of Wisconsin in the summer of 1969 after my four years with Polar Met in Washington, D. C. Plateau data was now on the Madison campus where it got its start. My research continued without delay just as it did in D. C., only now with the direct guidance of Professor Lettau and Professor Schwerdtfeger.

I shared an office with Bob Gall and Larry Mahrt. At first I was apprehensive being on the same research team with a man I was a little jealous of for his priority with the mathematical model of my research. My mathematical skills I felt were as good as anybody's, but while I was in isolation Larry wrote the model for what I wanted to do. I also believed observations should precede theory, but I was absolutely wrong on that score. In fact, theory even precedes application for grants. Judgments for grants are based on the promise of theory and never on cold uninterpreted data.

My envy of Larry was unfounded. He and Bob Gall became great friends of mine as we struggled together with Schwerdtfeger over research issues dealing with polar meteorology. My unfounded feud with Larry reminded me of a similar feud between Robert Falcon Scott and Ernest Shackleton over ownership to a base on Ross Island and over the Beardmore Glacier. No one owned Antarctica. No one owns meteorology or any other part of nature. Research is open and competitive. In the Scott versus Shackleton feud when Shackleton used an old base of Scott's over Scott's objection, Shackleton discovered the great Beardmore Glacier that was the open highway to the South Pole. Scott hiked up the Beardmore Glacier to be the very second expedition to the South Pole only thirty-two days after Roald Amundsen's victorious achievement 15 December 1911. Yet in my view Shackleton should be recognized as the first to the South Pole. By climbing the Beardmore Glacier and marching to a position which was only ninety-seven miles of flat terrain between him and the South Pole, he was really the first to the South Pole and beat both Amundsen and Scott by two years to the high polar plateau.

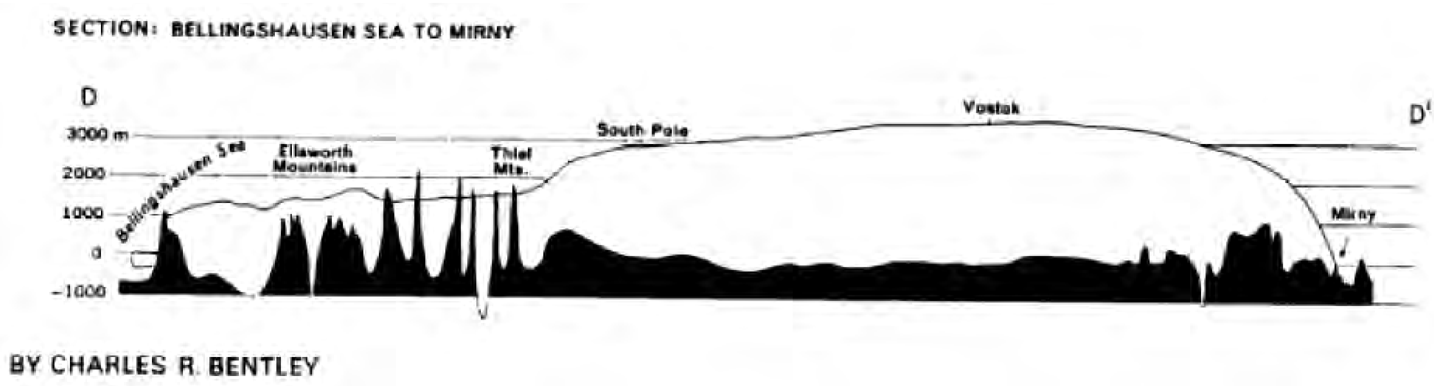
> "December 28. If the Barrier is a changing sea, the plateau is a changing sky. During the morning march we continue to go up hill steadily, but the surface was constantly changing. We are now 10,199 feet above sea level, and the plateau is gradually flattening out, but it was heavy work pulling this afternoon. The high altitude, and a temperature of 48 º of frost made breathing and work difficult. We are getting south - latitude 86 º 31' South tonight. The last sixty miles we hope to rush, leaving everything possible, taking one tent only and using poles of the other as marks every ten miles, for we will leave all our food sixty miles off the Pole except to carry us there and back. I think the country is flattening out more and more, and hope tomorrow to make fifteen miles, at least."
>
> January 9 [1909]. Our last outwards. We have shot our bolt, and the tale is latitude 88 º 23' South, longitude 162 º East. The wind eased down at 1 a.m., and at 2 a.m. were up and had breakfast. At 4 a.m. started south, with the Queen's Union Jack, a brass cylinder containing stamps and documents to place at the farthest south point, camera, glasses and compass. At 9 a.m. we were in 88 º 23' South, half running and half walking over a surface much hardened by the recent blizzard. It was strange for us to go along without the nightmare of a sledge dragging behind us. We hoisted her majesty's flag and the other Union Jack afterwards, and took possession of the plateau in the name of her Majesty. While the Union Jack blew out stiffly in the icy gale that cut us to the bone, we looked south with our powerful glasses, but could see nothing but dead white snow plain. There was no break in the plateau as it extended towards the Pole, and we feel sure that the goal we have failed to reach lies on this plain. We stayed only a few minutes, and then, taking the Queen's flag and eating our scanty meal as we went, we hurried back and reached our camp about 3 p.m. We were so dead tired that we only did two hour's march in the afternoon and camped at 5.30 p.m. The temperature was minus 19 º Fahr. Fortunately for us, our tracks were not obliterated by the blizzard; indeed, they stood up, making a trail easily followed. Homeward bound at last. Whatever regrets may be, we have done our best." (Ernest Shackleton, *The Heart of the Antarctic*, London, 1909)

There simply is nothing new to discover between 88 º 23' South and 90 º 00' South. Shackleton discovered it all and first. Larry Mahrt's formulas may have been first, but I was first meteorologist to gather the data during the winter at Plateau Station. These research tracks were my tracks. And if priority was all important, both Larry and I were students of Schwerdtfeger and

Schwerdtfeger's ideas were spawned in a lifetime of Southern Hemisphere research.

University research was different from government research. I had more material, more contacts, more exchange of ideas, and less pressure to work on the inversion winds while I was a research meteorologist for the government. I had more encouragement and more supervision at the university. Without a doubt, a PhD candidate discovered his professor's ideas.

[The next several pages were not posted on The New South Polar Times internet site. I am sure the graphs and math were a tad beyond K-12. Nancy and I had two sons both of whom earned engineering degrees from the University of Minnesota-Twin Cities. At the family supper table one Thanksgiving Day the conversation strayed into the distant past when the engineers suggested their math was beyond old dad. Indeed at my little college, where I teach future pastors and teachers, differential equations are not parts of sermons nor eighth grade science. But the saddest part of life is that your children never see you in your youthful power days. By and large that is probably for the best and of course dad is only dad. But physics is physics. So for Paul and Mark the fluid flow of the atmosphere as I knew it and tried to explain it follows. The more time passes the more science changes and I am sure the science literature since 1970 demonstrates that for inversions winds also.]



A LIST OF SYMBOLS USED
(in order used)

z = ordinaryvertical coordinate of height above the snow surface.

T_h = temperature at the top of the inversion.

ΔT = temperature difference between the top of the inversion and the surface.

z^* = independent variable in the vertical in nondimensional form.

k = coefficient of eddy diffusivity.

f = Coriolis parameter.

$\vec{C}_T$ = thermal wind.

$\vec{C}_T(z)$ = finite difference thermal wind between level "z" and the top of the inversion layer.

g = acceleration due to gravity.

T_s = temperature at the base of the inversion.

$\vec{G}$ = slope of the snow surface or icecap.

$\vec{k}$ = non-dimensional unit vertical vector.

$\vec{P}_T$ = a component of the horizontal pressure gradient force due to the thermal wind.

A = a constant of proportionality to be determined from boundary conditions.

P_x = "x" component of the pressure gradient force.

v_h = "y" component of the horizontal wind vector at the top of the inversion.

P_y = "y" component of the pressure gradient force.

u_h = "x" component of the horizontal wind vector at the top of the inversion.

v_{gs} = component of the surface geostrophic wind in the "y" direction.

z_s* = non-dimensional height of the surface wind level.

F_x = "x" component of the variable force of friction.

F_y = "y" component of the variable force of friction.

The genius of the Schwerdtfeger-Mahrt mathematical model for the inversion winds was their tie of the shape of the surface of the ice dome to the wind profile above. They did this by first modeling the temperature profile relative to height above the snow surface according to the expected radiational cooling. They formulated this profile as an exponential function (e ≈ 2.71828182846) with the power of the "e" function being the height.

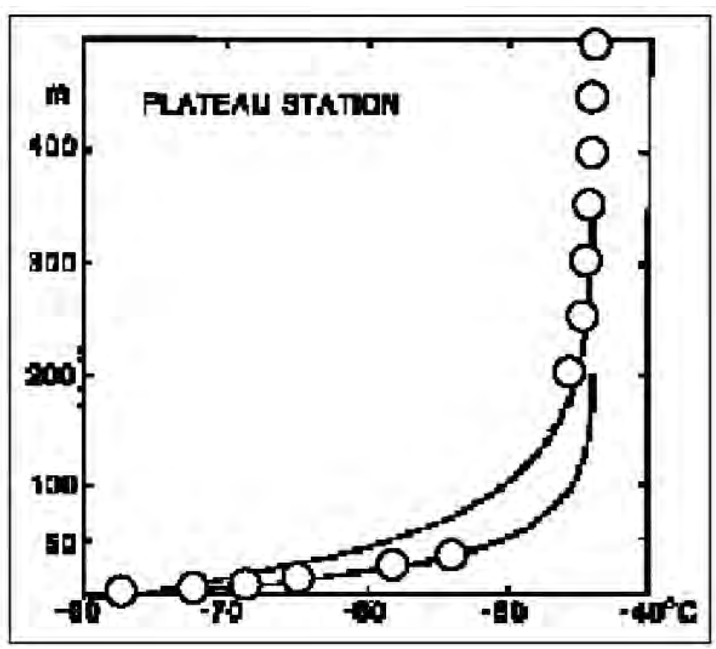
$$T(z) = T_h - \Delta T e^{-z^*}$$

where

$$z^* = \frac{z}{\sqrt{k/f}},$$

for the purpose to make heights non-dimensional.

Two attempts were made to match with the real temperature profile of the inversion, but nature does not use one formula for part of itself and the same equation with a different set of constants that happen to fit for another part. Their exponential function was correct. However, Prof. Schwerdtfeger's own studies led to views that super saturated sinking air in the lower regions of the great inversion ice crystals were condensing out of a clear sky, and this would add heat to this layer as I explained and graphically showed in chapter nine.



In chapter four I explained Schwerdtfeger's idea that the great inversion similarly formed on the sloping ice dome created a horizontal temperature gradient that produced a thermal wind.

A thermal wind equation first published by Dalrymple for South Pole data follows.

$$\vec{C}_T = \left(\frac{g}{f}\right)\frac{(T_h - T_s)}{\overline{T}}\vec{G}\times\vec{k}$$

By substituting the variable function of temperature with respect to height in the thermal wind equation in the place of the surface temperature Schwerdtfeger and Mahrt obtained an elaborate pressure gradient equation.

$$\vec{P}_T(z) = \vec{k} \times f\,\vec{C}_T(z) = -\frac{g\Delta T}{\bar{T}} e^{-z^*}\,\vec{G}$$

The magnitude of the pressure gradient force was set as

Ae_{-z*} where A is a constant.

The boundary conditions for the top of the inversion is that geostrophic balance exists, a balance between only pressure gradient force of the synoptic scale wind regime and the coriolis force.

These geostrophic balanced forces are

$$P_x = -fv_h$$

$$P_y = fu_h$$

$$A = \frac{-fv_{gs} - P_x}{e^{-z_s^*}}$$

Next, Schwerdtfeger and Mahrt defined the frictional forces.

$$F_x = k\frac{\partial^2 u}{\partial z^2}$$

$$F_y = k\frac{\partial^2 v}{\partial z^2}$$

Equations of balanced flow in non-dimensional form follow.

$$v^* + \frac{P_x}{A} + e^{-z^*} + \frac{\partial^2 u^*}{\partial z^{*2}} = 0$$

$$-u^* + \frac{P_y}{A} + \frac{\partial^2 v^*}{\partial z^{*2}} = 0$$

Non-dimensionalization with the following definitions:

$$u^* = \frac{uf}{A}$$

$$v^* = \frac{vf}{A}$$

$$\theta = \frac{\sqrt{2}}{2}$$

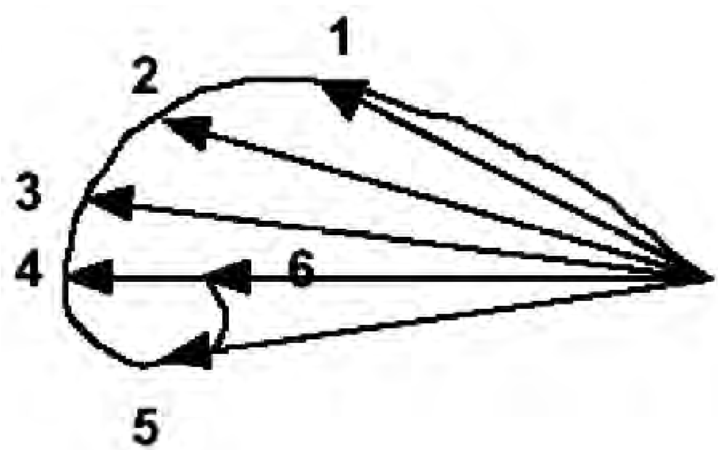
The Schwerdtfeger-Mahrt solutions follow.

$$u^*(z^*) = -\frac{1}{2}e^{-z^*} + \frac{P_y}{A} + \left(-a_1 e^{\theta z^*} + a_3 e^{-\theta z^*}\right)\sin\theta z^* + \left(a_2 e^{\theta z^*} - a_4 e^{-\theta z^*}\right)\cos\theta z^*$$

and

$$v^*(z^*) = -\frac{1}{2}e^{-z^*} + \frac{P_x}{A} + \left(-a_2 e^{\theta z^*} + a_4 e^{-\theta z^*}\right)\sin\theta z^* + \left(a_1 e^{\theta z^*} - a_3 e^{-\theta z^*}\right)\cos\theta z^*$$

These are parametric equations that are solutions to the differential equations written to describe vector added thermal winds to a typical and normal Ekman wind spiral. The normal Ekman wind spiral is shown immediately below. (Ekman spiral's were first describe in chapter nine.)



A few constants need defining.

a_1, a_2, a_3, a_4

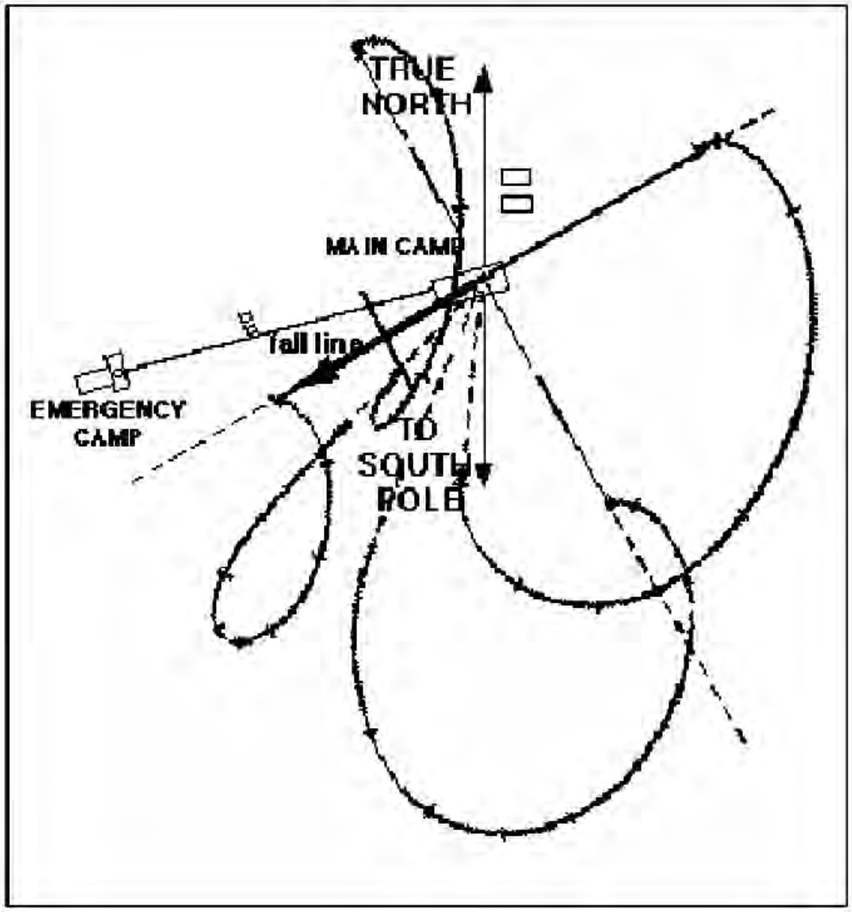
are constants from integration and can easily be determined from boundary conditions.

At the lower boundary

$u = v = 0$ at $z = 0$.

At $z = h$

$$\frac{\partial^2 u}{\partial z^2} = \frac{\partial^2 v}{\partial z^2} = 0$$



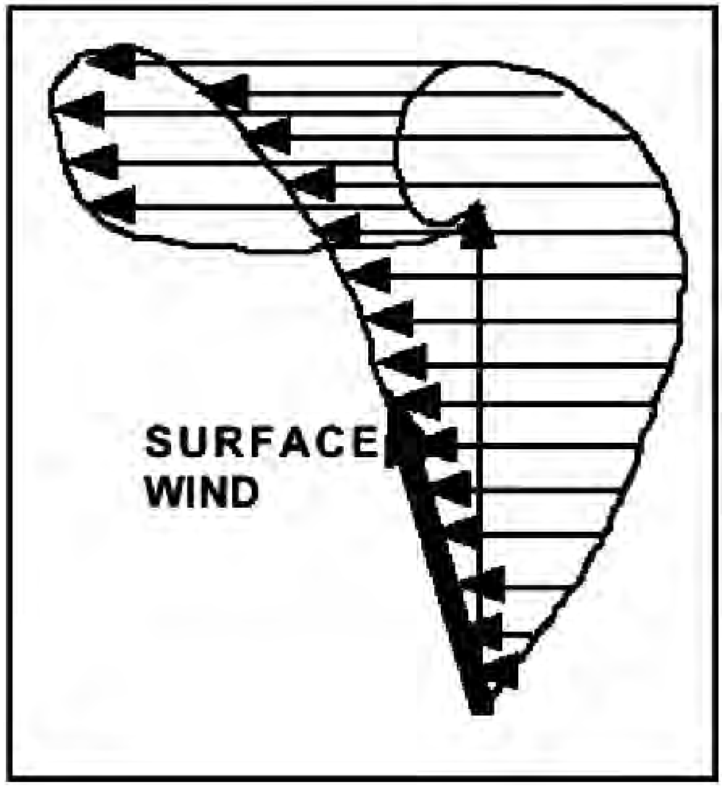
i.e., the top of the friction layer coincides with the top of the inversion.

These modified Ekman spirals are the inversion winds superimposed over a sketch of Plateau Station showing the slope or fall line.

Professor Schwerdtfeger originally chose for the top of these spirals the four winds, North, East, South, and West. In this diagram I have oriented his spirals with the direction down the gentle plateau slope. As we follow each of the four spirals around, and down through the air to the snow surface, we see the amazing results both Schwerdtfeger and Lettau explained to Mort Rubin and Dalrymple back in the initial meeting five years earlier as Plateau Station was being planned. The wind speeds and directions on the snow surface were nearly the same and not down slope but at about forty-five degrees between the fall line and the perpendicular to the slope. The majority of the wind vectors, especially the strong snow carrying winds just above the snow surface but below the top of the inversion, were dominantly sideways to the down slope no matter what the wind above the inversion was, even from any and all four wind points above the inversion.

For maximum impact for the sake of publishing these exciting results Prof. Schwerdtfeger and I chose a balloon series I launched at Plateau Station the days of 6-8 August in 1966. (Temperature and net radiation profiles for this series are shown in chapter nine.) If you placed your back to the wind at the surface on these days, the wind above the inversion was veering to the right. Said another way, it appeared that the wind was shifting clockwise relative to the observer on the ground. Such a shift of the wind was not a shift expected in the Southern Hemisphere. The exact opposite was expected. That indeed did get attention.

The thermal wind of necessity is a component of the wind that is always perpendicular to the temperature gradient. When the inversion causes a horizontal temperature gradient, it is fixed to the shape of the ice dome pointing from the cold surface temperature to some higher temperature down slope, aloft, but in the same horizontal plane as the point of origin. The thermal wind can be shown as an exponentially increasing vector altering the Ekman spiral as shown above. The resultant wind vector on the surface, with the observer's back toward the oncoming wind or the observer's face looking in the same direction as the wind vector, will turn the way it is supposed to in the Southern Hemisphere—toward the left. It will continue to turn leftward and get stronger and even turn counterclockwise at the higher levels of the inversion crossing over to the right. This crossover is easily missed with standard observational methods. My slow rising balloon series, in fact, captured this exact view.



It was a joy to publish these findings of my PhD research project with Prof. Werner Schwerdtfeger in the *Antarctic Journal of the United States* in 1970.

Giving reference to these findings and giving me priority as the discoverer of the inversion winds in nature, Werner Schwerdtfeger wrote in his more permanent book:

> "The result is a set of wind spirals— or hodographs— which show but little similarity with the original Ekman spiral for a barotropic boundary layer. Complete loops can appear, and it is interesting indeed that the occurrence of such loops in the hodographs of the real boundary layer has been confirmed by Sponholz at PLATEAU Station in 1966 as well as by Kobayashi (1978) at MIZUHO and Adachi (1979) at SYOWA." (Werner Schwerdtfeger, *Weather and Climate of the Antarctic*, page 55.)

The theoretical understanding of inversion winds, in the final analysis, over the past thirty years since the great meteorological studies from Plateau Station, has merged with katabatic winds in complex ways.

[Returning to the NSPT posted text:]

I remain a disciple of Werner Schwerdtfeger and his inversion winds. They, and they alone are tied to the snow surface. These winds explain why cold domes of ice, such as Greenland and

Wind in the frictional-layer over Plateau Station, August 7, 1966; temperature inversion between 1.5 and 400 m: 32°C.

Black circles: Vector averages of the wind measured by five soundings, between 0052 and 0842 GMT, during a stable weather situation ("steady state").

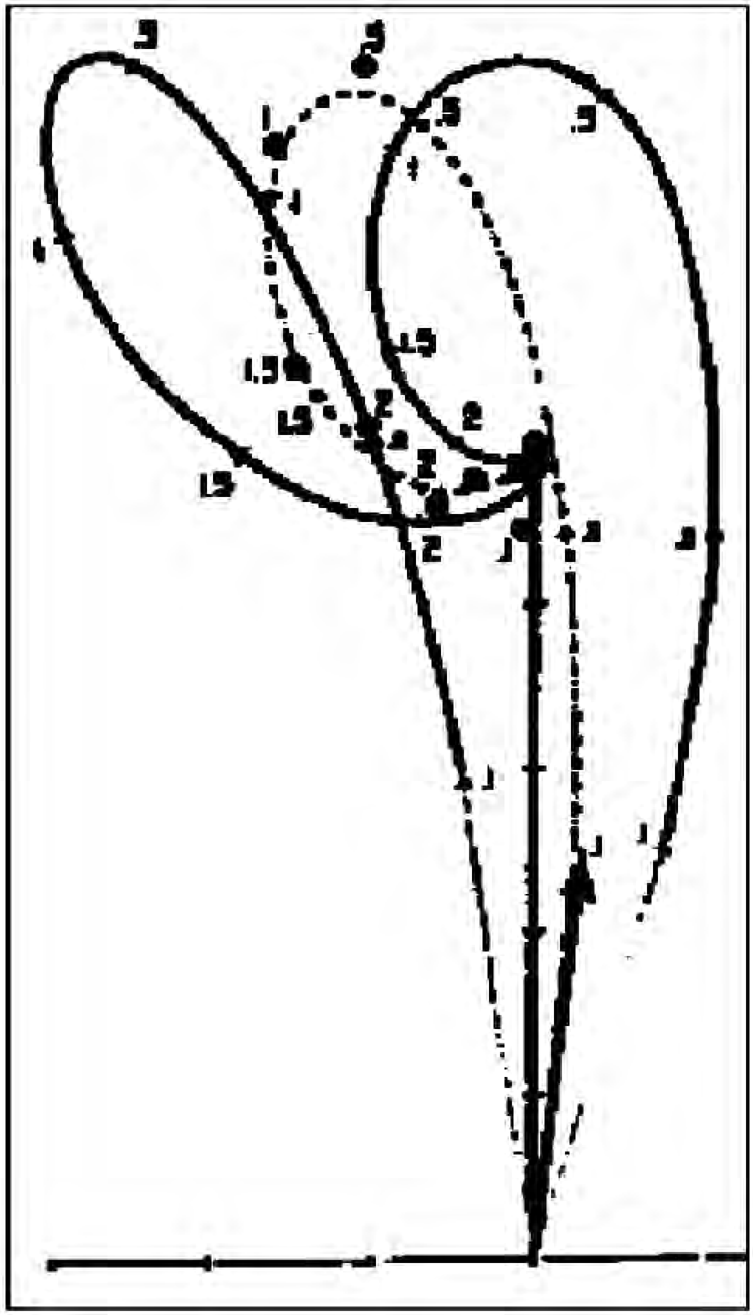
Heavy dashed arrow: Upper wind $\vec{V}$" (at 400 and 500m), from 55°, 5.4 m/sec. The three curves show individual theoretical wind spirals.

Dashed: Angle between thermal wind $\vec{V}_T$ (from 160°, along the contour lines of the terrain) and the upper wind $\vec{V}$" being $\alpha T = 105°$; $V_T = 3V_g$; $K = 3 \cdot 10^3 cm^2 sec^{-1}$

Solid at left: $\alpha T = 90°$; $V_T = 3V_g$; $K = 3 \cdot 10^3 cm^2 sec^{-1}$.

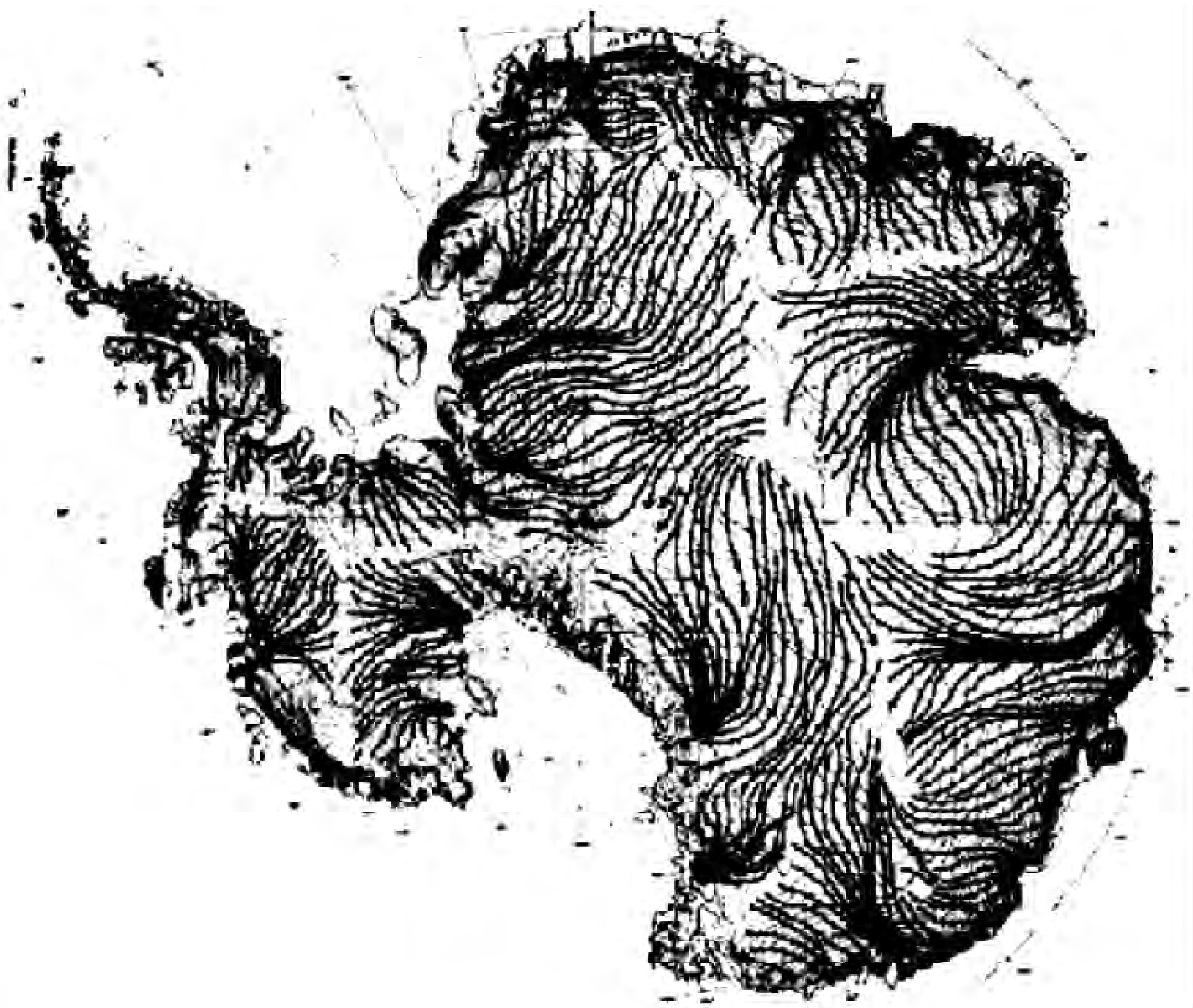
Solid at right: $\alpha T = 120°$; $V_T = 2.5V_g$; $K = 2.5 \cdot 10^3 cm^2 sec^{-1}$.

Unit of height values of black circles and of marks along spirals: 100m.



Antarctica, remain on a very warm planet. The warm moist air penetrates into the interior of the icecap where the great inversion causes the moisture to fall out while the inversion winds hold that moisture and snow on to the icecap. This circular bonding of the inversion shaping the winds that shape the icecap that again shape the inversion is a delicate environmental balance. Where that balance was broken, such as over North American by a collapse of the earth's crust now under Hudson's Bay that changed the snow surface, the ice dome dissipated and the ice age ended.

A letter of commendation for my outstanding work as a young weather forecaster, an Antarctic Service Medal from Congress for "courage, sacrifice, and devotion," and later, a plaque from the Department of Meteorology of the University of Wisconsin, signed by all members of my PhD committee and other friends, for my contributions to polar research, and the naming of Sponholz Peak in the Liberty Hills of the Ellsworth Mountains in Antarctica were rewards of the



The surface wind field according to T. R. Parish and D. H. Bomwich, "Advances in antarctic geophysical sciences from the IGY to the present," *Antarctic Journal of the United States*, National Science Foundation, Vol. XXI, No. 2, June 1986, page 9.

world. Nonetheless something was always very wrong.

I admired Tom Frostman on his return to the University of Wisconsin after his winter at Plateau Station. He honestly recognized his math skills were less than when he left for the seclusion of polar work. He quit graduate study to work with developing equipment and teaching units for the public school near his hometown in northern Wisconsin.

The mathematical modeling world, an automatic gift before Plateau, now for me was a struggle. This may have been the price for the experience in Antarctica. If so, I gladly pay it. The activities of discovery in the real world over against imaginary findings behind a desk or in a warm library permit no contest as to preference.

I join Richard E. Byrd:

> "The one aspiration I still had was to be vindicated by the tiny heap of data collected on the shelf in the Escape Tunnel. But, even as I seized upon this, I recognized its flimsiness; a romanticized rationalization, as are most of the things which men are anxious to be judged by. We men of action who serve science serve only a reflection in a mirror. The tasks are difficult, the objectives remote; but scholars sitting in bookish surroundings tell us where to go, what to look for, and even what we are apt to find. Likewise, they pass dispassionate judgment on whatever we bring back. We are nothing more than glamorous middlemen between theory and fact, materialists jobbing in the substance of universal truths."
>
> "At the end only two things really matter to a man, regardless of who he is; and they are the affection and understanding of his family. Anything and everything else he creates are insubstantial; they are ships given over to the mercy of the winds and tides of prejudice. But the family is an everlasting anchorage, a quiet harbor where a man's ships can be left to swing to the moorings of pride and loyalty."
>
> "A man doesn't begin to attain wisdom until he recognizes that he is no longer indispensable." (Richard E. Byrd, *Alone*, 1938)

Filled with self doubts and thoughts of decaying mental skills, I found my studies also were plagued with campus unrest. Protests against the war in Vietnam were boiling before I ever left for the Antarctic. Now Nixon ordered the invasion of Cambodia as well and the campus virtually blew up. Research and study performance as usual was more than difficult to maintain.

I remember in early spring, with demonstrations and protest marches increasing in ugliness and violence, Professor Hammer, my geophysics teacher and an invited professor on my PhD committee, announced that absence from a test on Monday when a campus wide student strike was called would result in an automatic failure in the course, absolutely no exceptions. Sheepishly, although I did have nearly shoulder length hair, I approached Prof. Hammer and begged an excuse for that Monday. Nancy was pregnant and our second baby was due on the very day. With moist eyes Dr. Hammer consented to my excuse because it was the only real life problem of a student he needed to deal with that was not connected to some political upheaval. Lisa Ann was born early that Monday morning and I did not have to miss class. Dr. Hammer sent Lisa her first pink dress as a gift a week later. That Monday we had class amidst tear gas.

I found no one in any of my science classes that believed as I was taught that the earth was created in six days and destroyed at the time of Noah in a global flood. Open ridicule waited for a person like me. What hurt more than open ridicule was the question about how I could get so far scientifically with the beliefs I had.

The University of Wisconsin made their doctoral program very clear as to what it was. The Graduate Catalog clearly stated that the PhD degree was a degree awarded not for classroom excellence alone but for a demonstrable philosophy. There simply was no creation philosophy of ice ages recognizable by any of the scientific communities. In the subject of polar science I knew them all. Some pastors and teachers of my church body wrongly claimed the best scientists still believed in Creation. I knew most of them. They did not! My own data looked right through and past Creation for millions of years.

In the end, despite great overall scientific success with my polar studies, evolution versus my personal faith in a literal interpretation of Scripture became a dominant inner conflict to the point of my inability to carry research forward. I could not remain loyal to both professors at the University and to the teachings of my church. Things came to a head at a meeting with my PhD committee discussing the Russian language and Russian work as research tools. Lettau spoke and claimed that, "one who is dedicated to the study of the Polar region . . ." BOOM! I don't remember another word. As a layman out East who had served on two different constitutional committees establishing two different mission churches with the WELS I could not continue in the false teachings of evolution and accept any more of the world's laurels.

I loved the physics of the atmosphere. I believe if I had remained a pilot briefer or researcher with operational weather forecasting I would still be climbing the professional ladder of excellence and serving my country in this profession. As my meteorological career moved to the higher levels of theories and I needed to look to the global ice sheets for fundamental answers for energy exchanges with the atmosphere, the sea, and the ice sheets, questions turned to age and how the atmosphere evolved without a Heavenly Father. Explanations of nature by science had always sought answers that left the Creator out of the picture all the way back to Thales.

I no longer could with a Christian conscience remain in the PhD program. In tears I withdrew. Perhaps my own inability and lost skills, certainly the unrest related to the war in Vietnam, and the philosophy of evolution all played their roles in changing my profession.

Three people active in the WELS also had an influence. Dr. Sigbert Becker, a frequent speaker at our Lutheran Collegians' gatherings Sunday evenings was quick to encourage my career change saying, "We need to turn you into a teacher before you get used to those scientific salaries." The dedication and love for their work exuding from the grade school classrooms of Dan Schmeling, a high school classmate of mine, and Paul Boehlke, a very distant cousin, made suggestions like that of Dr. Becker's a possibility. I spoke to their school children and parent groups of their respective schools as a polar hero and visitor but there was never any doubt that the little children they taught knew Dan and Paul, their teachers, were their heroes.

A LAST LETTER

The University of Wisconsin
Department of Meteorology
Meteorology and Space Science Building
1225 West Dayton Street
Madison, Wisconsin 53706

February 14, 1971

Mr. Martin Sponholz
Luther High School
Onalaska, Wisconsin 54650

Dear Marty:

Thank you for your letter of February 5.

Indeed, since you told me you enjoyed your work at LHS very much, I was not too surprised by your decision. But I appreciate the frank way you write me about it. I shall not try to persuade you to change your mind, not only because you certainly have considered the pros and cons carefully before writing. I really think that good and dedicated high school teachers are at least as important as meteorological researchers, and everyone of us should go, as long as he is young enough to choose, where he feels he can be efficient.

I have shown your letter to Lettau, Wahl, Kutzbach, Stearns, and Bentley, and all expressed more or less similar thoughts.

We also want to give you a little "document," nothing official, of course, but perhaps a friendly memento for you, and of interest for your children and grandchildren.

With best personal regards,
Werner Schwerdtfeger

END OF LETTER

Admiral Byrd’s role for active men between theory and fact, though driven by others, is still the more exciting role, but it is found in teachers more than mountain climbers or polar explorers. In the service of my Lord’s Church, what more can there be for me.

Still, there is a need for committed lay men and women to go to nature more than to the library. We must never stop learning lest we all fall into a dead orthodoxy that only sports words from books and not from the complete world our Lord has placed us in. An adult confirmand, a microbiologist who has done such advanced studies faced trouble when a pastor desired not to confirm her because she wouldn’t accept his view of unalterable and immutable species because she could watch those species change under a microscope. When this happens, our church needs to train its pastors and teachers better in science.

This work I now do. At times I miss the accolades of my former profession. Then I think of what both the government (Pontius Pilate) and the church (Caiaphas) ordered done to Truth personified and I am humbled by the privilege to serve Him. “You may keep your gifts for yourself and give your rewards to someone else.” (Daniel 5:17)

A POSTLUDE
by Paul R. Boehlke

A life is a canvas on which God paints. For some, God has used extremely broad and bold strokes. Events and journeys much larger than self occur, but the patterns can be hidden. Data is collected, but meaning is elusive. So it was in Marty's exceptional work as a researcher. The blinding white, the numbing cold, the screaming snow of the coldest place on Earth are all background for reflections and inner struggles.

Raised by his aunt, schooled in conservative German-Lutheranism, Marty came to work with the top theoretical meteorologists in the country: Lettau and Schwerdtfeger. Here among the wise, Marty learned how science was done by doing it. He worked at the cutting edge of his discipline. His greatest achievement was to successfully gather the measurements that supported the inversion winds theory. Nevertheless, at the same time Marty was impressed that without the theory, he would not have been compelled to make the balloons rise slower.

Books that show how science works, written by someone who was there, are rare. Those who have read The Double Helix by James Watson will see some of the same themes: theory selects the data, expectations define the observations, personalities clash. Science is very human. There are frustrations, politics, turf protection, stolen data, and doubts. To the complexities of large scale, government-funded research, Marty adds insight into working with military support and various government agencies. But he also reflects the lure, love and excitement of exploration and discovery. Above all, Marty's book is unique because he has read, loves, and shares the history of his subject.

Furthermore, Marty is unique because he risked his life and health to get his data. The single sentence/paragraph: "It was incredibly cold," chills the reader to the bone and speaks volumes. And at the same time the coldness and the loneliness put Marty's faith on the line. He had the only Bible at Plateau Station , and that is how he continued to feel while studying at the feet of outstanding scientists. He found himself questioning his beliefs: separating traditions and human opinions from Scripture. At the same time he saw scientific data bend and its truth change. He saw that some explanations were favored; others were laughed at. In the end God calls him to work in his church.

Marty and I have known each other for many years. We attended Wisconsin Lutheran High School at the same time, and later Aunt Edna would always report to me on my cousin. We have also enjoyed sharing an office for many years at Martin Luther College. I have often listened to Marty's fascinating experiences, and I urged him to record especially the Antarctic years, for the insights that come from writing, and so that his family, students and friends might also see his journey. His story is not a showy, superficial snowmobile trip across Antarctica, but it is a mission filled with hard science.

There are indictments of some of the aberrations in Christian education. We can learn from Marty's candid reflections and benefit from them. We do students no good if we support Scripture with human reason or if we think that science produces certain truth. We do no good if we favor athletic students over others. And we do no good if graduates of our schools know only their weaknesses, without realizing that God is making them into new people: able with His help to achieve excellence in this world.

Certainly, Marty's journey among the magi was formative. Martin Luther reminded us a long time ago that Christians are not finished products, but rather we are in the process of becoming that which we will be. God works in our lives for His purposes so that we grow and are more and more able to do His work. The journey among the magi certainly prepared Marty well for the call he now holds at Martin Luther College: teaching our future churchworkers. At MLC Marty continues to function as an extremely valuable member of our small science department. He is, of course, able to speak with authority on the content of science; but more importantly, he is also able to teach about the nature of science and its truth claims. It is a privilege to be associated with him and to have been asked to read this manuscript.

Paul R. Boehlke
Epiphany, 1995.

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“The wind in its everlasting flight sweeps over these tracks in the desert snow. Soon all will be blotted out.
But the rails of science are laid; our knowledge is richer than before.
And the light of the achievement shines for all time.”

(Written as an introduction by Fridtjof Nansen to Roald Amundsen’s The South Pole, MAY 3, 1912)