THE ROYAL HOLLOWAY METEOROLOGICAL EXPEDITION TO SVALBARD 1978

Expedition address: 142 Bullbrook Drive, BRACKNELL, Berkshire

Team members on the summit of Newtontoppen (5,445'). Left to right: Graham Bunn (Imperial), Rod Clarke (Oxford), Bruce Herrod (Oxford), Paul Strickland (Bristol-medic), Rob Heaton (RHC), Andrew Wilson (RHC - Leader).

PATRONS

Dr. Lionel Butler - The Principal, Royal Holloway College
Prof. Sir Owen Saunders - Royal Holloway College Council Chairman
Dr. Barry Smith - Assistant Director, Meteorological Office

SUPPORT

Royal Meteorological Society
Royal Geographical Society
Scientific Exploration Society
Imperial College Exploration Board

OBJECTIVES

Recent major pollution disasters have highlighted the urgent need to be able to predict fall out patterns over wide areas. The RHC Arctic Expedition had the aim to carry out research for the British Meteorological Office by providing wind turbulance data under ideal known conditions. The area of operation was OLAV V LAND ice cap on the Arctic archipelago of Svalbard. A secondary aim was to attempt to reach the summit of Svalbard's highest mountain, Newtontoppen. The team consisted of six University Students all 20 years of age.

INDEX

INTRODUCTION

by Andrew Wilson

In 1957, an accident in one of the reactor chambers at the Windscale Nuclear Station caused a cloud of nuclear material to be released into the atmosphere. The Meteorological Office studied the atmospheric conditions and predicted that the cloud would drift across the country and finally approach Norway over the North Sea. Unfortunately the wind turbulance around the Cumbrian mountains hadn't been taken into consideration, and the cloud was diverted south and dispersed over Liverpool.

A research team was formed within the Met. Office to study the phenomena of wind flow and drag effects around single, isolated hills with the ultimate aim of predicting wind flow fallout patterns and hopefully improve weather forecasting. The system was modelled mathematically with complex differential equations, but actual physical wind readings were required to confirm their research.

After attending an advanced 'rock and ice' course in Switzerland, I contacted the Met. Office with the view of undertaking a research project requiring mountaineering skills. I was duly invited to organise an expedition to take wind readings around hills in 'ideal' known conditions. Measurements could not be acquired by using wind tunnels as it is virtually impossible to simulate atmospheric layers, and attempts to obtain field data within the British Isles had been successful, but due to surface features, such as trees and buildings, the information was not accurate.

Svalbard (often known as Spitsbergen) was chosen for the project for three main reasons. Firstly because it is halfway inside the Arctic circle, with 24 hour daylight throughout the summer months, thus developing 'stable' atmospheric conditions. Svalbard also has a large open ice cap and is known for its symmetrical and fairly isolated hills. Svalbard is actually an archipelago, about the size of Scotland, which is administered by Norway. It lies on one of the shortest routes between Moscow and New York and is politically a very strategic position. There are several Russian settlements on the islands, and great care was taken when applying for entry permission into the region.

The Expedition took 1½ years to organise, the first 6 months being spent producing a feasibility study to investigate the sanity of such a venture. The North Polar Institute kindly sent me several aerial photographs and all existing maps of the ice cap (Olav V Land) and a suitable ice dome named Astronomfjellet was selected for the project.

My plan was to form a 6-man team and fly out to Longyearbyen, which is Svalbard's airfield serving a small coal mining community, and then hire a boat through the fjord system to a group of derelict huts known as Brucebyen. These would be our Basecamp for 2 months and the first two weeks of the expedition would be spent backpacking supplies to a dump camp near the top of the Nordenskiold Glacier. Once enough gear had been accumulated, sledges could be hauled 30 miles across the ice cap to 'Astro'. The expedition also had a secondary objective which was to attempt to climb Svalbard's highest mountain, Newtontoppen (5,445').

The team was formed over a 6 month period from students from the RHC, Imperial, Bristol and Oxford University Climbing Clubs. I organised a winter survival course in Scotland and hired the Alpine Guide, Geoff Arkless, to put the team through their paces. This course was of great significance as it was to develop friendships which were to become so very important later on.

Svalbard is a Polar Bear reserve, and I heard several horrific stories of explorers being eaten. Two Norwegian Explorers had been dropped off at one of the islands with only 3 weeks food. The boat did not return as planned, and after 7 weeks, both men were searching for food, when a Polar Bear attacked, killing one of them. After nine weeks, miraculously a passing yatch rescued the loan survivor.

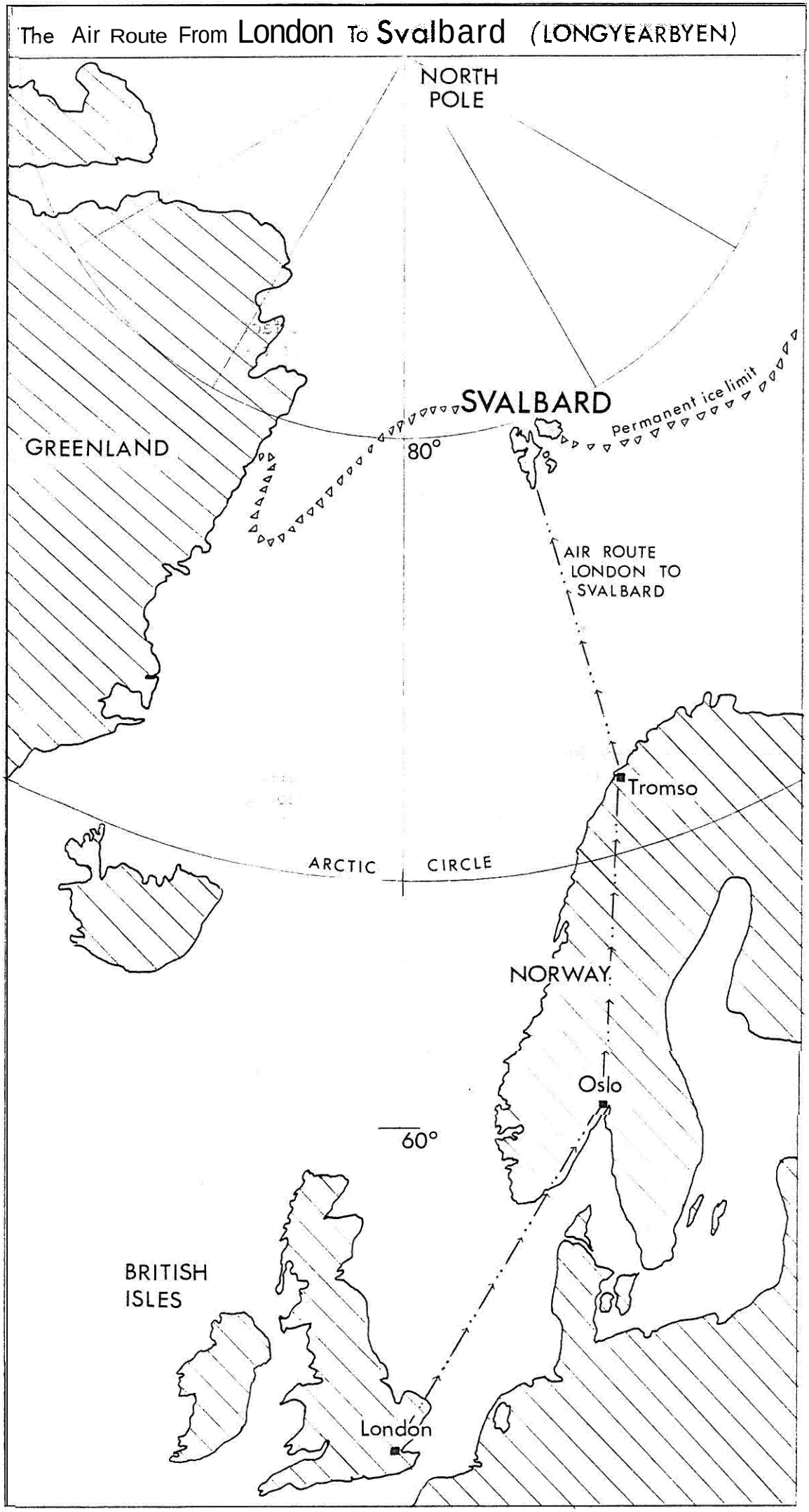
Stories such as this taught us two important facts. Firstly, it was essential to take a great deal of food and the total cash value of the expedition food amounted to Â£1500 Many donations were given including 576 Mar's Bars, 1500 Penguin Biscuits, 50 cans of Guinness and 50 Ibs of Soya Beans. Several long weekends were taken up prepacking all of our supplies into suitable man/day units - we were rationed 4½ Penguins per day! Little did we realise then how important this preparation would be to our morale and whole success of the venture.

A rifle was also necessary for protection against attacks from Polar Bears. The world famous explorer Col. John Blashford-Snell generously loaned his personal .303 rifle and gave instruction in its use. It was the very same rifle that saved his life when he was attacked by a crocodile in the Zaire river!

In November 1977, I produced and published a prospectus which outlined our objectives and then began a massive fund raising campaign requesting sponsorship. We managed to raise Â£508 and the ***6*** team members each contributed Â£380 giving a grand total of Â£7362 We are greatly indebted to our patrons, particularly Dr. Butler, who from the outset have been a constant source of encouragement to us.

One problem immediately became apparent - how would we train for sledge hauling with a distinct lack of ice caps in England? We eventually came up with the idea of dragging concrete slabs around Windsor Great Park to simulate the hauling motion. We were met with some very strange looks from the public, but it was all worthwhile as we were able to design and test efficient waist harnesses. The team also trained in cross-country skiing at the artificial ski track at the Aldershot Army Barracks. Instruction was very kindly given by the Olympic Skier, Col. John Moore, who also gave several fitness tests at the Army training clinic.

In an effort to minimise the expedition transport costs, I decided to despatch half of our supplies with a commercial freight company to Longyearbyen via Newcastle, while the remainder was sent on board a chartered yatch to Svalbard. Plans for cheap transport were, however, foiled when the RHC Maintenance Van failed its MOT only one day before our equipment was due to be transported!! But come early June, we had bought, modified and despatched all our food and equipment and exactly one month later we ourselves were ready to leave.


The Air Route From London To Svalbard (LONGYEARBYEN)
NORTH POLE
SVALBARD
Permanent ice limit
GREENLAND
80°
AIR ROUTE LONDON TO SVALBARD
Tromso
ARCTIC CIRCLE
NORWAY
Oslo
60°
BRITISH ISLES
London

EXPEDITION ACCOUNT

narrated by Andrew Wilson.

The RHC Expedition began on 3rd July 1978 when the 6-man team left London Airport for Longyearbyen, Svalbard, via Oslo and Tromso. At Longyearbyen, the local authorities indecision over camping permission meant a sleepless night huddled inside a large packing case before we made a 5-hour boat journey to our Base Camp Huts at Brucebyen, 500 miles from the North Pole.

PAUL: 'The first thing that struck me about Brucebyen as we approached, was the intolerable greyness of the place. Dark stratified cliffs rose directly from the blue green water. For the first time I felt cold. I thought of Caroline and of home, but then Graham distracted me. The glacier in front of us looked like a million miles away; massive, untouchable, absolute."

ROB: "We off-loaded our stores from our chartered yacht and transported them ashore in small rowing boats. Before Jarlie the boatman, left us, Andy paid him Â£20 for his help and confirmed that we wanted him to return in 2 months."

BRUCE: "We each stood quietly by the shore, each wrapped up momentarily in his own thoughts, no doubt wondering what the next 2 months would bring, whether we would succeed and how we would work together as a team."

The architecture at Brucebyen followed a classical neo-georgian tradition with a hint of the Florentine school, viz. three tiny wooden huts, two freshwater lakes and enough scrap metal to build a liner. The huts had been constructed in 1910 and subsequently abandoned by a small Scottish coal prospecting expedition. In one hut we discovered a rusty iron stove which we fueled with driftwood found at the edge of the fjord. Jarlie had earlier told us that the wood had been cut in the Siberian work camps and had drifted across the BarentsSea to Svalbard.

Brucebyen was situated in the centre of a colony of ferocious and beligerent Arctic Terns, who took great pleasure in discharging their excreta, with alarming accuracy, right down the back of our necks. Collecting water from the lakes soon became a hazardous business with Terns diving at our unprotected heads (not unlike scenes from the film "The Birds"). After Graham was struck on the head by a diving Tern, climbing helmets became the order of the day whenever venturing from the huts.

PAUL: 'What no Caviar? - no, but every other conceivable culinary delight. Rod has planned our menus well. He is a very good cook, although his concept of an "adequate portion" has to be seen to be believed. On the plane coming out he ate 3 portions of salad ... this was definitely a sign of things to come!"

GRAHAM: "Its occuring to me that being responsible for food or equipment is an invidious task because if you forget one tiny thing, someone gets fed up about it."

THURSDAY 6th JULY - THURSDAY 13th JULY

The plan for the first stage of the expedition was to backpack supplies up the Nordenskiold Glacier to a dump camp from where we could eventually pack our sledges and manhaul across the Olav V Land ice cap towards 'Astro'. During the next 9 days the team made 6 labourious backpack carries, sometimes with loads of 60 Ibs. Paul describes a typical day:-

PAUL: 'The day would begin with the inevitable struggle of willpower to heave yourself out of bed and don wet, cold clothes, reeking of woodsmoke from the stove over which they had been left to dry. No one was at their best first thing in the morning and usually a stoney silence prevailed as the unfortunate cook began his day's duties by dishing up bacon and scrambled egg with a vat of tea big enough to sit in.

After a good breakfast, primitive grunts and groans would be heard. These emanated from those washing up and cleaning the hut, but mostly from those washing themselves, shying away from the ice cold water.

The ritual of becoming fully conscious was usually followed by someone discovering that it was already 10.30am. Harsh words of retribution from the leader ensued, but most of us had dubbined our boots and packed our sacs for today's journey the previous evening. It must be said that one member never did this, and the start of the day's journey up the glacier would be delayed another half and hour while said member plastered his feet, cleaned his boots and packed.

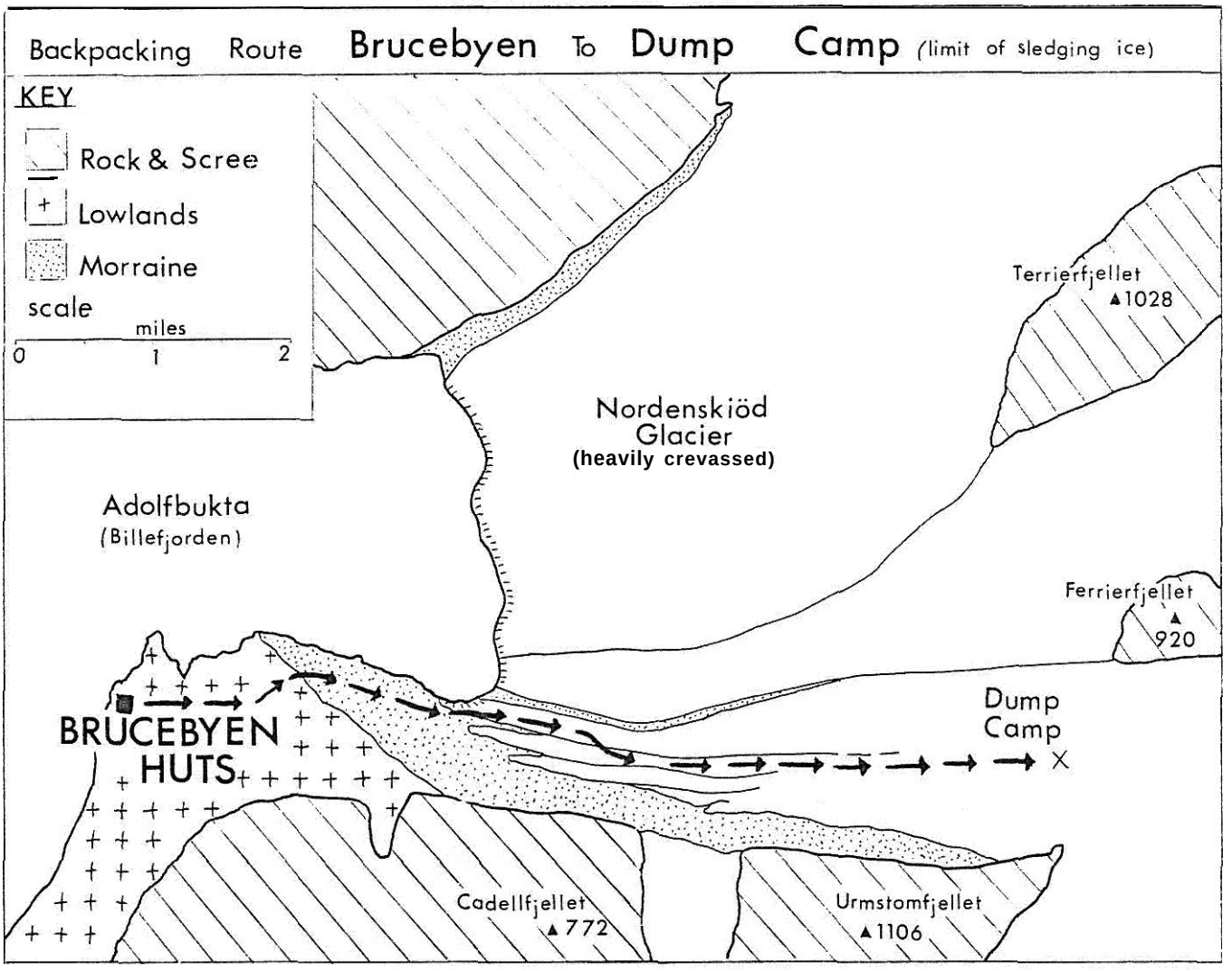
Andy took care that the equipment to be taken up the glacier each trip was evenly distributed, both in terms of awkwardness and weight and that each man was carrying a sensible maximum (about 50 lbs), thus ensuring the minimum number of 'glacier runs' before all the equipment was at the top of the glacier at the beginning of 'sledgeable snow'. A typical load would include a foodbox (25 lbs) a pair of skies and sticks (7 lbs) sundry items such as stoves, tent poles, climbing gear (15 lbs) and personal kit for the day, food, survival gear, waterproofs (5 lbs). It was vital to pack the sac correctly. Usually the sac would be removed from the frame and the items strapped on very firmly. A moving load, a noisy load, or an uncomfortable load was time wasting and annoying for everyone.

Boots on and we were off; starting slowly at first to let the cold boots mould onto your feet and the pack settle on your back. First hazard - nesting Terns. These birds would swoop down and peck at head or hand and most of us took the precaution of carrying a large stick above our heads to ward them off. The first mile or so of the 14 mile round trip was over bog and glaciated lowlands. The heavy packs made legging over wet areas difficult and it was not unusual to get 'a bootfull' in the first quarter of an hour. Before reaching and climbing over the glacier's terminal moraine, whose loose bouldered sides could only be described as 'ankle-snapping-good' we had to cross a large meltwater stream. This was particularly difficult on warm days when glacier meltwater would swell the stream into a raging torrent. Then followed a 2 mile stretch of 'boulder-hopping', climbing up and down the loose scree and rocks of the moraine, trying to keep on the firm mud which underlay them, and sometimes this was not as firm as it appeared! Our passage across the moraine brought us level with the glacier just at the beginning of the dead ice at the southern side of Nordenskioldbreen Glacier. Here we had left a marker flag and a tea chest containing our ice-climbing gear. Harnesses, prusiks and ropes were duly put on and after a brief rest we would set off up the smooth mass of dead ice, following a medial moraine onto and up the glacier.

Usually the party tried to keep together during this long haul, the faster members spurring on the slower ones. On the first trip up the glacier we had used crampons and ropes all the way, but soon realised that this was unnecessary. The gradient of the glacier was not difficult, and the surface was smooth. Once a good rhythm was established, we would plod on for 45 minutes at a time before stopping for a quick rest.

As we approached the dump camp the glacier became more undulating and crevasses began to split sideways from the bulk of the main moving mass of ice. These were often covered in fresh snow so we roped up for the last mile or so. Despite these precautions, Graham was several times 'lost from view' and only when we stopped laughing were we able to pull him out.

Four hours after leaving the huts, we arrived at the dump camp and deposited our heavy loads. The wind was often bitter and it was usually sleeting or snowing through a blanket of 'Spitsbergen mist' as we ate a quick lunch and surveyed the surrounding territory.



To the N, Ferrierfjellet; to the S and E the great basin of snow which was lined with ice and rock cliffs and to the W looking back down the glacier to the coastal plain, and the fjords far below."

Having ensured that the gear was secure and visable, we set off usually in good spirits, back down the glacier. Our lightened loads and the thought of the warm stove and a good meal spurred us on and the return trip usually took only 2½ hours. Being tired, it was vital to 'rope up' over the crevassed area, but after this the party would erupt into rude verse or song, and the conversation would turn to girlfriends, home, and university. We had time to look at the magnificent scenery without the heavy packs pushing down on our necks and knees. The climbing equipment was left at the snout of the glacier and then followed the final push to the huts. Often we were so tired at this point that it was just a question of willing our feet forward only to be sucked into the mud of the moraine. Once back at the huts, a vast mug of tea followed by the usual gargantuan repast, then loading up the sacs and cleaning the boots for the next trip the following day.

And so this daily routine was repeated until our first major task was accomplished. It soon became apparent that one of the greatest dangers we would encounter was that of crevasses. During the backpacking work Graham fell into the same crevasse at least three times even though we had clearly marked its position with a red flag. Rod wrote a descriptive passage in his diary about crevasses:-

ROD: 'If you can see where the crevass actually is in amongst the alpine style ropes, krabs, prusiks, slings, deadmen, ice axes and the like which Andy (quite rightly) insists on stuffing into every available crack in the ice, crossing the thing is relatively easy. The biggest ones invariably show themselves when you are going uphill with a 50 lb pack on, thereby decreasing your immediate life expectancy by several decades, courtesy of Issac Newton. If you are on mid rope you prod around with the axe to make it look good on cine, then shut your eyes and jump. Invariably Graham falls down it with a cry of 'Oh dear' not unlike a war cry of Atila the Hun. If you are on the sharp end of the rope, then its different. These crevasses are very deep, very cold and very frightening. So you edge up to it and it creaks a little at you. You poke it with an ice axe and it responds by giving way (or not) sending a tinkling of ice into bottomless depths and revealing that you are, in fact, standing on the roof of an ice cave which is only 3 inches thick. Having done this the procedure is the same as in mid rope - close your eyes and jump."

FRIDAY 14th JULY

ROB: The team rested on the 11th day of the expedition, which was the last at the huts before we made our final carry of personal gear to the dump camp. In the evening, over our last big meal, we began talking about Dougal Haston and other famous explorer types. Someone mentioned John Ridgeway's trip to the source of the Amazon, and Rod said "Why can't I do something like that?". Andy replied, "you will do tomorrow".

SATURDAY 15th JULY

BRUCE: "At the dump we packed the 2 sledges, each weighing 500 Ibs when fully loaded. We then put on our harnesses and leaned forward on the traces - nothing happened. We pulled a little harder; still nothing happened. Finally we kicked our heels in and to the sound of ONE. TWO. THREE. HEAVE, pulled with all our might. The sledge moved about 3 feet. Again and again this process was repeated until we began to establish a rhythm and made some head way."

The team set off at 5pm up the valley leading to the minor corrie on the S side of Nordenskioldbreen. The sledges bucked and creaked at the strain of being hauled in and out of meltwater channels underneath the surface of the wet snow. Both sledges tipped over after only a few hundred yards and had to be completely repacked - we were learning fast!

I employed three men pulling on each sledge, the central man being on a longer rope out in front with an additional safety rope in case of crevasse. The sledge runners were breaking through the soft upper crust and soon our boots began to go through, too often resulting in a wet boot.

An average speed of $\frac{3}{4}$ mph was recorded by the mileometer which was connected to a bicycle wheel and dragged behind the rear sledge. After hauling for 2 hours, firm ground was reached so I decided to stop and pitch our first camp. Morale was high, despite a hard day. To much laughter, I roped up and walked in a large circle around the proposed camp site. The idea was to probe for hidden crevasses, marking them with red flags, and then establish a safe toilet area. I did not want anyone disappearing down a hole in the middle of the night!

I divided the 6-man team into 3 groups of 2, each pair taking a food box and sharing a Vango Mk.4 tent. It was now to become general policy to change tent partners after each food box ran out (usually after 4 days) thus developing 'group friendship' rather than establishing isolated pairs. Rod began by sharing a tent with Paul.

PAUL: "Unfortunately Rod is a large fellow, hence a movement at his shoulder is amplified greatly by the time it reaches his hand. I will expand. This evening he cooked pancakes (not that the sheets of flame engulfing the tent worried me at all).

He poured water into the mixture but despite intense concentration, added 4 pints instead of ¾pt. As if knowing his error even before starting, the low rumble which grows into the characteristic 'Damn' welled up in his bowels and came spitting through clenched teeth even as he performed the act. Not to be beaten, with painstaking care he spooned out the excess 3¼pts, but alas, in his rapture at having saved the pancakes, he momentarily lost his concentration and knocked the whole lot over!!"

SUNDAY 16th JULY

Having spent the first night camped on the ice, we were keen to move on. Poor packing of sledges is fatal, as had been learnt the previous day. The bottom layer of food boxes were firmly secured with crossbindings, leaving the boxes actually in use readily available. It is important to keep the weight low, and behind the front contact points of the runners. It is also essential to have a good breakfast, and equally important to clean up and pack efficiently. The sledge packing and cooking thus combined to make an average time between waking and beginning to haul of about 3½ hours.

Ahead loomed a long hill, the backwall of the glacier corrie, which had to be climbed in order to reach the flat top of the ice cap before heading N towards Newtontoppen. Hauling commenced at 12pm and over a mile was travelled during the first hour. The weather up until now had been patchy, but cloud began to drift over, bringing in a grey depressing mist. We were having to rest often and as we began to move up the first gentle incline, the pace slowed even more. There was much sweating and cursing. Everyone was trying very hard, bent over at 4 5 in the harnesses in a desperate effort to at least lose sight of Camp 1. It was no use, 3 men could no longer even move a sledge.

The whole team then harnessed themselves to one sledge and began to relay the load up the hill. As the gradient increased, so the drift snow became deeper. This meant that each step involved lifting a foot buried to the knee, up from the snow, pulling, and then sinking back in. After travelling several hundred yards, we plodded back down to collect the second sledge. Spirits were relatively high, and it was lucky that the mist prevented us from seeing exactly how little distance we had covered. During the next relay, I decided to use snow shoes.

GRAHAM: "Damn, why didn't I realise how important snow shoes would be? Most of them have broken in some way or another, which is my fault, and do I feel annoyed with myself?"

One more backbreaking relay was attempted before it was decided to stop and pitch camp No.2. In 6½hrs hauling, only 2 miles had been covered. Pitching the tents involved digging and then trampling a firm base. Time spent on this was not wasted, as if rushed, we ended up sleeping on a scale model of the Himalayas. The team ate well and felt lifted. Bruce contacted England on the radio, but was not able to get a message through.

MONDAY 17th JULY

The effects of a full day sledging was more than apparent the following morning. Despite poor weather conditions, blanket mist, a cold breeze and snow like porridge, we decided to push on up what had been named 'heartbreak hill'. Visibility was such that a good bearing could only be kept if the navigator had two points, the lead man and the sledge, which he could keep in line.

PAUL: "The going was pathetically slow, we pulled our hearts out but at each step our snowshoes sank into the thick wet surface layer. It was apparent to us all that we weren't going to get far today. After two backbreaking relay sessions, Andy decided we should pitch camp and wait for more favourable conditions. In any case, it was essential to have good visibility when we reached the top of the corrie in order to fix a good northerly course."

GRAHAM: "We must have gone all of 0.4 miles. The depth of the snow is 3ft in places. Everyone is utterly exhausted; manhauling is easily the most testing thing, both physically and psychologically, that I have ever done. I don't think I will ever do it again."

TUESDAY 18th JULY

At midday, Bruce managed to contact Issfjord Radio (radio station near Longyearbyen airport) and obtained a weather forecast. "Stable conditions for the next 48hrs - no change in weather". Not at all promising. That night was Rob's birthday and in celebration the only can of beer taken onto the ice cap was consumed. The party did not last long.

WEDNESDAY 19th JULY

The weather once again, abysmal. The domestic arrangements were working well. At this stage, I decided to cut down our rations from the very liberal 'sledging rations' to 'white-out rations', thereby spinning out the food boxes as long as possible whilst waiting for the weather to change. Thus the term of stay with the other partner in the same tent was extended. When it actually came to change tents, most of the team were reluctant, though afterwards, we all agreed it was a good decision.

BRUCE: "Morale today is fairly low; there is talk in the camp of the impossibility of the task of sledging through deep snow, of changing plans, and descending S to Flichnerfonna or even back, and concentrating on a goose project. For myself, I simply chose to remain quiet and be patient."

After discussing the situation with each member of the team, I decided to remain for at least another 3 days. After this period, I would be forced to consider returning to bring more food back to camp. To try and dispel some of the impending gloom, I decided to practise skiing close to the camp, so as to keep everyone mentally and physically active.

At 3.15pm as if in response to these skiing efforts, the cloud cover began to lift. Eventually, slowly but surely, the wind swung round to the N and the cloud dispersed. The sun came out and improvement in morale was dramatic and instantaneous. We immediately decided to send the best three skiers (Bruce, Paul and Rod) to the top of 'heartbreak hill' and onto the ice cap to assess the situation.

BRUCE: "We set out up the hill to the N with instructions to test the snow and survey a possible route. On the ridge we could see glorious awe-inspiring views for more than fifty miles across the ice cap. The snow everywhere was deep, soft and sticky. We stopped on the crest for a while discussing our alternatives. The breathtaking views, the sheer scale of the problem of sledging through deep snow for 60 miles unnerved me. I realised that despite all the will in the world, it would be impossible to sledge in such conditions. Rod took off his skis and wandered around, floundering in the snow, sinking up to his waist at times. As we returned, the others looked at our disappointed faces and half guessed the truth."

I waited with baited breath to hear the report on their return. Rod was very depressed and refused to say more than "you'd better go and see for yourself Andy". Rob, Graham and I made rapid progress as we skied on a second recce to the ice cap. The sun's heat could now be strongly felt on hands and faces - it was hard to believe that the North Pole was only some 500 miles away. Rob unfastened one of his skis and placed his boot into the snow - then grinned.

BRUCE: "They returned an hour and a half later, and to our absolute amazement, seemed excited and full of hope. As if to answer our prayers, the temp. dropped to $-1^{o}C$. The snow began to freeze hard, and our spirits began to lift and morale had once again returned. In the space of 2hrs, what had seemed impossible was now in our grasp. It was still going to take a lot of effort, but at least we had been turned from the brink of defeat."

PAUL: 'I think we should go", said Andy. WE WENT.

THURSDAY 20th JULY

PAUL: "With a mixture of fear, excitement and anticipation, the sledges were packed, and by 1.00am we were pulling 3 to a sledge up the last few hundred feet of 'heartbreak hill'. The snowshoes were unnecessary, such was the hardness of the surface, and the sledges glided effortlessly over the ice. Half an hour later saw us on the top of the corrie and pointing into the distance at Newtontoppen reflecting spectral light from the midnight sun. We put on skis and to my astonishment, it was possible to pull the sledges in them. Even a gentle uphill gradient could be negotiated and on flat ice we could travel at about 5 or 6 mph with much less effort than with walking."

The sledges were hauled throughout the night on what Rob described as "THE JOURNEY OF A LIFETIME". The general direction was N, contouring to the E so as to lose as little of the hard won height as possible. The going was slightly downhill across the first of many shallow undulations and valleys in the top of the ice cap. Navigation was simple; point at Newtontoppen and start skiing. To the NW lay a group of nunataks which, on the map, had seemed a reasonable route marker and possible dump point. They lay at the head of the main mass of Nordenskioldbreen glacier, surrounded by vast crevasses. Every effort was made to keep well away from them. By 6am the dark mass of Ferrierfjellet was well behind and the view down the glacier, across Billifjorden, and as far as the open sea, was breathtaking. The air was so clear we could see well over 200 miles in some directions.

At 7am a stop was made to melt some ice over one of the pariffin stoves to get some water to quench thirsts. Three Thermos flasks had been filled the night before, but these had long since run dry.

GRAHAM: "Good old 'Rise and Shine', I like 'Rise and Shine'. We brewed up some tea; I also like tea. Then we continued on our journey with the odd stop for a gasp of air."

The excitement of pushing onto the ice cap masked fatigue which suddenly made itself felt having been on the go for over 24 hrs. This was the first encounter with circadian rhythm trouble - a sort of manhaulers jet-lag (see Medical Report). Without destroying ourselves, I wished to continue as hard, and as long as possible. I discussed the matter concerning the possible continued change of day/night pattern with Paul, our medic. We concluded that although there was a constant feeling of tiredness, progress should continue, but not to allow the situation to become out of hand, thus leading to a possible dangerous situation.

Eventually a stop was made to open a new food box and cook some breakfast. The angle of the sun in the sky was becoming more acute and the temperature was rising. Sadly the food box was contaminated with diesel fumes from the hold of the boat. The taste and flavour, with its lingering 'after-burn' had penetrated every non-tinned item. How many more of the 18 remaining boxes left were poisoned? An inspection luckily determined that they were in good condition.

ROD: 'Over to the E a whole new inland sea of ice opened up, glorious, sparkling in the midnight sun, quiet except for ski runners skating over the surface, and except for our laboured breath. Away to the W stretched endless lines of snowy peaks jutting out of the ice cap in majestic splendour; to the W lay Isfjord, tranquil and serene, hardly a breath of air disturbed the placid surface. We pressed on, changing occasionally to snowshoes when skis would not grip uphill. Eventually, as morning turned to midday, tiredness began to tell and the sledges began to break the surface jerking on the harnesses with sickening familiarity."

GRAHAM: "Made a camp at midday in the middle of nowhere in particular (about 78° 45' N 17° 45'E)."

Our position was just over half way to Astro (having gone some 12 miles during the last session) and we were now fully committed in the middle of Olav V Land ice cap.

A bivouac constructed between the two sledges kept the scorching sun off whilst a meal was consumed; we then slept for 8 hrs. It was unpleasantly hot inside the tents, although the air temp was below freezing outside. Just as I was about to lapse into sleep, I was startled to hear a strange sound outside the tent. "There's a Polar Bear outside!" By sods law, Graham had the rifle in another tent. I peered out only to find an Arctic bird pecking at a corned beef can. At 10pm the sledges were packed in a record time of 2 hrs; the longest time this task had taken was 5 hrs due to the tents freezing into the ice and it taking 2hrs to cut them out with axes.

FRIDAY 21st JULY

A bank of high cloud had drifted in from the N and its insulating effect raised the air temp slightly though not enough to affect the snow conditions drastically. At 12 midnight we set off on skis and made good progress. The magnificant view seemed to put Graham on edge.

GRAHAM: "The way ahead looks very bad and the map is giving us a totally false impression of the contour system around here. Rob got quite annoyed at Bruce for being a 'Prima Donna' and not pulling hard enough. We stopped to rest, and I stood staring at Grusdievbreen (Great Devil Glacier). It occurred to me that I find this place very frightening. I feel as though I have almost reached my limit of courage. Maybe I'm tired or something. No doubt by the end of this expedition I'll know a bit more about myself."

BRUCE: "At 6.40am we stopped for a meal. Out came the inevitable sardine tin with its pitiful little key, followed by the conventional profanity, the stronger tin-opener, the unexpected oil gush and at long last peace, with jaws moving in just appreciation of the hard-won contents."

Visibility was deteriorating and so I resolved to push on faster and try to reach Astro. After pulling the sledges across a large crevasse, using deadmen anchors and a fixed rope, the ice could be seen to fall away into what looked like a glacier. Several problems now became apparent. While I was confident that I had come the right way it was difficult to get a true fix of our position. Since the map had been compiled mainly from aerial photographs in 1949, the landscape had considerably altered. It was hard to relate what was seen with what was shown on the map. Several attempts were made before establishing our position on the map by back-bearings. This located our position some distance from where we obviously were - the highest point on the ice cap. Further, the map gave no indication of the seemingly 1000ft drop in front of us, nor the huge open crevasses which lay in the valley floor. Later Bruce suggested that the whole mass of the ice cap had shifted to the W since the map was made, and in doing so, formed the valley which blocked our path.

It was essential to stop the sledges to rest; Rob and Rod were completely shattered. Graham unpacked a primus stove and began melting ice to make a hot brew of tea. Paul, Bruce and myself made a short recce on skis to determine the gradient of the slope down to the valley floor. I belayed Paul across a snow bridge of an enormous crevasse, so that he could gain a better view from lower down. He reported the route highly doubtful so we both traversed W zig-zagging for several hundred yards to where the slope appeared to lose its gradient. We could clearly see a safe and steady sledgeable route right down to the valley basin. At the time, we were too tired and visibility was too poor to continue, so we returned to the sledges and pitched tents at 8.30am. Heavy mists soon engulfed our camp producing another 'white-out'. The mileometer read 21.8 miles and the altimeter 1275m (the highest contour on the map was 1100m!)

PAUL: 'The evening was grey, cold and cloudy when we woke at 9pm. The whole team had adjusted well to the 'night cycle'; although two days continuous sledging had taken its toll. Spirits were high despite the weather and there was a friendly atmosphere in the tents which was to persist throughout the entire period on the ice. Glad of a chance to rest, we stayed put, having learned that it was best to wait for the weather and that a decision of route or tactics was always more sound if not made in haste.

We had come to terms with the fact that the weather is God, and God cannot be rushed. About 11pm the weather momentarily cleared enough to let us see down to the E. We were almost in direct line with the 'Devils Glacier' full of nunataks and ice blocks. Several of the team members expressed feelings of unnease when staring through the mist into that rather weird place. Time passed slowly at camp 5, but then it always did in a 'white-out'."

SATURDAY 22nd JULY

GRAHAM: "The outside world was all mixed up again. Bruce made an abortive attempt to contact the Copious. We lazed around for the rest of the day eating (thank you Rod), playing whist and patience, and talking about anything and nothing in particular. Woke up around 10.30pm to hear people (Andy) saying that it was clearing up outside and that we should be prepared to move off. Groan! I rather liked staying where we were."

SUNDAY 23rd JULY

The wind was shifting round from the W to the N and the cloud began clearing. The sledges were quickly packed in order to take advantage of the good visibility to negotiate the awkward slope ahead. There were some suggestions to continue 'straight down' the slope, but I decided to follow the recce ski tracks W, towards the route we had seen a day earlier. After only a few hundred yards, the mist rapidly closed in and we were forced to stop.

At 3am however, after waiting only half an hour, the clouds suddenly lifted revealing a clear blue sky and bright sun. Conditions were now perfect as progress was cautiously made between crevasses along the route into the valley. The technique employed in the descent was to have two men at the back of each sledge, snow-ploughing as a brake and one man guiding the way at the front. Although our progress was safe (i.e. at a slow rate) efficiency would have been considerably improved if I had chosen to use the snowshoes instead of skis.

The Arctic had played a visual trick on us, as the downward slope was neither as steep nor as long as was envisaged. Stopping near the bottom and looking back at our tracks in absolute astonishment, we saw that the sledges had descended on the ONLY POSSIBLE route. A narrow strip of good snow between a 60ft ice cliff and large open crevasses. It suddenly became perfectly clear to us that we had made the correct decision to stop in bad visibility two days earlier. An individuals memory of a given event does not always match with those of his companions. Graham wrote a slightly different version in his diary.

GRAHAM: "Bruce thought we should go straight down the slope. I'm on the sharp end and I decided to go more round to the W. After 5 minutes the fog was in again and we had to stop. I could see that this cloud was only some 50' thick above us, as the sky was reasonably blue. Paul, Rod, Bruce and I upon my instigation, set up Olav V Land first piste. Suddenly the fog all cleared away again, so we set off down the slope. I chose a flukey path which only crossed one of the numerous crevasses. There remained now only a short easy section of the slope to descend."

PAUL: 'We all felt a bit frustrated as our progress was desparately slow. So near yet so far. I could pick out the peak of Astro but it was as if the hills formed an impenetrable wall before it."

GRAHAM: "Paul seemed to be losing his temper and was concerned about keeping things moving, so he shoved me off down the remaining slope with sledge in tow. I was quite annoyed as someone seemed not to be caring very much about my life! In the event I am still alive."

Finally when we got to the bottom we had to decide which of two alternative routes to take. Across the valley floor to our left lay the string of hills comprising Saturnfjellet, Titanfjellet and Tethysfjellet. To the right lay a smooth ice dome whose N face was an unknown quantity as was the terraine beyond it. Paul and I skied on a short recce journey to the right leaving the others to wait. It soon became clear that the route was totally out of the question. There were several very steep waves of ice and between them lay insurmountable crevasses. On returning to the sledges, I decided to send our best two skiers on a long journey to investigate the only alternative way. There was a possible avalanche risk and so we didn't know at this time whether it was safe to break through the chain of hills.

BRUCE: "Paul and I went ahead on skis along under the avalance strewn slopes of Saturnfjellet and up to the Col. between Tethysfjellet and Titanfjellet. There we halted having decided that the route was sledgeable and that the Col. would make a suitable camp site. We marvelled at the beauty of the scene before us, lit by a blazing Arctic sun, there across the ice-filled basin lay Astro and Newtontoppen, our two goals, majestic in their beauty, solitude and splendour. We returned to the others after skiing 6 miles in an hour and a half. We reported our findings, and grabbed 10 minutes well earned rest before restarting sledging at 9.30am."

Realising the importance of moving before the sun became too high, and while the weather was good, we began sledging immediately. We kept to the shadow of the mountains for some distance to make use of the hard snow, but the surface conditions deteriorated and the sledges began to dig in. At ½ mile from the Col. we began to relay the sledges, pulling 6 to each sledge. The sun was scorching and we stripped to the waist. The amount of water lost as sweat was tremendous, but after a backbreaking struggle by all members of the team, we finally made the top of the ridge between the two peaks. After a much needed drink we went to bed at 4pm and slept for 15hrs. At long last, 9 days from our base at Brucebyen, we have arrived at Astro.

MONDAY 24th JULY

It was unfortunate that we had unavoidably moved back into a normal day/night cycle again. I decided we should 'survey' Astro during the afternoon, and then move back onto a 'night shift' and wait (or pray) for some wind for our research project.

ROD: 'Four miles from camp across a shallow ice-filled basin, lay our chosen ice dome - Astronomfjellet - and it was clear from the start that movement both to and from there was going to be far from simple. Several gaping cave-like crevasses would mean detours of up to ¼ mile on the way. On Astro itself which was approx. 1000ft from base to summit, there was an exposed line of rock along the S side and a 100ft cliff to the NW.

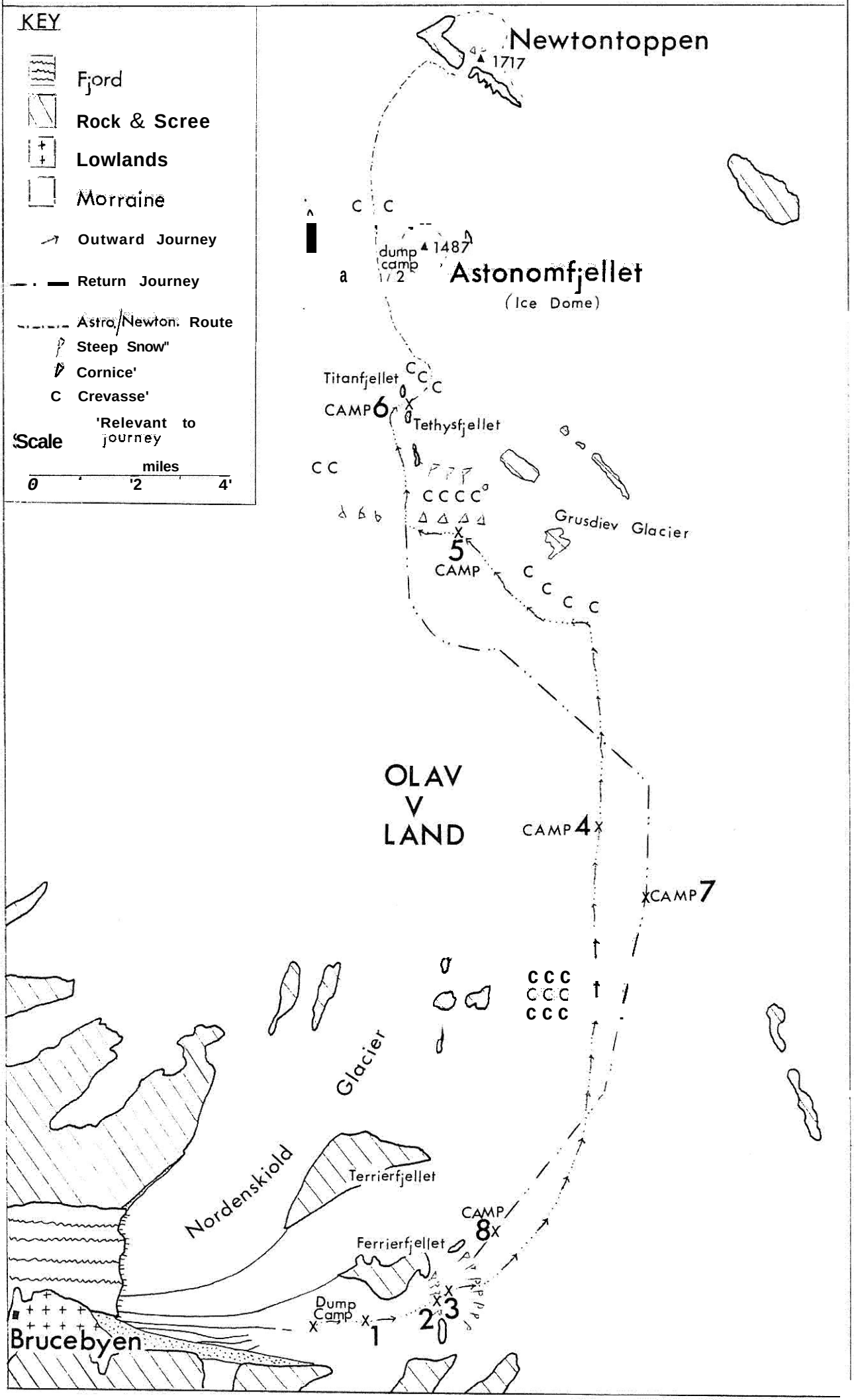
We set off on skis at 2pm with light packs, in glorious weather, to make our recce. The downhill stretches were superb fun if a little too fast. Eventually we made it in 90 minutes, stopping only to examine a particularly enormous crevasse."

GRAHAM: "After a trudge up to the crevassed and rather slushy W slopes, we made it to the summit. The views were almost unbelievable; enhanced no doubt by the perfect blue sky and blazing sun. All the effort that had gone into the expedition seemed justified, even if we never progressed beyond this point. It was an inspiring experience."

PAUL: 'I looked at Graham, and he glanced back as if mirroring my feelings. To the S and E just white snow falling lazily away to glaciers and the coast. It was just unreal."

BRUCE: "The mountains had been scarcely touched by man, healthily respected by those who have been there, and likely to remain little travelled for many years to come."

OLAV V LAND. The route to ASTRONOM. from Dump Camp



GRAHAM: "The journey back taught us a lesson; namely the importance of staying closer together while skiing. Rob was trailing a little behind and fell over onto his skis, thus being totally unable to right himself. The 3 faster skiers had just disappeared over a ridge and were totally oblivious of what was potentially a bad accident behind them. With a gentle breeze our voices were quite inaudible to the front 3 and it wasn't until a few minutes later that they realised anything had happened."

TUESDAY 25th JULY

After sleeping through most of the next day, then oiling ski bindings, we set off just before midnight for Astro; this time with a view to beginning our met. research in earnest.

WEDNESDAY 26th JULY

BRUCE: "I had devised, as project organiser, a plan of action that satisfied the essential requirements. We needed a pair on the summit as quickly as possible to start the control readings that would be made throughout the duration of the experiment and to build a small temporary shelter for themselves near the summit, as they would not be moving around. The S side needed checking over and this would have to be done in ascent. All the flags marking the positions at which measurements were to be made would have to be set out. In brief, the problem was to cover the hill adequately, deploying only three pairs and involving the minimum amount of re-ascent. We had 8 sector lines to cover with 4 positions on each line, 50, 100, 150 and 200m from the summit of the peak. On this, our first survey, we would set out the flags and also take our first set of readings, in an attempt to save time, as time available was strictly limited.

On arrival, we split up into 3 pairs. As Rob and I left the others and approached the crevasses at the foot of the S slope, we began to sink at least 6 inches, even though we were on skis. One could push a ski stick in right up to the handle, with little effort. The air temp was now about freezing and rising slowly. All around, the snow was deep, soft and damp. We roped up just before the first crevasse but kept our skis on as it would have been well nigh impossible to move on foot. As I began to cross, attempting to sidestep uphill at a slight angle, my skis became hopelessly entagled with the rope, with the result that I fell over in the soft snow bridging the crevasse. Rob just stood there watching with a big grin on his face, as I attempted to disentangle myself and stand up, no easy matter, while fully expecting to be swallowed up at any instant by the crevasse beneath me. Once over, it was my turn to watch, though I was surprised as Rob negotiated the crevasse with great panache.

In the end we traversed right and upwards for several hundred yards, crossing a number of crevasses on the way. Some more probing with the ski stick, a hesitant step from one over-hanging lip of the bergschrund to the other, another 50' and we were at the foot of the scree marking the edge of the S side. Here we took off our skis and scrambled a few feet on very unstable scree before donning crampons and taking to the icy slopes all the way up the dome to the summit."

GRAHAM: "While Rob and Bruce made their way to the top, the remaining two pairs pitched the 4th reserve tent at the bottom of the W slope. The idea was to store two sleeping bags, and a medical kit to deal with any emergencies should they occur whilst away from our ice base camp. At the time this seemed a good move ... we were later to regret this action.

Some time was spent building a stone/snow bivouac to give shelter for the summit pair between taking control observations. This turned out to be quite a masterpiece, if not a little elaborate - it certainly kept the wind out. We worked throughout the day, taking measurements, but returned to camp after we had been on the go for 30hrs. Snow conditions by now were disgusting. Even skis were tedious, although infinitely easier than walking. I remembered from one of our planning meetings several comments that skis would be a waste of time. How grateful I was that the protests were overruled. An enormous meal, at 11.30pm just about finished me off, before I turned in for a well deserved sleep lasting over 13hrs."

THURSDAY 27th JULY - THURSDAY 3rd AUGUST

We awoke to find ourselves caught right in the middle of a blizzard. None of us were too disappointed at first as it gave us a welcome chance to catch up on some sleep. Little did we know just how long it would be before we could return to Astro. Day after day, we emerged from our tents to be met by the same swirling whiteness outside. The artificial earth to the radio froze into the ground, the sledges were in danger of being buried and the hoar frost would build up to a thickness of 8 inches or more on our skis. Wind-blown snow hitting the rear of our tents would first melt and then freeze until the fabric of the flysheet was like armour-plating, protecting us from the worst of the wind. We would emerge, cocooned against the weather, only to perform the necessities of life, to fetch snow for water, to dig out our equipment in danger of being covered, to chip ice off the tents, skis, sledges and wires. Time and time again we cleared snow from the flysheets. To relieve boredom we talked, made chess and backgammon sets, played cards, wrote in our diaries and spent hours over creating such culinary delights as raspberry and apple fritters. Several times a patch of blue sky overhead would mock and tease us. Yet always, it seemed we would return to 'white-out'. Paul describes a typical day.

PAUL: "The worst thing about being stuck in a small orange sack in the middle of a snowfield with crevasses opening up underneath you, a forty mile an hour wind and a skin temp of -50°C, is the boredom; not the anxiety, fear, excitement or cold, just the boredom.

The first 48 hrs is alright because you are tired after several trips out to take weather readings on your local snow dome; the physical exertion, the mental effort to keep going, to keep calm, tidy, clean and efficient is all rewarded by 48hrs of oblivion interspersed with cups of tea and their ultimate natural consequence.

Then comes the wakening and with it the realisation that you won't be able to sleep again until you get tired. Getting tired by lying in a sleeping bag is hard work! And so you're left with your companion in a small orange world. The wind howls menacingly outside and you touch the wall of the tent behind your head only to find that it has frozen solid to the flysheet and that the two are encrusted with three inches of windblown ice. Well at least it will be something to do - go and clean the tent, dig it out, re-pitch it, set the guys and get things looking a little better.

But suddenly, a wave of blizzard lethargy steels over you. You shoot back into the warmth of your sleeping bag and try to sleep again. Its no good, you're not tired. Disgusted with your own laziness and inconsequential negligence (you hope) you resolve to do something positive to lift yourself out of the slippery downward spiral of depression, mistakes and ultimately, death. You force a 'good morning' out from the base of your bowels and direct it across the stinking air to your companion. "What time is it-?" "Half past three in the afternoon". It doesn't really matter - there is 24 hr light. We have moved our 'work' periods from the day to the night and breakfast could happen at 4 o'clock in the afternoon. Is it 'jet lag' or 'life lag'. I don't really care.

As a mark of deference to day and night, you decide to climb out of your bag and put on some clothes by way of making a dividing line between sleep and non-sleep periods. Bloody Hell - I don't smell bad, I smell horrible. The pungent odour crawls through the already thick air towards my semi-conscious companion. Soon he is fully awake, still battling with his own 'blizzard lethargy' he resolves to make the breakfast whilst you dig out and re-pitch the tent.

On with several jumpers, a jacket, three pairs of socks, mittens, goggles and balaclava, Damn! forgot my trousers! Out into the freezing cold and slip into squashy cold wellies. It takes about half an hour before you feel your feet. Outside the ice is thick on everything; the tents look remarkably unsafe in the howling wind; thick mist, visibility down to a few yards. You stomp around trying to get your circulation going. Check the skis, the aerial wire and the sledges and stores for ice. Clear it off and check that the protective polythene sheets are well tied down. Now is no time to be careless with supplies or equipment - we could be here for ever.

Shout 'good morning' to the chaps in the other tents. No reply. They're lucky, they're still asleep. You go back to your own tent and begin the soul destroying task of chipping off bits of ice from the flysheet and snow valance, being careful not to tear the flimsy material. Then out with the pegs, one by one, pull the groundsheet tight and bang the unwilling pegs back into the hard ice. Lighten the guys, have a pee, then back into the tent 'which is now looking like de famous Ritz' with much more space.

The air too has cleared somewhat and your companion has tidied up, mopped up the condensation and bits of last nights' supper, and greets you with a cup of tea. Things are looking up. The next few hours until lunchtime are spent in deep conversation.

The idea is to take your mind off food. Eating is the only diversion in a blizzard and we can't afford much more than minimum rations as this weather could last for weeks. We talk of England, of things familiar to us, of how the expedition is going, but mostly we talk about sex. (wouldn't you?)

Morning slips into afternoon and evening (which is now really about 3.0am). Conversation dwindles and we relapse into silent thought. That is very very dangerous. It took 3 days to realise that we did not have a 'bought' chess set to play chess. We made one out of paper and this served to disperse some of the gloom. That's material dependance for you.

After the chess match, a little (very little) light supper and then a raid on someone's tent. After the initial 'friendly' greeting, we embark on some debate of world-shattering significance, but we've heard all the arguments before, each individuals' standpoint is alarmingly predictable. We retire to our own tent and pray that we might sleep for a few hours."

BRUCE: "No thinking man who has lived in lonely places or travelled the rough spaces of the Earth can but find his thoughts straying to the manner of his end."

ROD: "Out of the gloom a voice said unto me 'Smile and be happy; things could be worse'. So I smiled and was happy and behold things did get worse!".

On the 5th day the storm momentarily subsided and the mist cleared, revealing patches of blue sky. I decided this would be a suitable occasion to practice some of the rope work involved for crevasse rescue.

GRAHAM: "Rather than continue to laze about in the tents, it was agreed that we should investigate one of the local crevasses - from the inside. Only 100m from camp we came across a rather likely looking hole where the snow bridge had partially collapsed due to our previous skiing journeys. A doubly safe belay system was set up for two ropes so that we were able to enter two at a time.

Hanging inside a huge cavern is quite an amazing experience. It is quite unlike a real world - more like a Father Christmas grotto with huge blue icicles hanging down in chandeliers, and great ballustrades of pale blue ice rising from the bottom. This was only slightly marred by the agonising experience of dangling on the end of a rope, being supported entirely by the infamous 'whillans harness'. Rob was in at the same time as me, and said 'this place scares the hell out of me", but he had a big grin on his face - definitely a case of mixed emotions. Even Bruce was well pleased with the experience, and it takes something pretty good to please our Bruce!"

The lull in the blizzard was only short lived and one question now became immediately apparent. What was the minimum quantity of food we could risk saving before being forced to attempt a return journey? I still had great hopes that we could continue our research on Astro or even climb Svalbard's highest mountain, Newtontoppen (5,445). We consequently had to spin out the food boxes for as long as possible which meant imposing some degree of rationing. Rod has an enormous appetite and apparently consumes more than all the others put together - very worrying! Blizzard rations were now reduced to approx. $\frac{1}{3}$ of the normal 'sledging diet'. Rod became deeply depressed, though we tried to explain that this was mainly due to boredom and that little energy (food) was required for the strains of lying in a sleeping bag all day.

A figure of 2 weeks full food rations (i.e. about 10 boxes) was proposed for a minimum food limit, thus allowing perhaps another 6 days at our present camp. Bruce believed we could risk staying another 2 days beyond the limit, allowing more time to proceed with our 'objective'. Paul and Graham on the other hand thought we should 'get the hell out'. The ensuing debate produced uncertainty and I found myself having the daily task of re-announcing the food limit.

Reaction became slow in the cold conditions but we tried to keep a happy face (well done Paul). The only job which seemed to take less time was that of answering the call of nature, with bare flesh being exposed for a minimum of time!

ROD: 'This ritual is performed by all team members at some time, though Bruce is never without his trousers down, whereas Rob is seen thus alarmingly infrequently - I don't know what he does with it! Speed is always of the essence due to the likelihood of impaired fertility on account of the cold wind which whistles round the knees and other features."

GRAHAM: 'Paul and 1 tried at one time to figure out what we were missing most being up here and most definitely off the beaten track. Paul reckoned music and, of course, Caroline. I couldn't really figure it out, but thought of 'postmen' and 'security'. Life in temperate latitudes is particularly secure compared with this. I'm not so bothered by crevasses any more. The main enemy is the weather - we are so very dependant on the weather. Paul opened a sealed letter from Caroline, which I gather was very rewarding."

FRIDAY 4th AUGUST

GRAHAM: 'During the blizzard we had become increasingly worried about the supplies left at the base of Astro. There was also a slab of Christmas cake on the summit, in which I had a vested interest - my mother made it! When the clouds cleared at 11.00 we made an amazingly fast getaway. The surface ice was extremely hard, making downhill slopes particularly hazardous. Rod had a dangerous tumble on one such slope doing his own special version of a hot-dog, which resulted in a bloody nose. We were relieved to discover there had not been a serious accident so far from our base camp. (Several weeks later Rod was to become the victim of another injury when one of his front teeth shattered and Paul was called in to apply a filling). Half way to Astro, we crossed a fresh set of fox prints - one wonders what a fox can live on out here - perhaps they eat dead explorers'. The tent was in a sorry state, having collapsed during the storms and was buried under snow. It took us quite a while to locate its contents, even though they were only about 6 inches beneath the surface.

A fuel container was punctured by a probing ice axe during these proceedings, but frankly I couldn't have cared less, content in the knowledge that all the important items were safe. Despite the threat of bad weather now approaching from the W, Andy decided not to waste what was to become our last chance to continue our windflow measurements."

The team divided into 3 pairs once again and a new survey was initiated after 7 days of inactivity. Rod and I began recording control readings at 15 minute intervals, while the others worked along the sector lines towards the summit. The sad remains of the bivouac were excavated, the Christmas cake rescued and then we began rebuilding the shelter walls while waiting for the rest of the team. During this reconstruction work, Rod broke his ice axe, reputed to be the strongest axe on the market. Within half an hour, Paul and Bruce arrived from the NW line by which time the weather had deteriorated, with a bank of cloud engulfing the hill. 10 minutes later, Graham and Rob appeared reporting 40 mph winds on the exposed W side - it was now only too clear that any continued research would have to be abandoned. We descended quickly and directly to our skis but ironically by the time we reached the base, the cloud had completely cleared and the wind reduced to 5 mph. Several more cloud banks approached from the west so we immediately began the return journey towards camp. After 20 minutes skiing we were forced to follow our tracks back in visibility dramitacally reduced to less than 30 yards. At the foot of a steep ice slope, ½ mile from camp, the tracks stopped. I remembered a snow covered crevasse at the top so the team filed out along its length and Graham soon found our deep ski tracks cutting through the soft snow bridge, created on our outward journey. From here we followed our way back to camp with little further difficulty.

Mountaineering is about gambling, not sure things, and 1 had taken two gambles neither of which had been successful. Firstly I had decided to leave equipment away from our main ice camp as a safeguard for any accident or emergency which might occur during our research on Astro. In the event, after seven days of blizzards, we had been forced to 'rescue' our emergency supplies. I resolved in future, not wishing to emulate the fate of Captain Scott, to keep all equipment within the central base.

Secondly I had decided to begin the Met. project, anxious to continue after a long period of inactivity, in weather which was definitely unstable. Far from improving (as it had done at camp 5) the weather deteriorated forcing us to return for the latter half of our journey in heavy mists. We were at no time in immediate danger (having the dump supplies) but this had surely been a gamble that hadn't paid off - therefore a mistake.

On reaching camp, I safely stored the equipment, unzipped my tent door and fell into my sleeping bag. Later that evening Graham said "we could sure do with some smooths with the rough."

SATURDAY 5th AUGUST

GRAHAM: "Just woke up this side of tomorrow to be greeted with cries from Bruce, " Dis am de Ugandan weather forecast, here we are, up on de roof, and its pouring it down".

PAUL: 'I read a while then I get tired of reading. I eat something. I get bored with eating. 1 don't need it. 1 talk to Graham but even he seems distraught, our conversation is of irrelevancies, things which have no place in this cold world of mist and slush. No green, no heartbeat, just cold and thoughts. Sleep comes fitfully. Dream of death and men outside the tent. Wake up, scared and think of Caroline. Dear Jesus, why did I ever leave her."

The blizzard returned in full force with an effective temp of -50°C. Morale sank to its lowest of the whole expedition. I fell asleep at 4pm with the knowledge that there remained only a half day's ration of food before we would be reduced to our 10 box -2 week limit.

SUNDAY 6th AUGUST

I emerged from my tent at midnight to be greeted with glorious weather - deep blue skies and not a cloud in sight! Rob and I immediately climbed Titanfjellet to survey the horizon, but soon discovered that the ice cap to the south was completely covered with a low lying blanket of fog - there would be no advantage in returning today.

The team's 'met. man', Bruce, was consulted and after several barometers had been inspected, he predicted that conditions would remain stable at least 48 hours. Ironically, the wind had dropped ruling out any further work on Astro, so instead we turned our attention to Newtontoppen, Svalbard's highest mountain.

Paul and Graham both believed we should immediately begin our return journey, while Bruce, Rod and Rob all preferred to attempt to scale the previously un-climbed SW ice wall of Newtontoppen. Although we had worked well as a team, morale had definitely reached a 'low' during the blizzard, and a success on Newtontoppen I felt, would give us a welcome lift before returning. The 10 food box limit was also a fair allocation as it allowed for 14 days hauling or 28 'white-out' ration days. I therefore decided (with opinions 4-2 in favour) to ski the 8 miles to Newtontoppen taking only light packs.

After a large breakfast we set off in fine style at 3am making rapid progress.

BRUCE: "As we moved into new territory, amid a glorious scene of jugged snow capped peaks, and ice filled bowls torn by large crevasses, our spirits rose. After so long in white-out, morale had dropped and as the realisation dawned on us that there was a very real chance, now, that we could ascend Newtontoppen, our faces lit up, the pace increased. We sped on over snow covered crevasses towards our goal. New scenery and excellent conditions and visibility made skiing a pleasure - the wind in our hair and on our faces, crisp surfaces, unbelievable clarity."

Snow conditions remained good all the way to the base of the SW face which was now in shadow as the sun was low in the east. As we appproached I became, for the first time, doubtful whether we could do it - it looked steep, too steep for us. The face consisted of two rock walls divided by a central ice section which rose 2000 ft to the summit ridge.

Rock climbing is a dead mans policy on Svalbard as the rock is rotten, taking the form of vertical scree cliffs. The only option available was to scale the W side of the ice wall to the ridge and then traverse E towards the top. Dangerous cornices lined the edge and the upper section of the ice wall looked decidely vertical.
Armed with numerous ice screws and 'deadmen', we left our skis at the base and began climbing, roped in three's and using crampons.

PAUL: 'As we started off, I felt confident that we were going to do it. I led the first section over the bergeschrund crevasse, and we made quick work of the first few hundred feet, pausing only for photos and a breather at a large boulder."

ROD: 'It looked steep, with a possible avalanche risk down a gully through the centre, but the ascent gave few problems though Rob's ability to tangle himself in rope surprised me. We continued rapidly, with incredible views of ice cliffs and cornices ."

PAUL: "I had a strange feeling of unparalleled excitement as we moved over the ridge top into the bright sun. Graham lead the final traverse to the summit - it was a first. On the top the view was unparalleled. I sat by myself for a while and I felt very close to God."

Morale had suddenly been transformed from near despair to great joy within the course of one day. The view was truly magnificent but for me personally, strangely irrelevant.

GRAHAM: "Numerous photographs were taken, including some silly ones of Bruce reading his local newspaper with a Duvey on. It was shirt weather to say the least. In fact it was no-shirt weather on the way back. What a poser!"

The time now was 9am and I had become very worried about the increased avalanche risk due to the slopes being warmed in the early morning sun. We therefore only remained on the summit peak for 30 minutes before making an incredibly fast return.

GRAHAM: "The descent of the SW face was fantastic fun, a high speed glissade down about 250m. It was only just possible to stop using an ice axe brake, and we all got rather hot in the posterior regions. I wouldn't have minded climbing back to the top just to glissade down again."

We arrived breathless at the bottom, warming to the rays of the sun which had begun to creep round the side of the mountain, throwing a new light on the slopes. All I can remember of the 4 hour ski journey back to our camp was that it was incredibly hot, incredibly hard work on the upward gradients and I began to dehydrate badly.

BRUCE: "Back at camp, supper was over at 4pm and the others immediately climbed into their sleeping bags. I, though tired, donned my boots again and climbed Titanfjellet to a cairn Graham and I had built some 2 weeks earlier. There I sat for about half-an-hour, wrapped up against the cool air and in my own thoughts. The scenery was fantastic and the contentment, I felt marvellous. I was for a few minutes on my own away from my companions, as free as a bird, glowing in the aftermath of our successful ascent. No matter how well we get on together, I still enjoy being alone for a while, alone to reflect on events and people, and also on my own thoughts and character."

MONDAY 7th and TUESDAY 8th AUGUST

GRAHAM: "We woke at midnight and as predicted, the weather had remained stable, so we prepared for the 32 mile journey back to Brucebyen. Paul and I completely took over the task of sledge packing and we did a good job of it too. I should like to add that not once did the sledges need repacking, despite numerous abrupt manoeuvres coming down icy slopes."

PAUL: "I wish that my companions would understand this; that you cannot rush sledge packing and expect to get away with it. If you don't tie the load on properly with good knots and have it well distributed, of course it will fall off. I suppose I have a chip on my shoulder about sledge packing because I always seem to do it right.

We set off from camp 6 at 3am in great style. The snow was firm and the sledges glided over the ice just like a Rolls Royce. No effort, just glorious fast skiing. A tug to the right and the nose of the sledge turned to keep on course. The ground pounded up through my feet as my skis, close and parallel, shot across the ground. I bent slightly and felt the air rushing past my face. Out of the corner of my eye I could see Graham pushing himself along to keep up with the sledge. Ahead of me lay the vast expanse of cloudless deep blue sky and the brilliant whiteness of the snow, each tiny point reflecting spectral patterns of colour from the copper midnight sun."

BRUCE: "We skied ahead, stopping every 70-80 mins. making very rapid progress. For myself, I was indifferent to the fact that we were heading back to Brucebyen."

After 2 hours of fantastically fast hauling, we began descending towards the bank of mist that Rob and I had seen a day earlier. Before entering into a near 'white-out' it was absolutely critical to pin-point our exact position on the map. I decided therefore to move slightly off our proposed route, and climb a small hill to the E thus enabling us to take accurate compass 'back-bearings' with an excellent view of the terrain to the N.

Navigation now became a serious problem and we continued (as always) to double-check all map work, usually with Bruce and myself working together. I decided that it would be best to continue, even though visibility was bad, as I feared being trapped in another long blizzard with dwindling food stocks. Once our position had been calculated, then verified, the sledges were joined together in tandem fashion and we began slowly descending towards the mist. Five men were employed to pull from the front, while a navigator was dispatched to the back to control operations by keeping himself, the sledges and the leading central hauler all in a straight line. By shouting 'left-a-bit' or 'right-a-bit' the navigator could ensure we kept to a true bearing, although we soon discovered that metal objects on the sledges affected the compass needle so the navigator had to ski, trailing several yards behind.

A dog-legged course was plotted envolving 4 different bearing changes at specified distances. The plan was to follow a similar route as used on our outward journey, by hauling from N to S in a large Easterly 'arc' thus avoiding several large and open crevasse belts near the Ekkoknausane nunataks. All distance measurements were made using the bicycle wheel mileometer which was connected to the back of the rear sledge. It became affectionately known as the 'prayer wheel' as we prayed we were going in the right direction.

ROD: "We stopped for a rest after 70 mins. further hauling, and would you believe it? - there in front of us was a whole load of toilet paper?? Navigation is going to be easy, all we have to do is follow the trail of 'loo roll', that Bruce laid down on the way out!!"

We continued throughout the day with the constant shouts from the navigator, but at 8pm we stopped to grab a few hours sleep before continuing the next sledging period. After the rest, the hauling became far worse as Paul recalls:-

PAUL: 'You lean forward about 45° in the harness and pull with your hips. The waistband cuts into your stomach. If you are on skis you just think that the sledge is going to keep moving when the ski slips backwards. You fall forwards and it takes tremendous effort to stay upright. You push on your ski-sticks, and they plunge through the soft snow. The sweat is pouring off you. Why aren't the others pulling! You turn the ski stick handles back to try and vault forwards. The rope goes taught and then it lurches forward. If you are on snow shoes or in boots your feet are wet and cold. The effort involved in lifting your feet weighed down with snow and slush is enormous. Pull it out of the deep hole which it has made, drive it forward then the snow takes your weight. Tentatively you begin to pull, then your foot plunges through the crust up to your knee. Exhausted you begin another step, then the runner of the sledge buries and the rope jerks you backwards sickeningly, soul destroying, as you fall gratefully, retching into the cold snow."

GRAHAM: "By all acounts, Scotts Antarctic party were unendingly cheerful and never able to praise each other enough. It's occuring to me that they were made of greater stuff than any of us."

When eventually the 'prayer wheel' read 42.1m it was time to make our last bearing change to 215 and thus began a final uphill section towards the top of the Nordenskiold Glacier and 'heartbreak hill'. Hauling became incredibly tough and our minds began reliving the painful memories of our insignificant efforts to conquer 'heartbreak hill' some 4 weeks earlier. Occasionally a snowshoe would fall off an unsuspecting boot and we would all stop, grateful of the unplanned rest. Hauling periods were gradually reduced to 15 mins. and rests became longer. Eventually I had to get everyone to synchronise watches and declare definite 15 mins. intervals so that each person knew exactly where he stood and was not tempted to 'slacken off when the runners caught rough patches of ice.

Morale again very naturally began to drop, the snow became deeper and there was much cursing - it was obvious we couldn't continue for much longer without a long sleep. Suddenly, for no apparent reason, the pace doubled, we were over a ridge and going downhill. Were we at the top of the Glacier? the 'prayer wheel' gave the predicted reading, but was it our Glacier?

I divided the team into three recce teams and we fanned out radially at 60° intervals to investigate the surrounding snow gradients. An hour later we were all back at the sledges and had put together a picture of the immediate terrain. It seemed as though we could quite possibly be on course after navigating 'blind' for 20 miles.

We pitched camp No.8 for a well earned sleep after 50 hours hauling, now we had only to wait for clear weather before descending to the huts.

Graham began complaining of a sharp pain in his left eye, which Paul diagnosed as the first signs of snow blindness. That evening, much eye ointment was applied, and a patch was taped onto the left side of his snow goggles. Although obviously very painful, the situation was not too serious, and Graham's sight was soon recovered. It would have been an entirely different matter, however, if this had occurred on our outward journey - probably leading to the whole project being abandoned.

WEDNESDAY 9th AUGUST

GRAHAM: "Bruce was quite ill during the early hours, I heard him being sick outside and initially thought that I, and then someone else, was having a nightmare. As we got up the mist cleared and would you believe it?? We were about 100m away from where we had originally come over the Ferrierfjellet ridge. I felt quite jubilant. What an incredible piece of navigation.
I had, in fact, promised to have a baby in the event of us being in the correct place. This was hastily denied.

On the glacier itself at 7pm; good grief, you couldn't possibly imagine how much a place can change in only four weeks. So much snow and ice has melted that the place is like a labyrinth of melt water channels, some of them are more than a metre deep, and they make sledge hauling just about impossible. Frankly I'm surprised that the sledges have not disintegrated after half a mile of this stuff."

ROB: "We left the sledges and stores near the old dump camp and backpacked our personal gear down the final section. Andy made us all rope up over the crevasses - he is certainly aware of his responsibility."

GRAHAM: "On the way down the glacier, I put it to Andy that it might not be a bad idea for him to give everybody the option of going off and doing their own thing for a couple of days after we've finally finished bringing the gear down. My idea is that it might aid the easing of some of the inevitable tensions which have been developing during the return. He thought it would be a good idea too, and duly put it to the men later that evening."

I lagged desperately behind all the way across the moraine and my companions stopped many times to allow me to catch up. I was grateful for their consideration. Across the glacial lowlands, mosses and small plants were in abundance, where previously there had been none. Four weeks of scenery deprivation, with no green to look at is probably making it seem all the more impressive.

The great burden of responsibility was now nearly over (during the last two weeks, I rarely ventured from my sleeping bag).

GRAHAM: "There wasn't much conversation back at the huts as we had an urgent appointment with more than several cans of beer. I later took a quiet stroll down by the fjord; it was beautifully calm and mild. It's good to spend a few minutes by oneself after 4 weeks in what could be described as 'close confinement'. Only when alone again did I realise how nice it could be. I returned to the hut once I'd had enough of this solitude."

ROD: 'We all ate in the hut, around the table, supping our ale and eating a superb meal, each wrapped in his own thoughts. Little was said."

BRUCE: "There was no feeling of euphoria that it was all over, just quiet contemplation of all that had happened - though there was most definitely an air of pride in our voices."

PAUL: 'Graham and I sat outside the tiny wooden hut and watched the sun setting for the first time over the fjord. We sipped a cup of Gypsum flavoured tea and talked of Courtiers and Sealing Wax."

EPILOGUE

During the remaining two weeks of the expedition, the team labouriously backpacked the sledges, skis and climbing equipment from the old dump camp to the huts.

One evening we were alarmed to see a Russian tug boat approaching Brucebyen from across the fjord. The boat beached and three Russians emerged, one of whom we discovered was a KGB agent. Several hours later, after an enjoyable meal followed by a liberal quantity of best Russian Vodka, they left us to return to a Soviet coalmining camp. We all felt a deep sense of shock that such friendly people could be "the enemy".

Several days before our planned departure, we met four Polish Kayak Mountaineers who intended to explore unknown territory to the W of our ascent route onto the ice cap. They stayed at the huts for one evening to help consume some of the bottles of Whisky that had been donated to us for "restoration purposes". It was subsequently established that the Polish leader was a leading world genetisist. He spent most of the visit chewing whale blubber and discussing the finer points of DNA molecules with Paul.

Our chartered yatch arrived several days late due to bad weather conditions. Using small rowing boats we eventually loaded our supplies aboard and safely sailed back to the Arctic coalmining settlement at Longyearbyen. Upon arrival we discovered that our packing crates had been stolen, which caused considerable concern until we were able to acquire a suitable replacement.

ROD "Before making the 12-hour flight to London via Tromso and Oslo, there remained only one thing left to do - visit the most northerly pub in the world. We all would have got rather drunk were it not for the fact that the beer cost Â£a pint and contained quinine to prevent it from freezing."

ACKNOWLEDGEMENTS

Our 6-man Expedition was merely the tip of an iceberg of support and sponsorship formed by the help, encouragement and finance given by a vast number of individuals and companies over the last two years. It is to those people who are appropriately, yet inadequately mentioned below, that we wish to express our most sincere thanks for making this Expedition possible for us.

Her Majesty, Queen Elizabeth the Queen Mother was graciously pleased to aid the Expedition.

Dr. Lionel Butler, Principal of RHC	For his patronage and constant advice and encouragement from the very start.
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Major Watson	For his help concerning the loan of the radio
Mr. R. Glen Hon. Equipment Officer Imperial College Exploration Board	For help in procuring the vast majority of equipment used by the expedition, and the Transit Van used to move it to RHC, and also to collect the sledges
Mr. G.C. Wilson, F.I.M.F. Expedition Accountant	For his extremely tolerant and understanding help and advice

The members of the Expedition are mindful of the courtesy extended to them by the Government and people of Norway in facilitating the journeys within their territory and are particularly indebted to the Governor of Svalbard and his staff for their assistance.

The RHC Expedition had the very kind and generous assistance of several typists, who together helped produce over 1,000 prospecti and an absolutely incredible volume of letters. The whole team wish to extend their warmest thanks to:-

Mrs. Iris Wilson Mrs. Pat Lawson Mrs. Eileen Berville Miss Janet Wilson

The team would also like to express thanks to their parents and friends for their enthusiasm and support.

FINANCIAL ACKNOWLEDGEMENTS

		£
Royal Holloway College:	Students Union	300.00
	Mrs. Horton's Fund	300.00
	Maths Department	150.00
	Kingswood Hall	50.00
	Driver's Bursary	40.00
	Lecture Prize	35.00
Imperial College:	Exploration Board	500.00
London University	Convocation Award	300.00
Bristol University:	Wills Hall	50.00
	University	75.00
Oxford University:	Queens College	80.00
	New College	50.00
	The Society	50.00
SOCIETIES:	Royal Meteorological Society	100.00
	Royal Geographical Society	300.00
	New York Explorers Club	260.00
	Scott Polar Institute (Gino Watkins Award)	100.00
INDUSTRY:	I.C.I.	200.00
	British Petroleum Company	100.00
	Carrington Fabrics	5.00
	Ingersoll-Rand Limited	10.00
	Gibbs and Mew Co. Limited	5.00
	KY Optical Limited	10.00
	Thorndick and Dawson Limited	25.00
	British Nuclear Fuels Limited	250.00
	Northern Research & Dev. Limited	25.00
	Cliffords Dairies (Bracknell)	25.00
	Clark Eaton (Bracknell)	20.00
	Pedigree Petfoods	50.00
	GAF	25.00
	Ferranti Computer Systems Limited,Bracknell	100.00
TRUST FUNDS:	Anguish's Educational Foundation Award	50.00
	The Wilforge Foundation Limited	75.00
	The Ernest Kleinwort Charitable Trust	250.00
	Rotary Club of Bracknell	25.00
	Salisbury Almshouse & Welfare Charity	100.00
	Gilchrist Education Award	50.00
	The Drapers Company	75.00
	The A. Reckitt Trust	400.00
DONATIONS:	Dr.Lionel Butler	100.00
	Miss **3.** Wilson	5.00
	Mr. D.S. Kingsley	5.00
	Mr. A. Fernandez	5.00
	Dr. Weigel	5.00
	Mr. D. Mordaunt	10.00
	Mr and Mrs Mason	100.00
	Dr. Sykes	5.00
	Miss M.A. Coade	5.00
	Anonymous	100.00

FUND FAISING:	RHC Summer Fete	127.00
TEAM CONTRIBUTION:	Personal contribution (6 x Â£380	2280.00
	TOTAL	7362.00

FINANCIAL DEBITS

	£
Return flight to Longyearbyen (6 x Â£273.00	1638.00
Insurance	230.00
Food	762.00
Training and UK Transport	360.00
Team Equipment, sledges and paraffin	534.00
Specialised personal equipment (6 x Â£280	1680.00
Medical supplies	12.00
Film	165.00
Cine film and copy	65.00
Boat charter between Longyearbyen and Brucebyen	400.00
Freight	655.00
Administration	861.00
TOTAL	Â£7362.0

ASSETS

2 Manhaul Sledges
(The money from the sale of these will be used to produce the report and pay all outstanding administration and photocopying invoices).

FINANCE REPORT

by Andrew Wilson and Rob Heaton

At the end of November 1977, after a great deal of research and planning, a 12-page Prospectus was published, listing information concerning our objectives and required finance. This marked the start of our sponsorship campaign to raise over Â£1,00 a month.

Throughout the following months, money was donated at a rate just sufficient to pay the most urgent bills. A crisis point occurred in June 1978 when the deadline to pay our air fares was reached. On paper, at that time, we could afford to fully pay the Â£1,638.0 required, but many Companies had still actually to send promised money. Fortunately, we were saved by a very generous interest-free loan from the Imperial College Exploration Board, which was subsequently fully repaid in September 1978.

In total, we raised Â£5082.00 with the team members making the balance up to Â£7362.0 by each contributing Â£380.00 This figure of Â£380.0 can be considered as the purchase of Â£280.0 of specialised personal equipment (to a defined minimum standard) plus a donation of Â£100.00

A sum of Â£360.0 was spent on 'training and UK transport', which includes all rail fares to meetings at RHC, hiring an Alpine Guide during the Winter Survival Expedition and Training, such as the skiing at the Aldershot Army School of Physical Training.

The expedition was able to receive many products and services at a discount or entirely free. Without such help the real cost would undoubtedly be at least double the stated total.

ADMINISTRATION

by Andrew Wilson

The total sum of money spent on administration was a staggering Â£861.00 which is just over 11% of the Expedition grand total of Â£7362.00 The whole success of the venture depended on extensive planning and organisation before leaving and this is reflected by the sum of Â£480.0 spent on telephone calls, stamps, train fares and petrol.

	£
Maps and Aerial Photographs	26.00
Telephone calls	152.00
Stamps	161.00
Petrol (journeys requesting advice, collection of equipment, food etc.)	97.00
Train Fares (to collect rifle, radio, visit B.A.S. etc.)	70.00
Rifle Licence	12.00
Sweat Shirts (for Administration Staff)	15.00
Photocopying, secretarial work and production of 1,000 12-page Prospecti	256.00
Membership of Societies, purchase of books and reports	21.00
Sundries	51.00
TOTAL	Â£861.0

MEDICAL REPORT

by Paul Strickland (Medical Student)

Equipment taken

All equipment was divided into two units, one for each sledge.
Adequate base camp First Aid kit was provided in addition to this.
Each team memberalways carried a small personal First Aid kit - mainly plasters.
All equipment was kept in fully watertight containers with simple clear instructions.

Essential Drugs

OXYTETRACYCLINE	Broad spectrum antibiotics for infections and in
PENICILIN V	case of frostbite.
ENTEROSAN and IMODIN	for diarrhoea
SENEKOT	for constipation
LEMOTIL II and ACTRACITE	for stomach upset (pains, d and v)
SEPTRIN	skin infections and abscesses
VIBRAMICIN	for sinusitis and bronchitis
PIRITON	for sea sickness, allergy, stings
LOBAK	for muscular pain
EQUAGESIC	'heavy' analgesic
ASPIRIN and PARACETAMOL	'light' analgesic

N.B. 'Potent' pain killers, such as Morphine and Fortral are not essential.

1. They require specialised knowledge for safe administration.

2. In an emergency, it is not always desirable to sedate the patient.

Bandages and Plasters

1. These are essential. Rolls of elastoplast are excellent, as they can be cut to any size. 2½" or 3" widths are most useful. Small plasters for blisters etc. should be taken in large quantities. (Don't use 'Bandaids').

2. Gypsona (Plaster of Paris) impregnated bandages are useful for fractures (one for arm, one for leg).

3. An assortment of crepe and conforming bandages.

Others -

antiseptic cream (Savlon) and antiseptic wipes.
anti-chafe cream
insect repellant
thermometer, scissors, tweezers, safety pins
ORAL 'Cavit' temporary tooth stopper
Bonjella and Bocasan, antiseptic/analgesic cream and wipes.

The Red Cross provided us with a set of inflatable splints. These are light compact and easily used.

Problems Encountered

1. Blisters and sore feet, inevitable with heavy loads and new boots. Ensure regular toe nail cutting and plaster to cushion blisters. Break in boots well.

2. Water supply. If in doubt, boil all water, also use PURITABS.

3. Personal Hygiene - wash as often as practical. Clothes too must be cleaned or painful sores and boils may develop. Clean surroundings are also a boost to morale.

4. Colds and sore throats - occur in physically and mentally exhausted people. Treat with antibiotics, bedrest, good food and jokes.

Circadian Rhythm (or 'manhaulers jet lag')

When the weather is good and the snow is firm, you move. You move until you are too tired to go on. This is generally at night and for a period of 8 hours. With 4 hours at either end of this to allow for striking and pitching camp, this means a 16-hour period of intense activity. Such activity requires at least 12 hours sleep before a man is fit to go on, and hence a 28 hour day cycle is established. Adjustments for night travel and local weather conditions must also be made and hence the circadian rhythm gets constantly altered. This is very tiring and the fact that there can never be a settled day/night pattern means that one is almost constantly feeling tired. If this is not recognised it could lead to a dangerous situation.

Points for Future Expeditions

1. Medical knowledge is not essential; most situations can be dealt with by basic first aid and a lot of common sense.

2. Radio contact should be available for emergencies - most life-threatening situations (e.g. fractured femur) demand immediate hospitalization. A thorough knowledge of basic survival techniques is more useful than any specialised medical ability in such cases.

3. The medical officer should ensure that the whole team is fully immunized against all usual diseases (especially tetanus) and against any specific disease common to the area to be visited.

4. Student Expeditions will find University Health Services very helpful for both equipment and advice, also B.A.S. medical notes.

5. A certificate of dental fitness should be obtained from each team member.

EQUIPMENT AND CLOTHING

By Graham Bunn

Apart from the specialist meteorological and medical equipment, as detailed under the appropriate sections, the team equipment can be classified under two broad headings, namely 'personal equipment' and 'general team equipment'.

The following lists detail almost everything taken and used, with comments or recommendations where appropriate.

TEAM EQUIPMENT

4 Vango Force Ten (Mk.4) Tents
with spare pegs, zips etc.

These had been made up as a special order and had a 1-foot snow valance on the fly sheets. This proved to be a saving grace, for without them, it would have been virtually impossible to pitch a tent.

6 Primus Stoves and spare parts

3 No.5R Primus Stoves with throttle valves. These proved to be incredibly efficient stoves and are definitely recommended. They have two problems - the washer at the base of the burner unit tends to need replacement, as does the wire which holds in the flame diffuser. Also, it is critical, when using solid fuel to prime the stove to (a) do it in a draught-free area, (b) to make sure there is no paraffin in the tubes above the throttle valve, (c) do not open the valve until the priming fuel is almost out and (d) when turning the stove off, always close the throttle valve first, then open the pressure release valve. If done properly, priming generally required about ¾ of one 'Meta' fuel bar.

3½ pint Optimus Stoves were also taken (as spares) but not used.

3 Aluminium fuel bottles,
500 Bars 'Meta' Fuel
25 gallons of paraffin

The bottles were useful for transferring fuel. The bars were only just sufficient. The paraffin was 50% in excess. This was deliberate. In three weeks of ice travel, only 1 jerrycan (4 gallons) of paraffin was used. It should be noted, however, that very rarely was it necessary to melt snow for water.

1 large plastic fuel funnel
3 small plastic fuel funnels

Must be securely tied to a relevant container.

3 sets small billy cans
I set large billy cans

For basecamp use.

1 large saucepan

For basecamp use supplemented by a number of large cooking pots found in the huts.

3 small frying pans (non-stick) and spatulas

Extremely useful.

2 collapsible water buckets and water container
4 boxes **3** cloths6 Scotchbrite pads

Probably the most efficient pot cleaning device.

4 bottles washing-up liquid

2 Can openers

Of the larger variety, for basecamp use.

1 plastic washing bowl

Could have done with 2 or **3.**

20 boxes matches

For basecamp use.

4 Thermos Vacuum Flasks

Definitely worthwhile being careful with these. Only 2 survived the expedition. Plastic vacuum containers are not likely to be as efficient

3 Tea towels

Could have used several more. **3** cloths are not adequate, except during ice travel.

I Tilley lamp and spare mantles
and correct size jet cleaner

Proved essential inside the hut towards the end of the expedition.

6 pairs cross-country skis and
Kandehal bindings and sticks

None of us would ever travel on ice without these. Not worth using high quality ones, as ice damages the surfaces.

Ski wax (Rex Universal)

Ski wax appeared to be almost ineffective and soon wore off.

6 Pairs Snow Shoes

Far more important than we had realised. It is worth buying new ones if sledge hauling is contemplated. Our Ex-Army shoes disintegrated.

2 6' Manual Sledges

Each with a capacity for about 600 Ibs, as designed by the British Antartic Survey, and specially built for us by Skeemaster of Great Yarmouth. These were of excellent quality and could not be faulted. It would not be worth the money saved, if inferior sledges were used.

1 Sledge wheel assembly

A distance measuring wheel which attaches to one sledge. Invaluable. Also supplied by Skeemaster, though one could be easily built at less cost. Do not use an inner tube, only a tyre on the wheel.

6 Dragging Harnesses

Basically our own design. Consisted of a broad waist belt (9") supported by two shoulder straps. A Karabiner passes through eyes in each end of the waist belt for attachment to sledge hauling trace. It is important to have the harnesses made up well in advance, so that perfect fit is achieved. The length of the shoulder straps was quite critical.

6 Climbing Harnesses

Whillans sit harnesses were used. Essential for travelling over crevassed terrain and for climbing.

Three 45-metre climbing ropes

All used.

200 feet polypropylene rope

Only suitable for traces on sledges.

30 Karabiners

5 per man. Two of these are necessary for sledge hauling.

Twelve 2-metre Prusik loops
(2 metres when untied

Primarily for crevasse rescue. Two per man at all times in crevassed areas.

12 tape slings

6 short slings and 6 long slings.

8 Ice screws and pitons

Ice screws are vastly superior to pitons in hard, glassy ice. If not so expensive we could have taken more screws, as they made tent pitching much easier.

6 Deadmen

Essential for climbing and crevasse rescue. Also useful for tent pitching.

6 Ice axes

One each. A spare would not be a bad idea. One (plastic shafted) axe broke, causing some alarm.

2 Snow Shovels

Home made. Not strong enough.

2 Snow saws (aluminium)

Useless - (a) because they were not strong enough, and (b) because there was never sufficient deep snow cover to facilitate their use.

Maps

A selection of various scale maps were taken. Each team member had a copy of a 1:125000 map of Central West Spitsbergen (R.G.S) which was the standard used for all navigation work.

3 Red 'parachute' flares

3 Red 'smoke' signals

One .303 rifle plus 20 rounds soft nosed hunting ammunition
and 60 rounds of standard ammunition for practice purposes

Loaned by Lt. Col. B. Blashford-Snell, R.E. This would be the absolute minimum calibre for a weapon to be effective against Polar Bears.

1 Radio Transceiver 'Clansman' and
hand generator unit

Much debate will ensue as to its value. This radio would cost *Â£5,00* in 1978. Unless it is possible to borrow one, a radio is not really feasible for a small expedition.

50 rolls of toilet paper

Only just enough. This is equivalent to one roll per 7 man-days. 1 roll per 4-man days would be better. (Allowing for rain damage etc. etc.)

Boot waterproofing

Nik Wax, Suppletect and Hydrolan all used. A combination of Suppletect and Hydrolan worked extremely well - no one suffered from wet feet.

2 Entrenching tools

Digging latrine pits etc.

Repairs

Box 2" nails (2 lbs)
Sheets of heavy gauge polythene
Box small brass screws
Screw driver, mole wrench, hand drill and bits
Bow saw and spare blade
2 Hand axes
File (crampon points)
Hammer
Superglue, araldite, evostick
Adhesive (ripstop) tape
Needles and strong thread
Rawhide strip and tarred hemp string for sledge repairs
Hand pop rivetting kit
1 Spare pair of crampons (not used)
3 balls of sisal string

This list could be improved by increasing the number of nails by a factor of 4 or 5, adding a felling axe, doubling the quantity of string and adding a pair of pincers.

We would like to thank especially, the Imperial College Exploration Board and RHC Mountaineering Club, who between them provided the majority of the above equipment.

PERSONAL EQUIPMENT

2 Pairs Wool Breeches

MOAC Bonnevilles were worn, but not reckoned to be as good value as ex-Army wool trousers.

1 pair Jeans

For casual wear - essential at base camp.

I pair Waterproof overtrousers

Essential to have zipped legs. We only used them for glissading as we had very little rain.

1 pair Snow gaiters

Essential. Heavy duty nylon zips are a must. Canvas gaiters seemed to wear out more quickly than nylon ones.

2 pairs long underpants or similar

Preferably wool, but cotton is better than nothing. Underneath Bonneville breeches these tended to generate excessive warmth when working hard.

1 Balaclava hat

Wool - essential

1 bobble hat

Wool - really as a spare version of the more expensive Balaclava.

3 wool shirts, 2 wool vests

Ex-army shirts are excellent value. Other combinations, such as fibre pile jackets would be fine.

2 thick wool sweaters/fibre pile jackets etc.

Essential

9 pairs wool socks

4 pairs long loopstitch. (North Wall socks tend not to be long enough). 4 pairs others (outer socks).

1 pair Mountaineering boots

Standard fare were of Scarpa Fitzroy quality or slightly better. These proved to be something of an over-kill whilst on ice, but a great advantage for travelling over moraine and the omnipresent scree.

1 pair spare boots

Non essential, but non stiffened boots proved to be an advantage when skiing.

1 pair light (e.g. gym shoes)

Mostly for base camp use. Full weight boots can be a bit trying if worn all day.

1 pair strong Wellingtons

We used 'Whernside Wellies', incorporating a vibram sole. Very useful on the ice, when a short trip outside to answer nature valls was required - also very useful at Base camp.

2 pairs Mittens

Dachstein/Helly Hansen used - all standard climbing equipment and essential.

1 pair Gloves

On most occasions only a thin pair of gloves was necessary (to prevent finger dehydration and flesh splitting). Miller mitts were not reckoned to be as good as 'Damart' thermawear gloves.

1 pair waterproof over-mitts

As these also tend to be wind proof, they ate an essential addition to Dachstein/Helly Hansen mitts.

1 pair Crampons plus crampon spanner:
plus protection (rubber point protectors are best)

Vital when contemplating any snow/ice climbing or even walking on some very smooth glacier ice. Salewa adjustable 12 points used. Neoprene straps superior to any other types.

I pair Snow goggles/sunglasses plus spare

Polaroid sunglasses are almost certainly the best thing to use. Goggles mist up and become very uncomfortable. A spare pair is vital as snow blindness can totally incapacitate a man.

1 'Arctic' Standard Sleeping Bag

Down being extremely expensive, we all used synthetic bags. 'Ultimate Forty Winks' plus cotton liner, excellent - no problems. 'Point Five Thermo plus Blacks Icelandic' has the advantage of being useable in non-winter conditions, but lacks a hood and consumes more rucksack space. Also, the Thermo bag had bad stitching which began to come undone. 'Polywarm Basecamp' no problems. 'Point Five Roaring Forties' certainly warm enough, but rather incompressible.

NOTE: Bags with nylon inners can be very cold to get into at first. The use of a cotton liner would certainly decrease the severity of the shock. Also, synthetic fillings have the advantage of working when wet, which down does not.

1 Windproof Jacket

Preferably double cotton. Ventile is definitely the best, but is extremely expensive. Some ex-Army jackets are fine. A 'Functional' jacket with extra quilted liners was used and reckoned to be extremely good value as it was also waterproof, but did not cause undue sweating. A heavy duty zip front opening is useful for ventilation. Gortex jackets would probably be good, but too expensive.

I Rucksack plus frame plus padded hip belt

A framed pack is really essential when carrying very heavy, awkward shaped loads. The stronger the frame the better, a bottom 'shelf' and welded joints yielding the greatest strength. It is very important to ensure that the frame fits the torso well (keeping the pack high up) before going into the field.

1 Duvet Jacket

These were not really used except as convenience garments (viz. for nipping outside for a little relief). However, had conditions been more severe, they could have proved invaluable. All those used were synthethic rather than down.

1 Full length closed cell foam mat (Karrimat)

Absolutely vital when sleeping on ice - it is not worth skimping by using a ¾ length mat in view of the comfort afforded by these wonderful devices.

I Emergency bivvy bag

Always vital.

1 Compass (liquid filled, transparent base)
1 Whistle

Silva 15TDCL compasses were used. See the section on Navigation.

1 Mug (plastic and large)

It avoids arguments to have all mugs of equal capacity.

1 Penknife (sharp)
1 Can Opener ('compo' type)
1 Knife/fork/spoon set
1 pair spare boot laces
1 Notebook and 2 or 3 biros

Extremely useful.

2 Dishes (or deep plates/mess tins)

Mess tins are better as they can double as cooking pans.

1 Camera and film

A matter of personal taste. It was not necessary to 'winterise' any of the cameras, but condensation proved to be an occasional problem both inside lens systems and on the film itself, causing the emulsion to go sticky. Cold also causes film to become brittle - one film was lost due to it tearing when brittle.

I Torch and spares

In the land of the midnight sun, hardly an essential. However, very useful for looking into dark corners inside huts.

1 Gas cigarette lighter

Saves a lot of time.

Soap, toothpaste, toothbrush, flannel, towels, comb, nail-scissors, shampoo

It is unbelievably pleasant to have a wash after three weeks.

Glacier Cream

Vital, even for those with a suntan. Greasy stuff is best.

Spare Sleeping Bags were taken, but remained unused throughout the expedition.

CUSTOMS

by Graham Bunn

In order to get all of the listed equipment through customs to Svalbard, it was only necessary to provide the shipping agents with a complete and detailed list of the contents of the crates into which it was packed.

The same applies for getting the equipment back to Britain. The packing of flares/solid fuel etc. should be declared. This merely resulted in the crates being shipped on deck rather than in a hold.

TRANSPORT, FREIGHT AND ENTRY PERMISSION

by Andrew Wilson

Many different permutations and combinations were investigated for the expedition travel with the objective of selecting a cheap yet reliable plan. This work was partially foiled when the RHC mini-van broke down the day before half of our stores were due to be transported to meet a critical deadline. During the resulting panic, extra money was hastily drawn to pay a commercial van hire company to move the gear at only 3-hours notice.

My strong advice therefore, to any future expedition leader, is to organise a reliable but relatively cheap transport schedule (with minimum complications) and then concentrate on fund-raising.

Team Travel

The complete 6-man team flew on three scheduled Scandinavian Airline System flights from London to Longyearbyen via Oslo and Tromso. The overall flight charge per person was Â£273.00 after a 20% discount, thus giving a total airline bill of Â£1,638.00

The most critical single stage of the whole expedition was that of organising transportation of personnel and stores from Longyearbyen to the Btucebyen Huts, through the fjiord system. At the beginning of April 1978, much money had been committed and with only 14 weeks before our planned departure, I was under considerable pressure to find a solution to this problem. After early attempts had failed, I flooded Longyearbyen with a tide of letters and telex messages requesting help and eventually I was able to charter a 33-foot private boat owned by a coal worker, Jarlie Kollbotn, for a total of Â£400.00

Addresses:

Scandinavian Airlines System
SAS House
52 Conduit Street
LONDON W1R OAY

Jarlie Kollbotn
Appartment 222/37
9170 Longyearbyen
Svalbard, Norway

Freight

The commercial freight charges from Bergen to Longyearbyen tripled during the early months of 1978, so I was forced to adopt an incredibly complicated and time consuming procedure in order to save money. Basically, without wishing to go into too much detail, the final arrangements were as follows.

1.3 cubic metres of supplies were packed into 2 crates and shipped by a commercial freight company from Newcastle to Longyearbyen via Bergen at a total cost of Â£270.00

2. Approximately 1 ton of stores were transported to Grimsby and loaded aboard a privately sub-chartered yacht, the 'M.V. Copious'. The Copious was to sail in Svalbard waters for several weeks working for a Geological Company from Cambridge, and the Captain, Mr.Tuson, kindly agreed to deliver our stores direct to Brucebyen.

The cost evaluation was calculated using units of cubic metres for the commercial freight and tonnage with the Copious, so I have presented the information in this form.

Addresses:

P.H. Mattiessen and Company Limited
54 Pilgrim Street
Newcastle-upon-Type, NE1 **633**

Mr. Michael Tuson,
Copious Enterprises Limited
Rockwell Court
48 Ridgeway
LONDON SW19 4PQ

Packing

Packing crates were generously donated by:

The Downmill Box Company
Downmill Road
BRACKNELL, Berks.

Storage boxes for food and transportation purposes were kindly manufactured by:

Corrugated Products Limited
Western Road
BRACKNELL, Berks.

Permission of Entry

Permission to enter Norwegian Polar territory was initially granted by the Norwegian Government via the Royal Norwegian Embassy in London. Entry permission was later confirmed by the Sysselmannen Pa Svalbard, (Governor of Svalbard) on arrival, after proof of adequate food, stores and travel plans had been produced.

Addresses:

Sysselmannen Pa Svalbard
9170 Longyearbyen
Svalbard, Norway

The Royal Norwegian Embassy
25 Belgrave Square
LONDON SW1X 9QD

The North Polar Institute
Rolfstangvein 12
Postboks 158
1330 Oslo
Lufthavn, Norway

FOOD REPORT

Compiled by Rod Clarke

With the prospect of 2 months away from home cooking and 'the fish and chip shop', the value of enjoyable food was apparent from the onset. When conditions became hard, hauling heavy sledges through knee-deep snow in 'white-out' conditions, the thought of a good meal would do much to prevent morale from falling.

Before beginning to plan any form of menu, I asked each member about any particular dislikes and equally important (though often very impractical) their personal cravings. I was lucky to be able to try out various menus during a week's Winter Survival course in Scotland. This was invaluable, since it allowed one to discover Bruce's stomach would not function on 'Readybrek' and 'Ryvita'.

The food was to be of two basic types. Basecamp and sledging. With the very high cost of freight, and not being able to buy any stores on Svalbard, the weight and bulk of all food had to be kept to a minimum. These criteria are not conducive to the most palatable meals, but were vital since once at Basecamp, all the sledging food had to be backpacked up the glacier, and then dragged by sledges onto the ice-cap. The food to remain at Basecamp was to be as much like home-cooking as possible, and catering-size packs were used.

After spending several days searching the supermarkets for ideas, I began to realise there was no perfect solution, since the best products were either too expensive, impractical to store or cook, or too heavy. I was then lucky to find much useful information in Chris Bonnington's 'Everest the Hard Way' report. I began to wonder whether a lynching would result from inflicting endless, dehydrated meals on the expedition members for two months. After several discussions with the others, it was decided that within reasonable limits, we would be prepared to pay slightly extra for good food.

To keep the expedition working as a team, Andy decided it would be best to split up tents every few days. Since we only wanted two in a Mk.IV Vango, we decided that the best way to organise the food was in three-day two-man packs.

We realised that it would be impractical to stop at 'midday' for a hot meal. Therefore breakfast was as substantial as possible, whilst not taking too long to prepare. Manhauling sledges at low temperatures uses a very large amount of energy, which should preferably be replaced as it is used. Carbohydrates are rapidly absorbed and therefore raise the important blood-glucose level. For these reasons many chocolates and biscuits were eaten throughout the day, along with nuts and raisins, whilst a short psychological break with tinned meat or fish gave a definite midday to look forward to. We also used flasks for hot tea or coffee which proved a tremendous asset.

The proposed menus gave different rations for six days. To break the monotony of dehydrated meals, every three days the evening meal was solid tinned meat, with fruit for desert. Although this was heavy, we made a saving in the paraffin needed to melt snow for the dehydrated foods, and above all kept our 'fish and chips freak' Bruce quiet.

Although we took multi-vitamin tablets, the food was chosen to provide all the nutritional requirements. For a typical '3-man, 3-day' box each day included over 5500 calories which is essential for the energy needs of a hard 'days' hauling. In total, we decided to take $1\frac{1}{2}$ times our food need (i.e. 12 weeks food for an 8 week expedition) through fear of being left stranded for a long period at Brucebyen.

The Basecamp food was initially worked out with fixed menus, similar to the sledging food, but only budgeting for 3500 calories. Lunch was more flexible, such that a field pack could be taken when backpacking supplies up the glacier, when the energy intake was high.

More usually, a large cooked breakfast was followed by a light lunch and a more substantial evening 'blow-out'.

The generosity of many manufacturers and suppliers permitted us to afford the large quantity of food we required. Often they offered us the items already in the menus, and more than we could have hoped for, and sometimes donated alternative excellent products. Without such sponsorship, the expedition would have been financially inviable. The final menus which we packed off were therefore somewhat different from those initially conceived.

Two very long weekends were completely taken up in a frantic effort to split large food packs into 2-man day units. With the loan of a polythene bag sealer, and thousands of bags, every item was packed for the two months before it arrived on Svalbard. This proved very effective, very few breakages occurred. Most important for sledging food, a single box, 1 ft x 1 ft x 9 in could be taken into the tent, containing everything from matches and 3 cloths to sugar and 5 pints milk powder.

The Basecamp food proved adequate, whilst many members were defeated by the evening meal. Special thanks should go to Danepack who specially packed 40 lbs of bacon which survived for three months in prime condition, and gave an excellent change from tinned or dried meats. Granny Smith's bread mixes provided a challenge with no real oven, which was finally met by Rob, who provided us with a greatly appreciated reminder of 'real food'.

The sledging food provided enough variety whilst the quantities, as envisaged, proved adequate for very active days. Appetites varied and when some didn't eat a complete day's food, it was either kept over for the next day or consumed by Rob or myself. When we were unable to move due to 'white-out' conditions, our requirements fell, permitting us to stretch the food to over twice the time alloted, allowing us to sit-out bad conditions so we could still execute our scientific work. Similarly, days of moderate activity allowed us to stretch the food from three to four days. Of particular merit were Cadbury's cream eggs - you could bribe someone to do anything for one, whilst a well-made pancake and treacle set the mood for the rest of the day.

Sledging Food

We packed 48 2-man, 3-day boxes. For variety we prepared two types (24 pink boxes and 24 light blue boxes) thus giving a 6-day menu rota. On the expedition, the boxes (approx. 25 lbs) in fact lasted between 3 and 8 days depending on whether we were on 'sledging' or 'blizzard' rationing.

'PINK BOXES'

Day 1	
Alpen	3 oz
Service Bis	3 oz
Rise & Shine	1 Pk
Savoury Fry	1 Pk
Cheese Slices	3
Pilchards	4 oz
Nuts	3 oz
Raisins	3 oz
Penguins	9
Mars	4
Crunchies	1
Soup	1 oz
Chicken Oriental	3 oz
Smash	3 oz
Soya	3 oz
Xmas Pud	1 slice
Mixed Veg	1 oz

Day 2	
Porridge	2 oz
Tube Cheese	1
Biscuits	3 oz
Rise & Shine	1 Pk
Omelette mix	1 Pk
Nuts	3 oz
Raisins	4 oz
Corned Beef	4 oz
Penguins	9
Mars	4
Opal Fruits	10
Polos	1 Pk
Apple Flakes	3 oz
Custard	1 oz
Soup	1 oz
Vesta	3 oz

Day 3	
Alpen	3 oz
Pancake	2 oz
Rise & Shine	1 Pk
Oatmeal Blocks	3 oz
Nuts	3 oz
Raisins	3 oz
Penguins	9
Mars	4
Kit Kat	1
Sardines	4 oz
Steak (tinned)	8 oz
Fruit (tinned)	8 oz
Soup	1 oz
Onions	1 oz
Rice	3 oz
Dried veg	2 oz

General	
Biscuits	3 pks
Sugar	8 oz
Jam	1 Jar
Milk	5 pints
Tea Bags	12
Coffee	2 oz
Fruit Cake	5 oz
soup	4 oz
Marg	8 oz
3 Cloths	2
Matches	1 box

'LIGHT BLUE BOXES'

Day 4	
Omelette mix	1 Pk
Rise & Shine	1 Pk
Tube Cheese	I
Digestives	1 Pk
Hovis Biscuits	1 Pk
Nuts	3 oz
Raisins	3 oz
Penguins	9
Mars	4
Milky Way	2
Toblerone	1
Pork Luncheon Meat	4 oz
Soya	3 oz
Beef Chunks	3 oz
Mash	3 oz
Oxo Cubes	1 Bix
Soup	1 oz
Angel Delight	2 oz

Day 5	
Pancake	2 oz
Jiff	1
Alpen	3 oz
Oatmeal Bis	3 oz
Rise & Shine	1 Pk
Nuts	3 oz
Raisins	3 oz
Penguins	9
Mars	4
Choc.Eggs	2
Picnics	2
Dentine	1 Pk
Mackerel (tinned)	4 oz
Vesta	3 oz
Custard	2 oz
Xmas Cake	3 oz
Soup	1 oz
Green beans	3 oz
Apple flakes	2 oz

Day 6	
Porridge	2 oz
Scrambled Egg	3 oz
Rise & Shine	1 Pk
Rye Bread	1 Pk
Polos	1 Pk
Opal Fruits	1 Pk
Penguins	9
Mars	4
Nuts	3 oz
Raisins	3 oz
Corned Beef	4 oz
Choc.Eggs	1
Glacier Mints	10
Tinned Ham	8 oz
Rice	3 oz
Dried peas	2 oz
Soup	1 oz
Tinned pears	8 oz

General	
Biscuits	3 pks
Milk	5 pints
Syrup	1 tin
Cup-a-soup	2
Soup	4 oz
Sugar	1 box cubes
Tea Bags	12
Coffee	4 oz
J Cloths	2
Matches	1 box

Basecamp Food

We packed 20 days supply of Basecamp food into boxes (colour coded Dark Blue) and menus were chosen to suit by the duty cooks. The following lists give the menus for three typical days.

		Day 3
Danepack Bacon	Savoury Omelette	Danepack Bacon
Granny Smith's Bread	Tinned Ravioli	Scrambled Eggs (mix)
Savoury Fry	Sugar Puffs	Weetabix
Shredded Wheat		
Service Biscuits	Granny Smith's bread	Oatmeal blocks
Gales Honey	Peanut butter	Treacle
Penguins	Mars Bars	Granny Smith's bread
Tuna Fish	Tinned Steak	Frankfurter Sausages
Colmans Cheese Sauce	Colmans Bolognese Sauce	Granny Smith's Bread
Tinned Carrots	Spaghetti	Tinned green beans
Smash	Parmesan Cheese	Smash
Jam Sponge Pudding	Tinned Peas	Tinned Pineapple
Treacle	Tinned Rice Pudding	Custard

The expedition team would like to express their sincere thanks to the following Companies who are appropriately, yet inadequately mentioned below.

Companies who donated foods:

Beechams Group Limited
Berni Inns Limited
British Soya Products Limited
Danepak Limited
Farley Health Products Limited
General Foods
Granny Smiths
Mars Limited
Nabisco Limited
Quaker Oats Limited
Rowntree Machintosh Limited
Tate and Lyle Refineries Limited
Tobler Suchard Limited
Unigate Foods Limited
Unilever Export Limited
United Biscuits Limited
Weetabix Limited
Whitworths Holdings Limited

Companies who donated drinks:

Britvic Limited
John Dewar and Sons Limited
Arthur Guinness Son and Company Limited
Grants of St James
McDonald and Muir Limited
Scottish and Newcastle Breweries Limited
Whitbread and Company Limited
Whiteways of Whimple Limited

INSURANCE

by Graham Bunn

All Insurance was handled through Imperial College and the cover was as follows. I would like to thank Mr. R. Hermitage of Imperial College for his patience when dealing with myself and the two insurance companies involved. Without his help we would have had to spend far more time in sorting out this problem.

		Extent of Cover	Approx Premium
Leader Only	Public liability	Â£250,00	
Individual members:	Personal accident Death Permanent disability Medical expenses (including helicopter rescue)	£ 2,000	£110
All personal equipment and team equipment (including food)		£ 2,000 max	
1 Radio, valued Â£5,000 all risks when accompanied			Â£12

RADIO REPORT

by Bruce Herrod

We had on loan from the Army, one of their latest manpack radio transceivers - a highly sophisticated piece of equipment yet simple to operate and weighing only 20 Kg when complete. (Radio, carrying frame, hand generator, 2 batteries and other accessories).

A temporary radio licence was obtained from the Norwegian Department of Telecommunications and we were allocated the call sign LH 70. Upon arrival at Longyearbyen on Svalbard, I contacted the operator for Svalbard Radio to confirm our earlier letters concerning distress frequencies and also the frequencies on which Svalbard Radio operates. (We were limited by the range of frequencies for our set, 2 to 30 MHz).

The frequencies used were:

2182 KHz	for calling and distress (silence maintained for 3 minutes past each ½ hour, except for distress calls - Svalbard Radio listens 24 hours a day on this frequency).
3664.5 KHz	for communication with Svalbard Radio
3201 KHz) 2056 KHz)	for communication with Mr.M. Tuson, Captain of M.V.Copious
1410.0/15.0 KHz	for communication with our English radio amateur link
15070 KHz 12095 KHz 9750 KHz 9410 KHz	BBC Northern Europe Service and various other stations

We maintained regular contact throughout the Expedition with the M.V. Copious to obtain weather forecasts, statements of barometric pressure at sea level and to inform them of our position. We also contacted Svalbard Radio on several occasions for weather forecasts. For the first six weeks of the Expedition, every Sunday, at 2000 hours G.M.T. we attempted to make contact with our amateur link in England and though we did make contact several times, no really satisfactory results were obtained.

Though we never had to use the radio 'in anger' it was always a great comfort to have it with us in the knowledge that had a serious accident occurred, we could have attempted to obtain help (weather conditions permitting).

Whilst on the ice-cap, it should be noted that we had to use an artificial earth at all times. The hand generator we had with us enabled us to regularly recharge the batteries. Reception was nearly always reasonable or good, depending on how well I managed to tune our aerial. I am certain that with more experience in the setting up of aerials that we could have made better contact with our amateur link in England. We had no problems at all with the set, apart from the fact that often 2-3" hard frost would form on the counterpose and aerial wires, causing the bamboo canes, lashed together to form an aerial mast, to bend double under the weight.

ROUTE, LOGISTICS, NAVIGATION AND USEFUL INFORMATION

by Andrew Wilson

MAPS

Maps were obtained from:

Edward Stanford Limited, 12 Long Acre, London W2
Norges Geogafiske, Oppmaling St., Oavs GT32, Postboks 8153, DEP OSLO 1
Royal Geographical Society, 1 Kensington Gore, London

The RGS map of 'Central Vestspitsbergen' (scale 1:125000, contour interval 100m) was chosen for general use and comes highly recommended although several areas are left blank or sketched.

Aerial Photographs were obtained from:

Norsk Polarinstitutt, Rolfstangveien 12, Postboks 158, 1330 Oslo Lufthavn.

NAVIGATION

For navigational purposes we used three instruments; an altimeter, silva compasses, and a distance measuring wheel specially built for the rear of one of our sledges. Navigation in good visibility posed few problems - just point the sledges in the correct direction and start skiing. In heavy mists however the sledges were joined in tandem with 5 men hauling and one navigating from the rear. By continually shouting directional instructions, the navigator could ensure a good bearing by keeping himself, the sledges and the central, leading hauler, in a straight line.

Each member of the team had a Silva-15TDCL compass, very kindly supplied at a 50% discount by Silva. The magnetic variation on Central Vestspitsbergen is approximately 1°W of true north and we found that the needle was no sensitive that it was affected at close range by metal objects packed on the sledge.

The Altimeter readings depended on the pressure at sea level which was obtained by a series of radio calls. Although this instrument was essential for marking flag positions during the Met. project, it was only of secondary use during navigation as the 'ice cap contours' had considerably altered since the existing maps were compiled.

FOOD LOGISTICS

In total the RHC expedition took 1½ times the volume of food required for 8 weeks:-

48 (2-man, 3-day boxes) but average 2-man, 4-day rations (i.e. 64, 6-man days).

20 6-man/day units for Basecamp consumption

Therefore in total we took 84 6-man days of food

These calculations were made assuming that one box would last, on average, for 4 days even though they were packed into 3-day units and at one time stretched to 8 days. I decided to begin sledging towards Astro, with 22 boxes each being approximately 25 Ibs which assumed '30 days' food for 6-men. After 26 days on the ice cap we returned with the equivalent of '10 days' supply remaining.

BACKPACKING SUPPLIES TO DUMP CAMP

In total, the team made 33 backpack carries from Brucebyen up to the Dump Camp which was sited on the limit of 'sledgeable snow' near the base of Ferrierfjellet. The round trip entailed I4 miles of rough walking half of which with a load equivalent to 50 Ibs.

Although loads such as a sledge and several pairs of skis were relatively light, they were considered equal to a standard 50 lb pack as they were extremely unstable to carry.

Supplies finally accumulated at Dump Camp were approximately:

Personal gear (250 lbs)
Paraffin (80 lbs)
Food (550 lbs)
Radio (45 lbs)
Equipment (100 lbs)

SLEDGING

The sledging route on the outward journey consisted of a large easterly arc from South or North keeping as high as possible and avoiding large open crevasses 1 mile east of the Ekkoknausane nunataks. The region one mile south of Saturnfjellet should only be negotiated in perfect weather.

Skis are <u>essential</u> and were used 80% of the entire journey with 20% use of snow shoes on steep gradients.

Alternative routes are possible from the North side of Nordenskiold Glacier or from Skottehytta (petuniabukta) but both lack the security of a good Basecamp even though the routes are slightly shorter.

For a 6-man team I would ideally recommend, if finance allowed, 4 sledges lightly laden rather than our 2 sledges loaded to 500 Ibs each on our outward journey and 300 Ibs for the return. It is however, <u>essential</u>, to take only the highest quality sledges for maximum efficiency - there was much cursing and sweating on the steep uphill gradients and morale would have collapsed if the sledges were not of the very best.

Sledges were generally pulled with haulers organised in an 'arrow' formation (maximum trace length of 40 ft., minimum 9 ft., when 5 men were hauling sledges in tandem). In heavy mists or over dangerous ground, I extended the leading trace so that only the front man would fall into any hidden crevasses.

PHOTOGRAPHY

Compiled by Rod Clarke

My equipment consisted of:

Pentax KX Camera
55mm Pentax lens
28mm Tamron lens
300mm Vivitar telescopic lens
1 set of extension tubes
Small Computer Flashgun
Slik 500 tripod
1 Starburst Filter

The other team members had the following cameras:-

Kodak Retinette plus 135mm lens
Cosmic Symbol
Zorki
Kodak Instamatic

Graham wrote to several film manufacturers, who offered us little discount. He finally bought 36 rolls of Agfa CT18 and 10 rolls of Kodak 64 from Jessops of Leicester.

I chose the Agfa CT18 because I was familiar with its characteristics, and particularly wanted its good colour saturation with dull light. Most of the results were very pleasing, though several films stuck in their cannister before loading, giving streaks on those which could be coaxed into the camera. The Kodak 64 film gave no such problems. They gave excellent fine-grained slides in good lighting, but dull, bluish results in bad light.

The major problem in the conditions was that of condensation. I left all my equipment outside the inner tent, and only had problems with condensation when bringing the camera inside for shots within tents.

The wide angle lens was used for much of the time, giving greater depth-of-field, whilst being less prone to condensation on the inner elements. The close-up extension tubes enabled the flora to be recorded giving a more complete idea of what Svalbard was really like.

CINE FILM

by Bruce Herrod

The RHC Photographic Society very kindly loaned the following equipment:-

1 Eumigette 2 Super 8mm Cine Camera (not winterised)
1 Skylight 1B Filter
I Lens Hood
1 Cable Release
1 Tripod
Spare batteries

I decided not to attempt anything too ambitious and to follow a set of simple rules:-

1. To use good light as much as possible.
2. To shoot scenes for a minimum of 8 seconds.
3. To have movement in every picture, if only by 'panning' the camera.
4. To run through each shot mentally before shooting.
5. To attempt to hold the camera rock steady while filming.

During the first few days of the expedition, I practised pointing the cine camera at everybody as much as possible, until they accepted its presence as natural, so that they did not 'freeze up' when they thought they were being filmed. Nearly all scenes were shot unrehearsed, which meant that I was running around like a scalded cat making sure I was in the right position at the right time. The tripod was used once only - the cine camera being hand held at all other times. Again simple procedures were followed to minimise 'camera shake' –keep the elbows well in, one hand on top of the camera, only filming from a comfortable steady position, e.g. sitting, or resting against a rock etc. The camera travelled on most occasions within my jacket so that it was ready for instant use at all times. At 'night' or when not being used it was kept inside my tent, together with the radio and my personal camera equipment.

The results obtained were very satisfying and well worth the expense, the final result being a 22 minute film with the addition of a sound track on cassette tape which will be used for expedition lectures.

RIFLE

by Graham Bunn

Polar Bears, Firearm Certificates and Customs

Lt. Col. Blashford-Snell R.E. very kindly offered to loan us one of his personal .303" hunting rifles for the duration of the expedition. Anyone who intends going to Svalbard without such protection is a fool, since Polar Bears are the largest land living predators on Earth, and have a fully justified reputation for being deadly. They used to be less of a danger than at present, but since the total banning of commercial hunting in the early 1970's, the population has increased to such an extent that it is quite possible to find a bear in any part of Svalbard during the summer months, despite the migration with the retreating pack ice.

Acquisition of the rifle required the previous acquisition of a firearm certificate. Application forms for these are held at most police stations, and they cost Â£12.00 It is only necessary for one person to hold the certificate.

It might be worth mentioning that it appears to be very much more difficult to obtain the grant of a certificate in the Metropolitan Police area than in other areas - probably due to the high incidence of crime and violence in London. At least two months should be allowed between application for, and receipt of, a certificate.

A.303" calibre rifle is about the smallest bore that would be truly effective against a Polar Bear. Although the Lee Enfields etc. do have great accuracy over a very great distance; this is not a necessary feature, and it might be better, should one have any choice in the matter, to have a larger calibre, shorter barelled weapon.

Soft nosed, even flat, soft nosed, ammunition is the order of the day. Since a fully copper clad bullet would go straight through a bear and do it very little damage. This is quite easily obtainable in London, but may have to be ordered from a local gun smith (cost is about 30p per round).

So far as entry into Svalbard with the weapon was concerned, this only required the prior permission of the Sysselman, which he was only too happy to give.

In order to take the weapon into Norway, en route to Svalbard (or probably into Svalbard direct also) it was necessary to obtain a temporary import licence (valid for 3 months) at the customs point. This is no problem, provided that the British firearm certificate is produced at all times.

We encountered no problems regarding transport of the rifle by aircraft, but it appears that we were lucky not to have done so with the ammunition. It would be very worthwhile making absolutely sure of the legal requirements for in-flight containment of ammunition. Also, it saves a great deal of time if the Airlines are informed in advance that an accompanied firearm is being brought.

Training

When Andy and myself went to collect the rifle from Col. Blashford-Snell, he was the CO of the Junior Leader's Regiment, based in Dover. The Colonel very kindly arranged for us to have a practise session on the range after lunch in the Officer's Mess. The very brief introduction to the weapon given us by the Corporal in charge of the Armoury was gratefully accepted. We only hoped that it would be sufficient in the event of an untoward incident.

As soon as it was possible at Brucebyen, everyone was shown exactly how to use, and not abuse, the rifle, and given the chance to shoot at a few tin cans.

In the event, we encountered no bears, although two or three had been around the Longyearbyen area not long before our arrival.

As soon as it was possible after our return to the UK, the rifle was returned to Col. Blashford-Snell and the firearm certificate sent back to Scotland Yard. Although a certificate is normally valid for 3 years, it was only granted on condition that it be revoked immediately after the end of the expedition.

N.B. Failure to comply with the Firearms Act incurrs very stiff penalties, so it is not worth trying to cut corners in any way.

SOME INTERESTING LETTERS

MARS LIMITED
SECRETARY'S OFFICE

Secretary D C DRAKE

266 BATH ROAD,
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Telephone Slough (0753) 36161
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Telex 847701

Mr. A. Wilson,
The Royal Holloway Meteorological
Expedition to Svalbard 1978,
C1, Kingswood Hall,
Coopers Hill Lane,
Englefield Green,
Egham, Surrey.

28th April, 1978

DONE 4/5
AW

Dear Mr. Wilson,

I am sorry to have been so long in replying to your letter of the 23rd March, but I have been out of the country. In the meanwhile I was very fascinated to read about your Expedition and I am wondering whether two cases (576 units) of Mars Bars, which we have carefully worked out to be something like two per day for your party plus a cheque for £50 would be useful to you. If so would you kindly get in touch with Mr. Jeremy Kane at this office who will handle the business side.

I wish you all the very best for the success of your Expedition, and if anybody should take a photograph of at least one person eating one Mars Bar we would be happy to receive a copy.

Yours sincerely,

R.C. Edwards

Directors: R. C. Edwards (Chairman), W. Dickson, B. R. Law, C. D Lawson
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1330 OSLO LUFTHAVN

The Royal Holloway Met.Expedition
to Svalbard 1978,
C1, Kingswood Hall,
Coopers Hill Lane,Englefield Green,
Egham, Surrey.
England

Dato: 6.12. 1977

Vår ref.: Li/GE/4703/77

Deres ref.: Letter 3.12.77
Ref. AW 115

Dear Mr. A. Wilson,

Thank you very much for your letter of December 3rd. I have read the prospectus for your planned Spitsbergen expedition which seems to be well planned. I am sorry to say that we are not able to help you with your year in Longyearoyen but I think Sysselmannen might bring you in touch with Store Norske Spitsbergen Kulkompani A/S, who is handling goods coming in - to the harbour.

I think you should take the icebears seriously. They can be seen anywhere on Spitsbergen during the summer and they are normally very hungry at that time of the year. Last summer a tourist was eaten by an icebear.

I very much hope that you will have a nice trip to Spitsbergen and wish you luck with your expedition.

Yours sincerely,

Olav Liestøl
glaciologist

POST BES ADRESSERT TIL NORSK POLARINSTITUTT IKKE TIL ENKELTE MEDARBEIDERE
PLEASE ADDRESS LETTERS TO NORSK POLARINSTITUTT NOT TO INDIVIDUAL MEMBERS PERSONALLY

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YOUR REF

DATE 24 April 1978

A. Wilson, Esq.,
The Royal Holloway Meteorological
Expedition to Svalbard,
C1, Kingswood Hall,
Coopers Hill Lane,
Englefield Green,
Egham,
Surrey.

Dear Mr. Wilson,

Thank you for your letter of 7 April addressed to our Glenmorangie Distillery. This has been passed on to us as we are the proprietors of the Glenmorangie Distillery Company.

We were most interested to learn about your forthcoming expedition to Svalbard and would like to be of assistance. Unfortunately we could not provide Glenrnorangie as due to the exceptional demand and the small size of the distillery, it is presently distributed to regular trade customers on a quota basis.

However, we do have an excellent blended whisky called Highland Queen. The basis of this blend is composed of whiskies both from our Glenmoranqie and Glen Moray-Glenlivet Distillery in Elgin, coupled with other fine whiskies from the various distillation areas throughout Scotland. If you are interested in Highland Queen, we would be pleased to provide you with one case delivered free of charge under bond to a United Kingdom port.

We look forward to hearing from you in due course.

Meantime, with all good wishes,

I am,

Yours sincerely,

D.W.A. Macdonald
Chairman & Managing Director

REGISTERED IN SCOTLAND NO. 19038 REGISTERED OFFICE: QUEENS DOCK, LEITH, EDINBURGH EH6 6NN

Lt Col J N Blashford-Snell, M B E., R.E.
The Junior Leaders Regiment,
Royal Engineers
Old Park Barracks,
Dover, Kent CT16 2HG
Tel ~~Kearsney 1333~~
Dover 820333 Ext 25

THE SCIENTIFIC EXPLORATION SOCIETY

Mr Andrew Wilson
C1
Kingswood Hall
Coopers Hill Lane
Englefield Green
Egham
Surrey

15th February 1978

Dear Andrew

Thank you for your letter dated 4th February. I confirm that subject to a Firearms Certificate being issued the Scientific Exploration Society is prepared to loan you a .303 sporting rifle. Therefore I suggest that when you have your certificate you purchase 50 rounds of .303 soft nosed ammunition and telephone me to arrange a date for the visit.

I'm not a polar expert and I recommend that you send your plan (plus SAS) to Dr Ken Hedges, Medical Director, Shell Canada Ltd., Box 400, Terminal 'A', Toronto, Ontario M5W 1E1, Canada and ask his advice.

Good wishes.

Yours Sincerely

John B-S.

BRITISH ANTARCTIC SURVEY

NOTES ON MANHAULING

by E. J. Chinn

General

When manhauling, two factors become relatively more important than with dog sledging. The first point is weight limitation which should ideally be kept down to 150-200 Ibs per man. Careful selection and weeding out of non-essential items is necessary to keep weight on the sledge to a minimum. For example, get rid of surplus packing materials in food boxes; if necessary, repack non-perishable foods in cotton or polythene bags. Take smaller sized notebooks, less clothing, less paraffin (within the limitations of safety).

The second consideration is the running surface of the sledge runners and skis. The sledge runners, which are faced with Tuphnol, should offer as little friction as possible. Scrape them clean at regular intervals and take care not to score the runner surfaces on rock. Ski surfaces must be prepared for manhauling - use an 'uphill' wax or skins. Remember that skins wear out fairly quickly with constant use.

Equipment

1. Sledges

Manhaul sledges are constructed with ash timber and made as light as possible to reduce weight. They remain inherently strong under load but are susceptible to sudden stresses and will not stand rough treatment. The runners, bridges, longitudinals and cowcatchers are fastened by means of lashings - rawhide to fasten the bridges to the runners and hemp cabled cord to lash the longitudinal and cowcatchers to the bridges. All lashings must be checked regularly to ensure tightness and painted with taughtening dope to eliminate stretching and shrinkage of the hemp cord. A good practice is to cover the longitudinal lashings with tape to reduce abrasion from sledge loads.

A rope brake made from 16-20mm dia. rope should be spliced up and attached to the front bridge pillars - the bight of the rope can be held up to the outer longitudinals with a lashing to keep it clear until required.

The runners require little attention. However, should excessive abrasion cause exposure of the linen core of the Tuphnol sheathing, ski wax could be rubbed on to reduce porosity of the exposed area.

2. Harnesses

There are various designs of manhaul harnesses but the type generally preferred consists of the broad body strap supported so that it is held at hip level. Support can be in the form of shoulder straps which should be long enough to avoid strain being put on the shoulders. Individuals who prefer to use the weight of their shoulders umhampered by a harness sometimes devise a harness which is held up by loops round a waist belt.

The following points should be borne in mind:

The canvas body strap should be wide enough (8 - 10") and held at hip level so that weight is taken on the pelvic girdle.

The lower the harness, the greater your pull for a given lean forward.

The less you have to lean forward the less tired you become.

Experiment with your harness BEFORE you undertake a field manhaul trip.

3. Traces

The most suitable rope is terylene which has a much lower stretch factor than nylon. With nylon a proportion of your effort is lost through the elasticity of the rope every time load is put onto it. You want all effort to count. Terylene, or similar low stretch synthetic rope, should be hawser-laid so that it can be spliced.

Opinions vary with regard to legth of traces and much will be found out by trial and error. Another governing factor will be the terrain over which you are travelling. The following extracts have been taken from various reports on manhauling which indicate opinion variation.

"Optimum working distance is 8-18 feet. Traces should not be shorter than 10 feet - you can always shorten a trace which is too long for a given situation. To allow one skier to follow in another's footsteps without treading on the back of his skis (a valuable energy-saver in soft snow), the separation must be at least 10 feet."

"We had three men at distances of about 10, 20 and 35 feet on their traces. This gave us adequate room for crevasse probing."

"The interval between any two men should not be less than 15 feet."

"Keep traces as short as possible on steep descents."

The conclusions are that length gives security against crevasses, while a short trace gives speed through manoeuvrability. On open, flat terrain longer traces may be used, while in difficult, winding terrain and when descending the shorter trace will be preferred.

Remember once you have decided on the length of your traces to allow sufficient for splicing an eye at each end (say 1'6") before cutting the rope lengths. You will need a clip hook (or karabiner) at one end of the trace to which you attach the ring of your body harness; at the other end a ring should be spliced for securing with a karabiner to the sledge towing pennant.

On the subject of hauling more than one sledge, whether or not they are hauled in tandem (linked one behind the other) will largely depend on personal preference and the terrain. In difficult country splitting the party equally to haul the sledges will probably be the best solution, while in flat, open terrain two sledges may be hauled in tandem.

Techniques

The first essential is to plan your day bearing in mind the sort of terrain you are likely to encounter. Each day is likely to bring a different obstacle. As a guide, on good, level surfaces you can expect to average 12 - 15 miles per day, or about 2 mph.

Before starting each day, turn the sledge over and clear the runners of any ice frozen onto them overnight. Take care not to damage the surface of the runner as this will affect manhauling performance.

Make sure that items you will need en route are not lashed inextricably in the load. These are likely to be food, map, compass, camera, etc. A good idea is to have a gadgets box attached to the rear of the sledge which is accessible at all times.

1. Loads

When more than one sledge is used the loads should be split equally between them.

Wherever possible, survival equipment, e.g. tents, sleeping bags, rescue equipment, food and fuel, should also be split so that in the event of a crevasse accident some of your equipment will survive. Weight should be kept down to 150–200 Ibs per man. With this sort of load, a three-man party should be self-contained for 4–5 weeks.

Points to remeber when loading a sledge:

(a) If you envisage traversing, put the weight forward.

(b) On soft level snow or sastrugi put most of the weight at the back.

(c) When traversing consistently on one slope, the load should be concentrated over the uphill runner.

(d) On a descent it is easier to stop a sledge which is heavy at the back rather than nose heavy.

2. Lashing Procedure

Rope loops on the sledge are strongly recommended to facilitate lashing down with the lash rope. This is much quicker and easier than passing rope round sledge longitudinals and bridges. Finish off lashing your load by taking up any slack with frapping turns. Do not use up excess rope with strings of half-hitches - remember you may have to undo them when they become frozen up.

3. Relaying

There will be occasions when a sledge load is too heavy to pull over difficult terrain or on poor surfaces. If relaying is likely it is wise to split the load into two parts beforehand, lashing each separately on the sledge. In this way much unnecessary lashing and sorting the load will be avoided.

Points to remember when relaying:

(a) On occasion it could be easier to ski ahead with heavy backpacks - this could lighten the sledge sufficiently to manhaul the remaining load in one journey.

(b) Sometimes a standing haul on a long rope can be used for a very short but hard pull. This gives the legs a break by using the arms for a change - and could save unlashing a load.

(c) Situations could arise when it may be necessary to backpack a load a short distance over very rough country. It is not illogical to carry the sledge as well where it could cause damage by hauling it over a damaging surface, e.g. sharp rock.

Manhauling - ascent

Try to keep a steady pull on your trace and not progress by a system of jerks. Lean well into your harness all the time to maintain your pull. Use a sailor-type roll from one foot to another instead of slackening your pull to move your foot forward. On a steep ascent it is easier to climb using a series of short traverses than to try an ascent direct. Towing loops should be arranged at each end of the sledge as, on accoasion, it is easier just to clip-on to the other end than try to turn the sledge through soft snow.

Manhauling - traversing and slight descent

Here the aim is to make horizontal distance while only losing a limited amount of height. The sledge movement varies between being pulled and running free. Attachment for two men should be one pulling forward in the direction of travel and the other man uphill and slightly behind the bows of the sledge so that he can control forward and downhill movement. Often on a level/descending traverse the sledge has a tendency to catch up with the main pulling forward and this can be controlled by the back man. On a variable surface, the front man may not be able to keep the sledge moving. The cure is not for the back man to come forward but to give on his trace so that the sledge nose drops downhill.

Once moving again the sledge is controlled by the back man taking in on his trace. In effect the back man determines the angle of descent of the sledge and adjusts it in anticipation of each change of ground to give the front man a steady forward pull.

When traversing on a steep slope the back man can save the sledge toppling by passing his trace over the load and attaching it to the downhill side.

Manhauling - steep descent

Here the aim is to lose height with the minimum of horizontal travel. The sledge will naturally run free all the time so requires continuous control.

If the descent is not too steep attach the traces of both men to the front of the sledge. The men should then ski one either side and behind the sledge.

On the very steep descent it is better to traverse obliquely across the slope from side to side. One man should be attached by his trace to the front, uphill side of the sledge; the other physically holding the front of the sledge from the downhill side. When changing direction to traverse back over the slope, the downhill man holds the sledge while the uphill man with the trace clips himself onto the other end of the sledge. The downhill man can then change ends. Remember the front end of the sledge always has the tendency to break away downhill.

Manhauling in crevassed areas

In crevasse country certain precautions should be taken before setting out on your journey. Firstly, check that the traces of each person on the sledge are of different lengths to ensure that if one person falls into a hole his companion will be either ahead of or behind him. Unless it is a wide, weakly-bridged crevasse there is a good chance both men will not break through the surface together. Provided your harnesses are well-made and there are no weak links you should have no problems. However, a wise precaution, and one which should preclude the the necessity of further roping-up, is to fasten the towing trace to your harness leaving sufficient slack to tie the end of the trace round your waist by means of a bowline. This ensures that when you are pulling the weight will be taken on the harness and not on the trace round your waist. Another useful contribution to safety is to have a pair of jumars attached to the rope immediately after the harness attachment. In the event of a fall these will be useful to get your hanging body weight off your waist.

As far as the sledge is concerned, one slight modification to the towing trace will be of value. The towing strop should be fastened directly to the centre bridge instead of being looped round the front bridge as is normal practice. The strop should also be detached from the towing pennant (on the cowcatcher) and, instead, loosely tied to the cowcatcher with light hemp cord. In the event of a person falling into a crevasse the sledge does not follow you down. Instead the towing strop breaks free from its hemp lashing, allowing the front of the sledge to ride over the hole leaving you suspended immediately underneath. This has been proved and works in practice.

Do not forget that the best precaution against falling into a crevasse is to wear skis all the time. If a region of heavy crevassing is suspected, travel should be halted immediately. the Sledge should be unclipped and the party members roped-up to carefully probe the route ahead on skis. Remember to flag your probed route as ski tracks are easily obliterated by a snow fall or drifting.

E. **3.** Chinn

METEOROLOGICAL RESEARCH

Compiled by Andrew Wilson and Bruce Herrod

The equipment on loan from the Royal Meteorological Society consisted of:-

6 Ventimeters sealed 5 - 50 mph (4 fitted with a compass) plus protective cases

3 Whirling Psychrometers (-15°C to +30°C) plus leather carrying case

1 Minimum thermometer (-30°C to 40°C) plus carrying box

1 Aneroid altimeter plus leather carrying case (calibrated from -300 m a m.s.l. to + 200 m a m.s.l.)

1 Wooden box (padded) for carrying the above.

Additional equipment:-

50 marker flags (6' bamboo poles with red flags)

Clipboards, result sheets, pens, compasses

The letter following, written by Dr. F.B. Smith (Expedition Patron) describes the research work undertaken by the expedition. Basically the team had the task of measuring the surface windflow around a fairly isolated, symmetrical hill so that the Boundary Layer Group, within the Met. Office, could verify a mathematical model involving complex differential equations. Suitable data could not be obtained using wind tunnel experiements because it is not possible to accurately simulate atmospheric layers in a model. Svalbard was an ideal site for such work for three main reasons:-

(1) Svalbard lies halfway within the Arctic Circle, so during the summer months there is 24 hour daylight, which encourages "stable" atmospheric conditions.

(2) There is a large ice cap with a smooth snow surface (i.e. there are no houses and trees to disturb the windflow).

(3) Svalbard has many symmetrical shaped mountains (Spitsbergen means "pointed mountain").

The expedition team managed to make 1½ surveys on Astro and a typical result sheet has been included in this report. The result sheets have been presented to the Boundary Layer Group and the data is being analysed with the use of the Met. Office computer.

N.B. This report has been mainly devoted to the mountaineering aspects of the expedition. A separate report has been written, giving details of the research, including a mathematical model of the windflow using non-linear equations.

Acknowledgements

To Dr. F.B. Smith, Assistant Director, British Meteorological Office, for unstinting help with every stage of the project.

To P.J. Mason and R.I. Sykes of the Boundary Layer Research Team at the British Meteorological Office, for their patient explanation and help concerning the technicalities behind the project.

To the Royal Meteorological Society for their support and approval of the expedition and for their help and loan of all meteorological instruments required by the expedition.

METEOROLOGICAL OFFICE Met.O.14
London Road, BRACKNELL, Berkshire
Telegrams: Metbrack London Telex
(Telex 84160)
Telephone: Bracknell 20242, ext. 2214

Please address any reply to
THE DIRECTOR-GENERAL
and quote:
Your reference

COMBINED UNIVERSITIES EXPEDITION TO SVALBARD, SPITSBERGEN, 1978

Meteorological Experiment : The drag of hills on the Atmosphere.

One of the major unsolved problems of meteorology concerns the overall effect of topography (and hills and mountains in particular) *on* the flow of b e atmosphere. The effect, which i s certainly profound, will influence weather development, climatology and the dispersion of pollutants. At the present time, topography is included in operational numerical weather forecasting schemes and other models in a relatively crude way.

Recently new mathematical techniques, known as 2nd order closure schemes, have been developed in the field of fluid dynamics to "solve" the complex system of non-linear equations which govern the flow of the atmosphere over heterogeneous terrain. In b e Meteorological Office active research is being pursued in the subject and certain predictions have been obtained, and the accompanying note outlines this work. Experimental confirmation is urgently required and as the note implies a study of the wind field around an isolated hill called Brent Knoll in Somerset is planned by my Branch for late 1977 in order to determine the overall akin-friction affect of the hill on the airflow.

Brent Knoll is a reasonably good site but is probably the *only* satisfactory site in the U.K. where measurements car. be made easily at ground level (as distinct fret making measurements around small but tall rocky islands when aircraft are required).

Given the right kind of hill. .fairly tall, reasonably symmetric and. surrounded by flat uniform terrain.....this study, unlike most scientific experiments, does not entail making measurements to great accuracy. Simple robust instruments sensibly and intelligently used are capable of providing invaluable data or real scientific value. A simple contour-height survey of the hill will need to accompany the meteorological survey.

In summary: 1. The experiment is n t h m the capability of the expedition teal.

2. The instruments required are simple, robust and light to carry, and if intelligently used are capable of giving data of sufficient accuracy.

3. Measurements need to be taken over a reasonably short period of time (2 to L hours for Bach experiment).

L. The Expedition will hare the advantage a? making measurements in terrain inaccessible to the Met. Office over very open snow-covered countryside, and in fresh winds advantageous to the study.

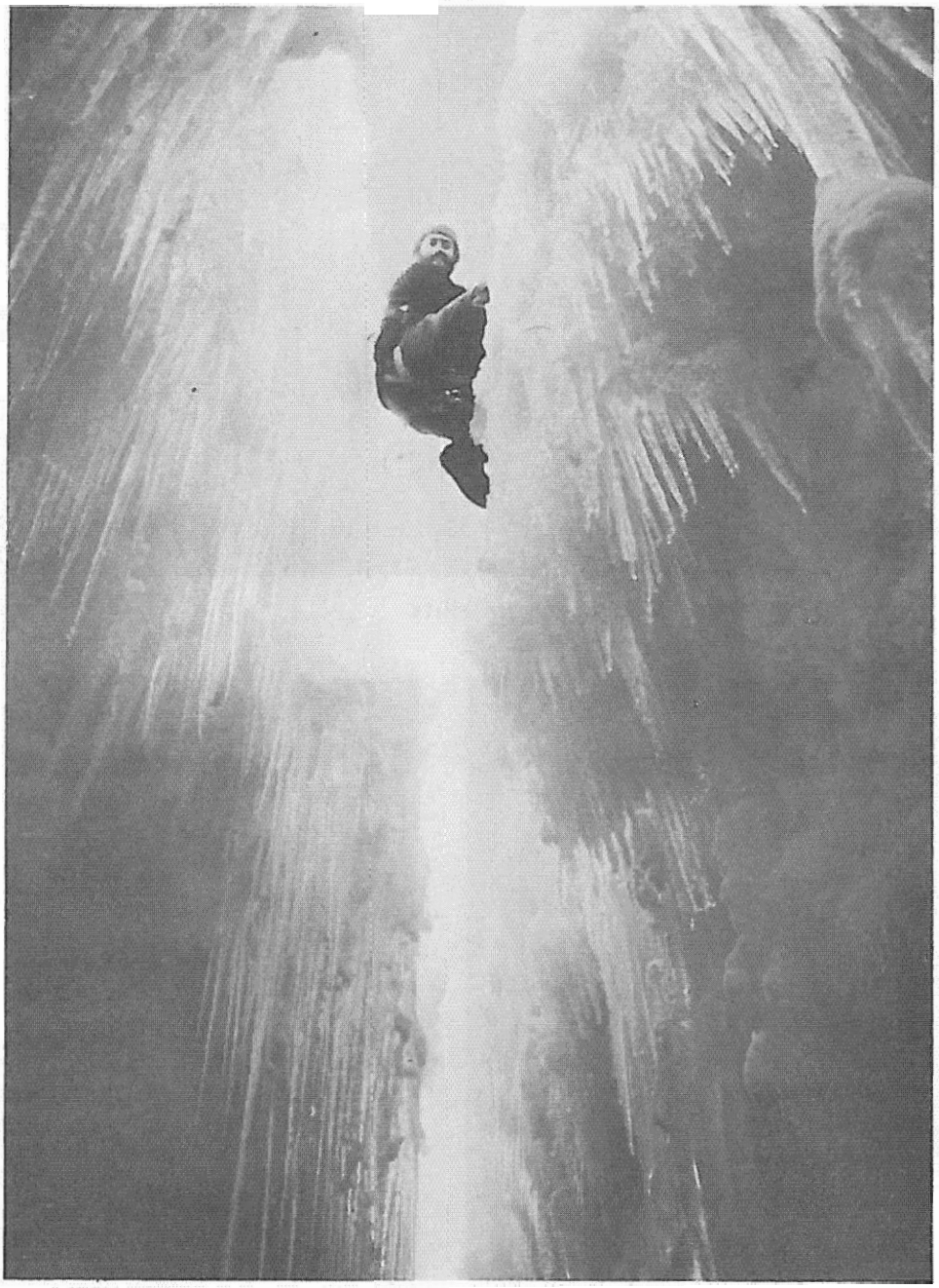
5. The results should be of genuine & immediate scientific value in a developing field of meteorology. Furthermore the study is free free political social or economic overtones which could be resented by the Norwegian Govt.

The Royal Meteorological Society are giving as much support as they car;, allowing for their limited means, by loaning suitable met. instruments.

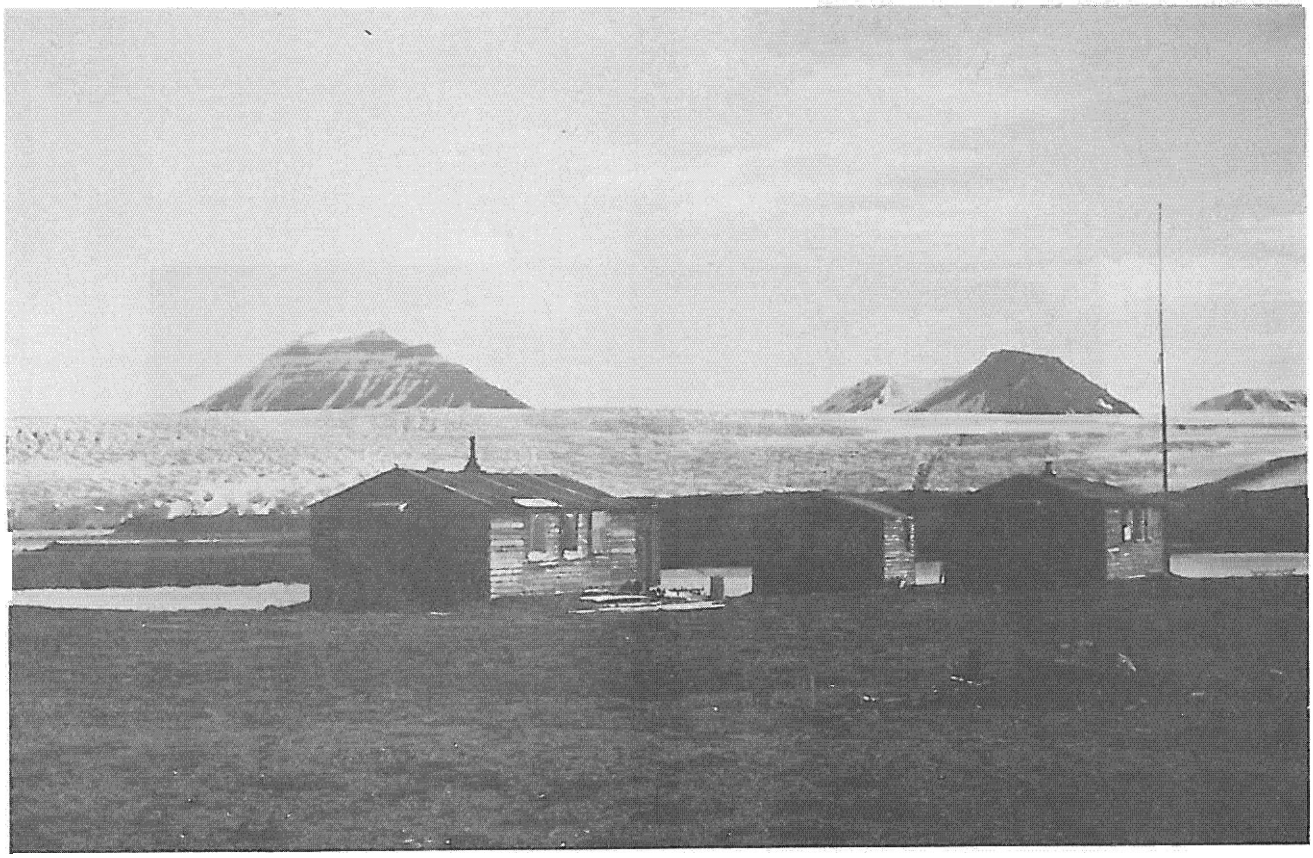
F.B.Smith, Assistant Director, Boundary Layer Research Branch, Met.O.14

SHEET NUMBER	SITE	SURVEY NUMBER	NAME OF RECORDERS	DATE	TIME START	TIME FINISH
6	ASTRO	1	PAUL ROD	26th July 1978		

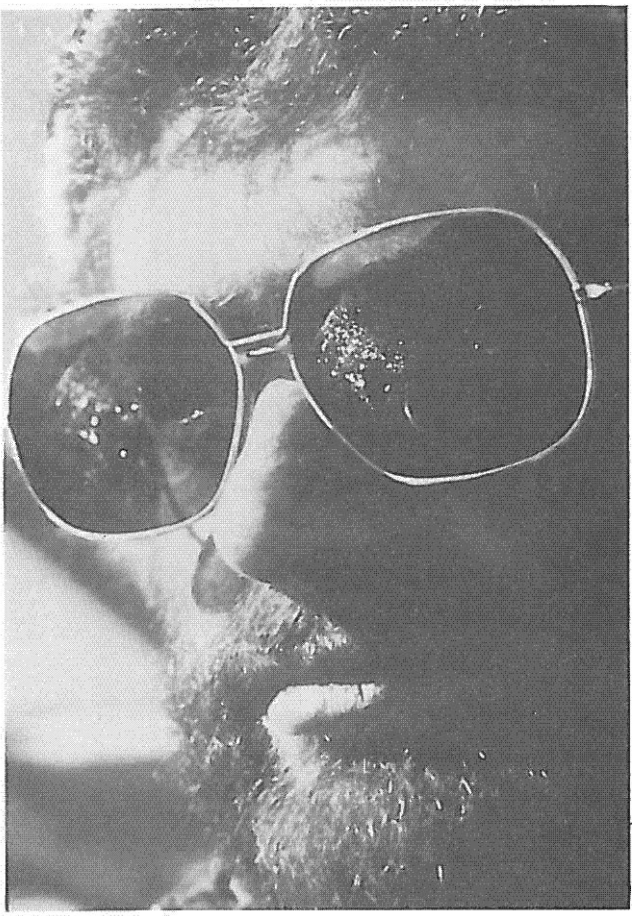
FLAG	HEIGHT	LINE SECTOR	DURATION OF READING	MAX WIND.	AVERAGE WIND	MIN WIND	DIRECTION WIND	TEMP °C	COMMENTS
NW3	-150m	NW (305°)	3mm	6	5	<5	S	3°	0300 hrs Hill falls too sharply to get readings at 200m. Too many crevasses to proceed exactly NW
NW2	-100m	NW (305)	5mm	6	5	<5	NW/W	2°	0335 hrs Difficult to keep to sector line due to many large crevasses. Wind direction very erratic
NW1	-50m	NW (325)	5mm	<5	<5	<5	SWNW	2°	0405 hrs Hampered by crevasses. The concept of starting at the bottom and going upjoint accurate. Difficult to estimate
SE1	-50m	SE	3mm	8	6½	5	W	2°	0156
SE2	-100m	SE	3mm	8	5½	<5	W	4°	800 Gusting often.
SE3	-150m	SE	3mm	8	5½	<5	WNW	4°	0810 Very steep here! - lots of love, Paul.
SE4	-260m	SE	3mm	9	8	6	W	4.5°	0820 It's raining (brief)
NE4	-175m	NE'	3mm	5.5	5	<6	WSW/WNW	3.5°	0837
NE3	-150m	NE'	3mm	5	<5	<5	WSW/WNW	4°	0850
NE2	-100m	NE'	3mm	<5	<5	<5	?	3.5°	0900



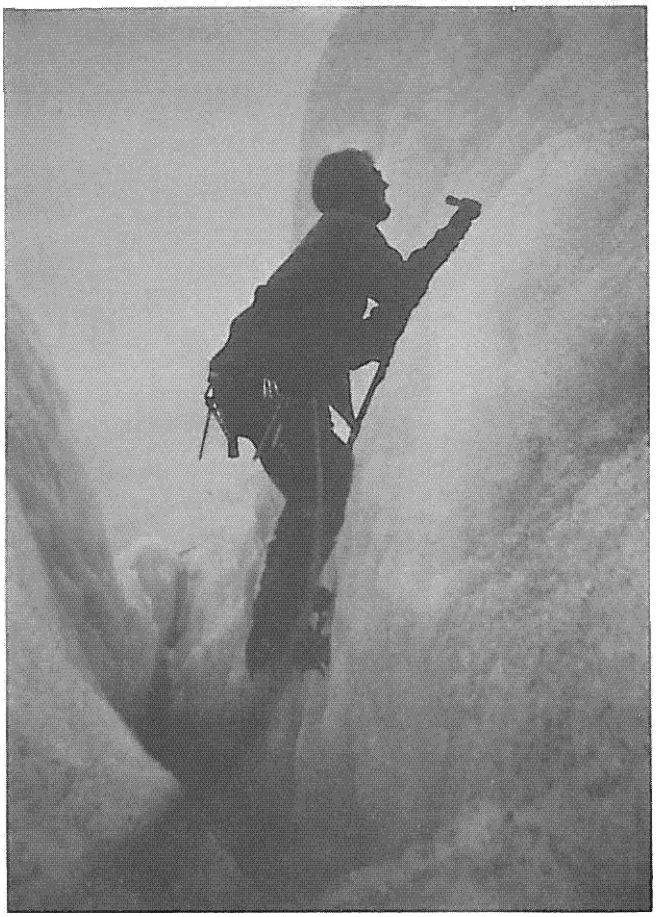
Graham investigates a crevasse during crevasse rescue practise



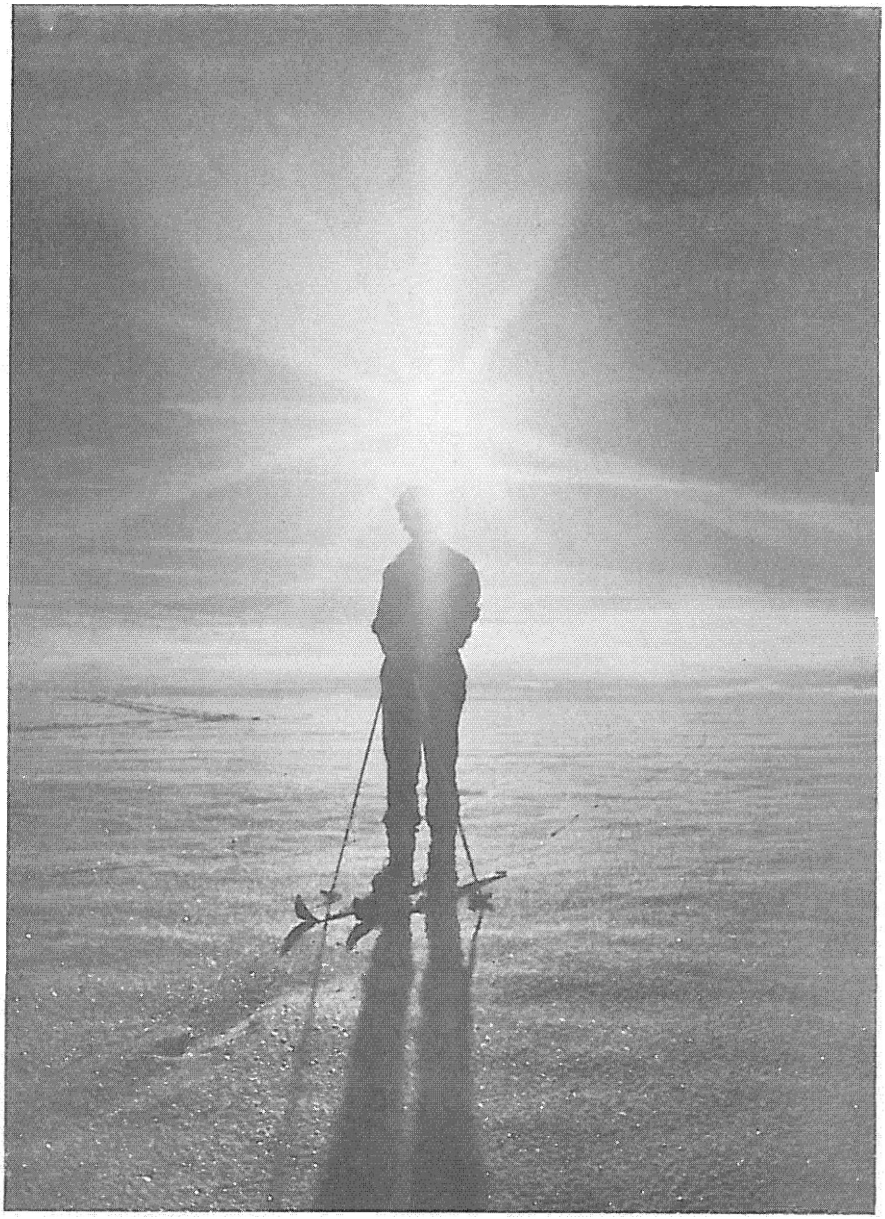
Basecamp at Brucebyen Huts



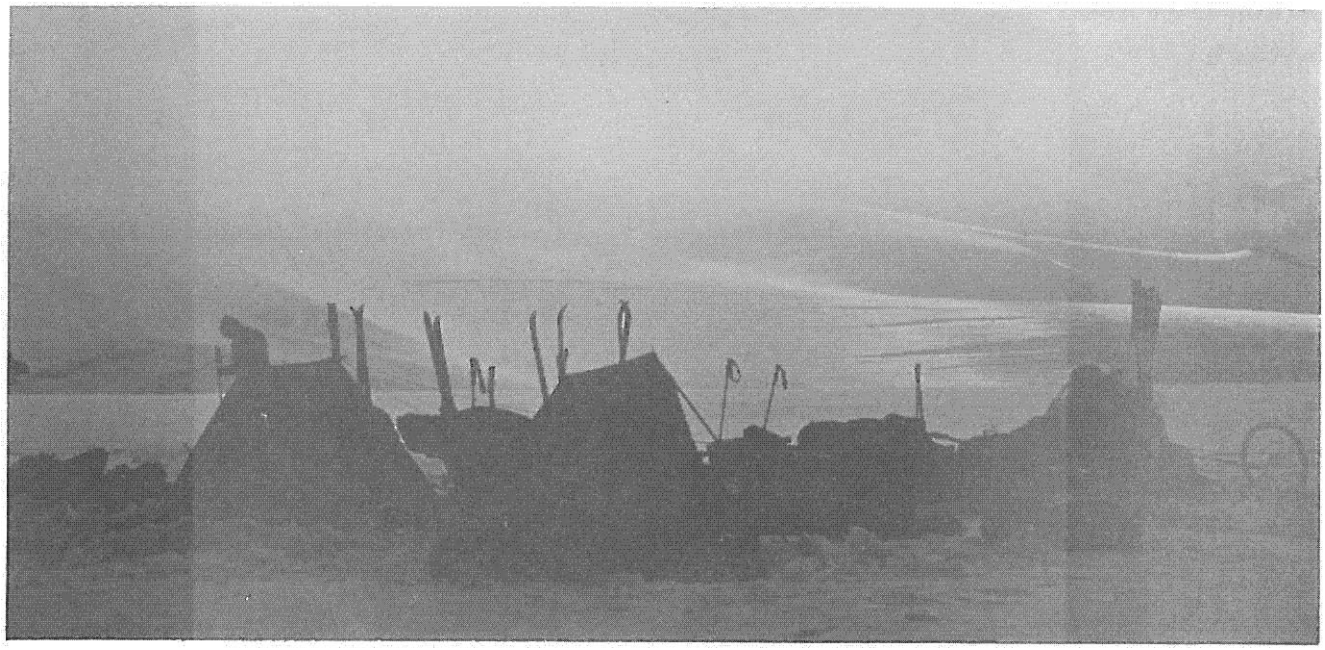
Graham Bunn - Equipment Officer



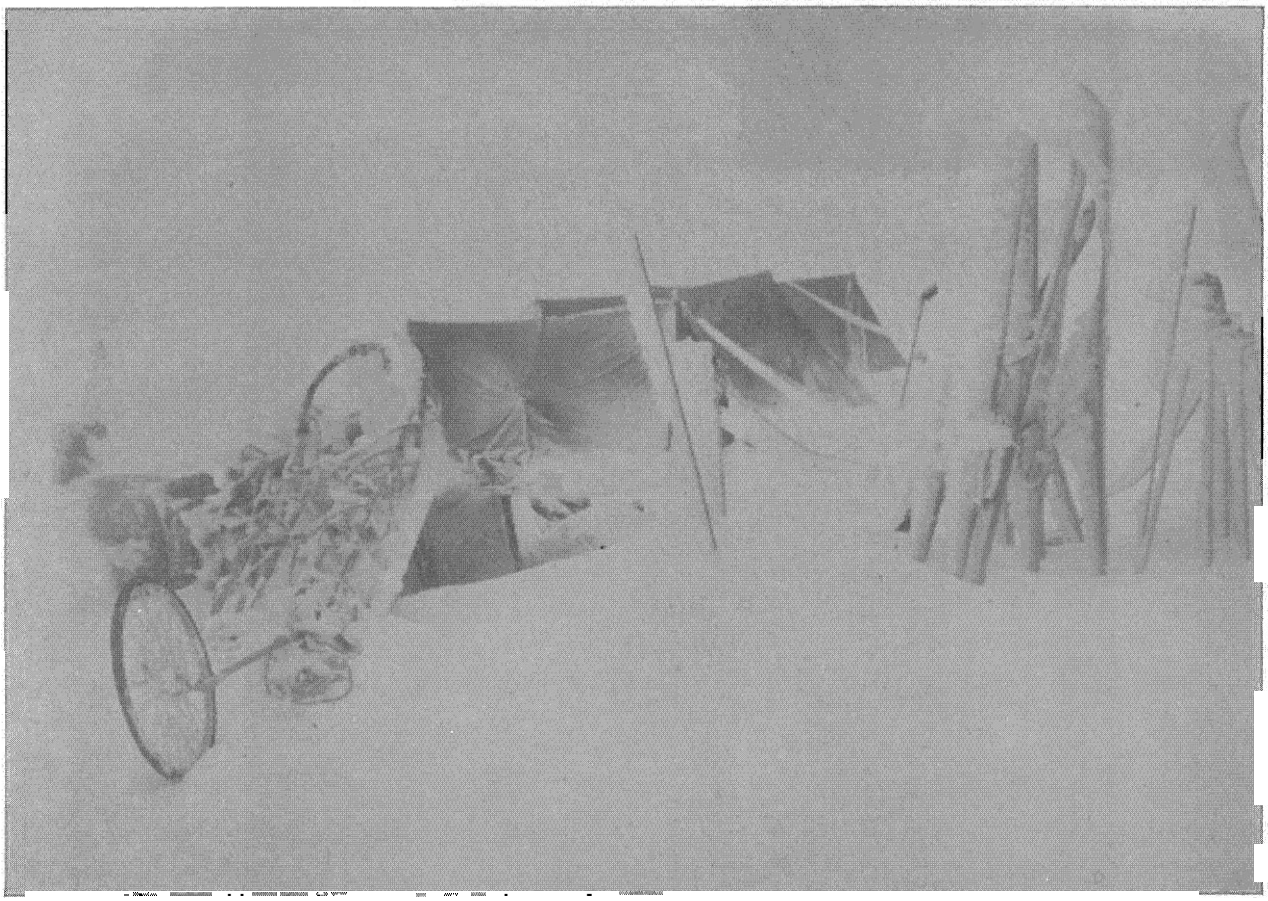
Bruce negotiates a crevasse



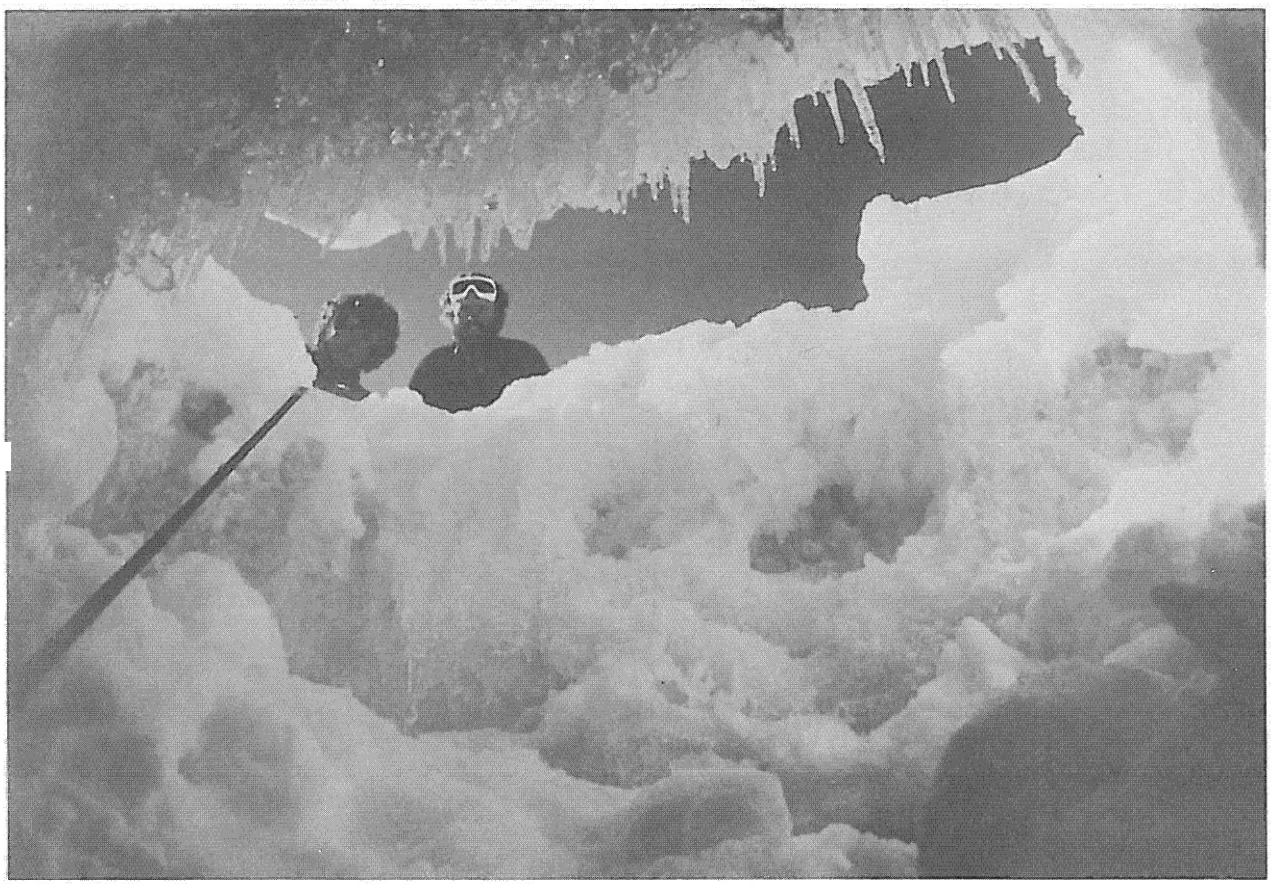
Our first view of the ice cap - Andrew Wilson



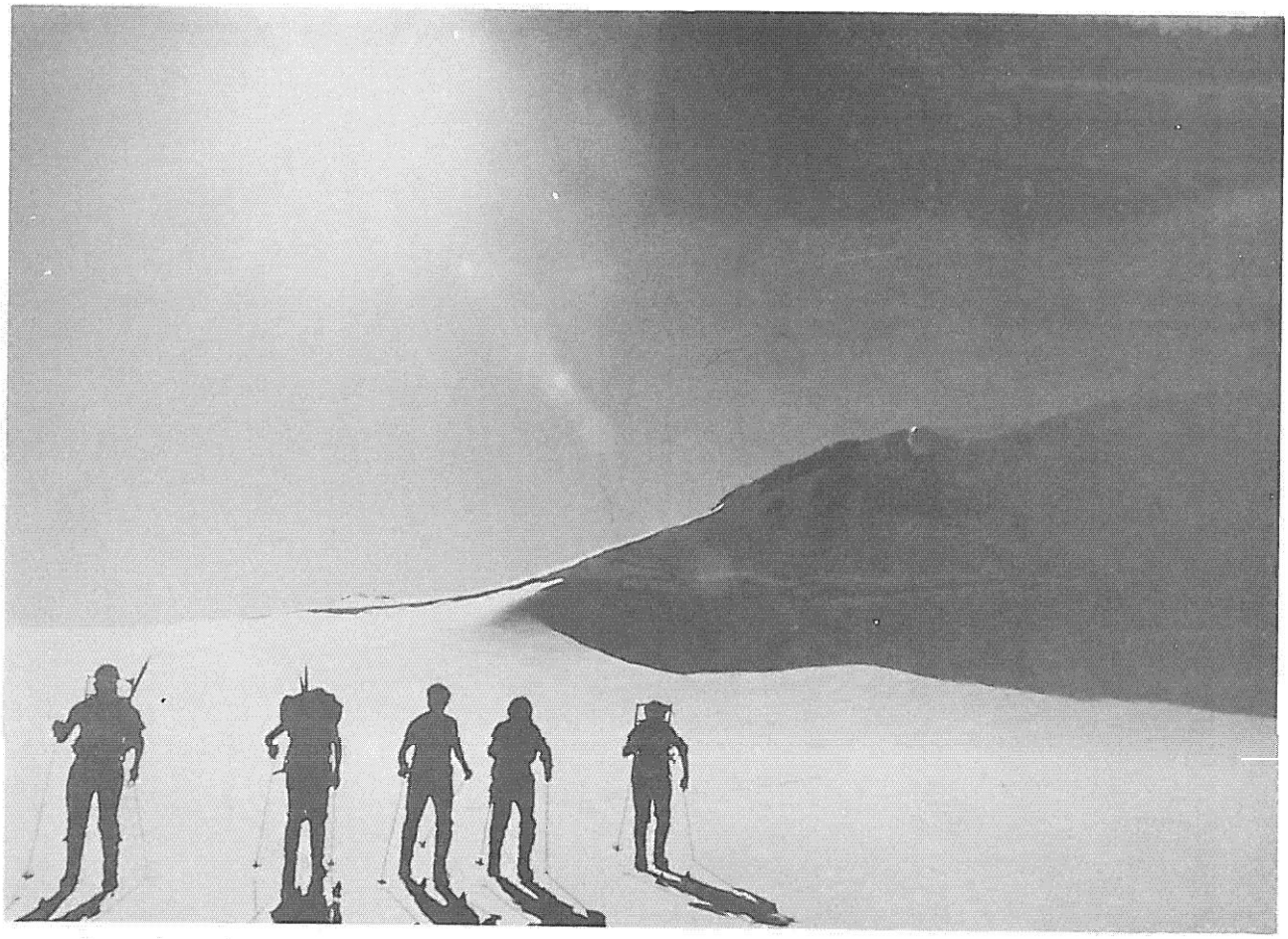
Camp 5 - pitched on top of an ice cliff in the mist



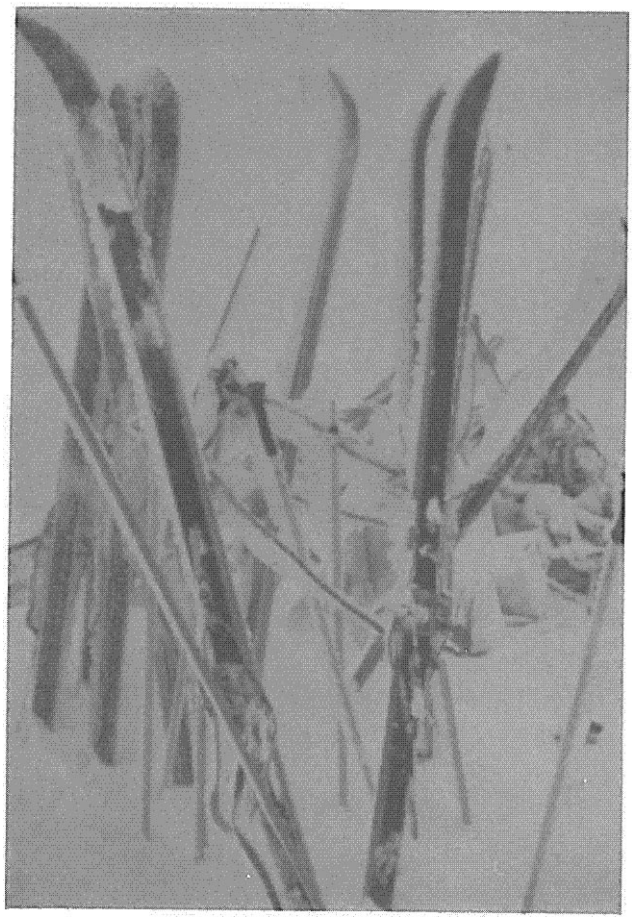
Trapped in a blizzard at Camp 6



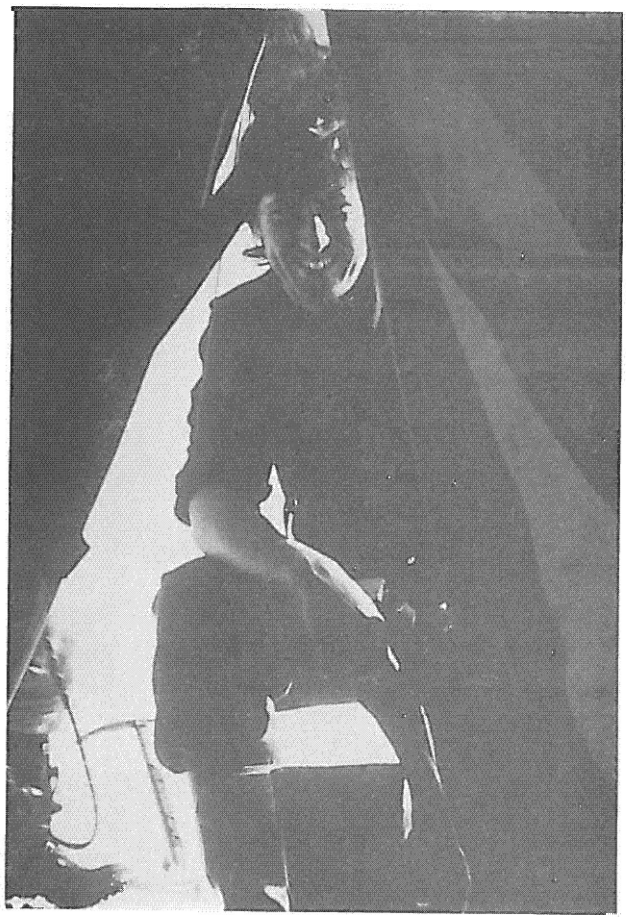
Investigating a crevasse



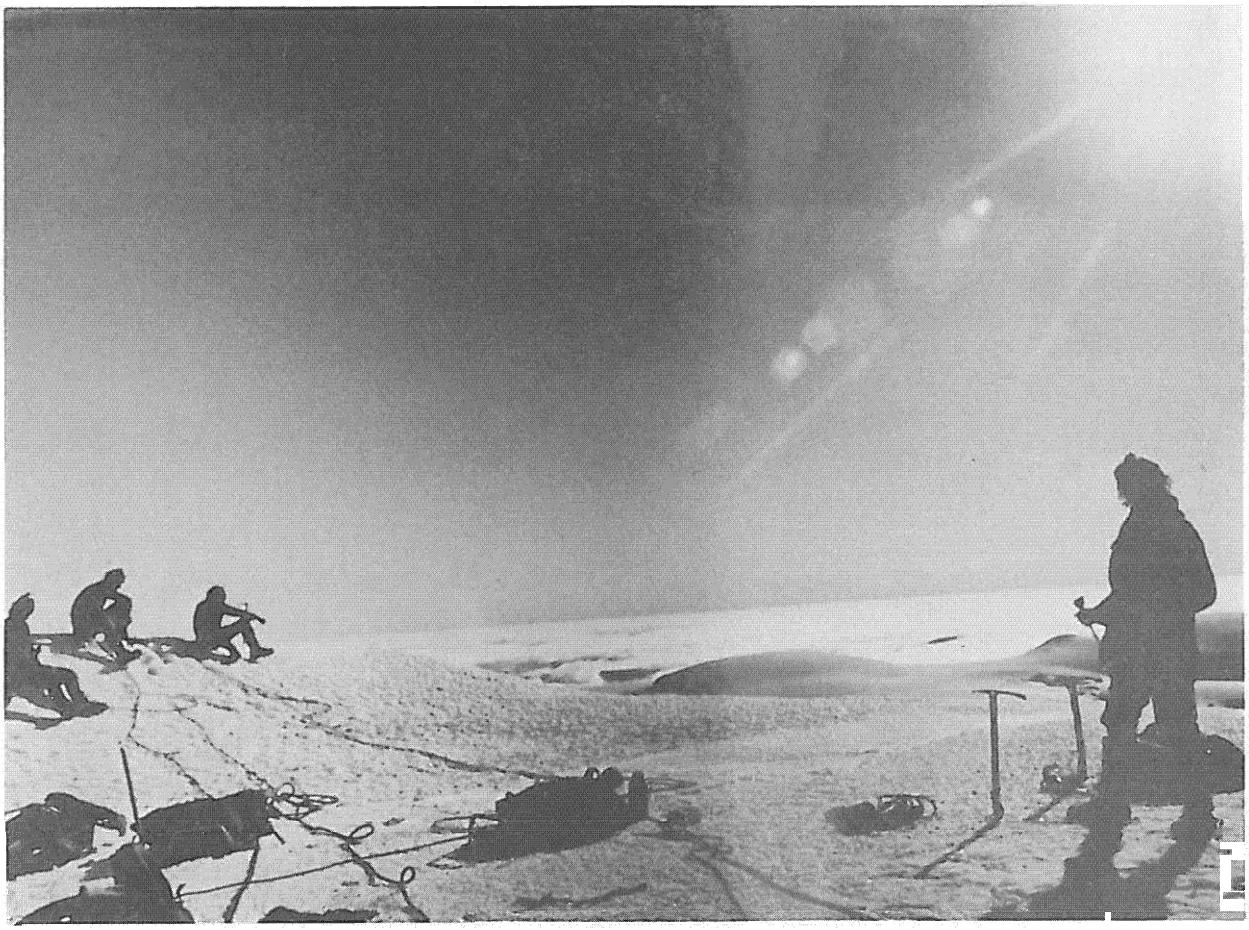
A perfect day - our first recce journey to Astro



Ski-Scape - Camp 6



Paul Strickland - Medical Officer



The summit of Newtontoppen

The return journey - hauling in a near white-out