

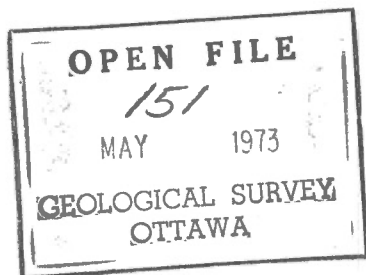
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Tips on Organizing Arctic Geological Field Work

by

J. Wm. Kerr



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TIPS ON ORGANIZING ARCTIC GEOLOGICAL FIELD WORK

by

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ABSTRACT

The Geological Survey of Canada has developed efficient methods of conducting field work in the Canadian Arctic Islands, and this report summarizes those methods. It deals with important and potentially dangerous or costly problems, as well as the routine matters of camp life.

INTRODUCTION

In my years of field work in the Arctic Islands, I have evolved a mode of operation that works very well for me. This summary of my system is made available in the hope that it might be of help to others. It does not include all aspects of an operation but only those that are potential problems. Since I may revise this, I would appreciate suggestions and criticism - please jot them down as they occur to you in the field.

Conditions described in this report apply to those parts of the Canadian Arctic Islands lying north of about 70° N latitude. Geological work in this area inevitably uses Resolute as a main base of operations, for that settlement is the only substantial supply and distribution centre in the region.

The work of my field party in the Arctic Islands usually consists of making a geological map and stratigraphic study of a particular area, and spending the entire season within that area. The next season we may move to the adjacent area, or move to a new region. The optimum number of geological workers for such a study is five, which includes myself, two senior assistants, and two junior assistants. This provides two sub parties, which mainly work from flycamps remaining in them for about 6 days and then returning to base camp for one day. I fly out of base camp each day with the helicopter and usually visit or move the flycamps on alternate days. While they are being moved, I am left somewhere to traverse, and later carry on alone with the aircraft for the rest of the day. All told my optimum sized permanent camp consists of nine people; in addition to the five geological personnel there are a helicopter pilot, a flight engineer, a cook, and a camp manager. A Bell 47 G4A helicopter on term charter, is just adequate to support a group of this size on a mapping project.

The two and one-half month period from June 15 to September 1 is the upper limit for doing useful surface geology in the Arctic Islands. Winter usually comes quite suddenly in early September, and prolonging the season then is rather fruitless - snow obscures the geology; the days are short and many are unworkable; and morale deteriorates. If a season must be stretched beyond the two and one-half months, it is best to arrive earlier than June 15. At that time there may still be a substantial amount of snow, but valuable reconnaissance work can be done and checked later in mid-summer.

## PLANNING

### Helicopter

Good helicopter support is crucial to the safety and success of any operation. A Bell 47 G4A is best for a small party. Some of the reasons are: (a) It has adequate power to carry 2 men and a light flycamp, (b) it has a good safety record, (c) it has been around for years, and the bugs have pretty well all been taken out of it, (d) it will burn either 80/87 or 100/130 fuel, (e) in the case of an engine failure during flight, the controls continue to be power assisted and safe landing is easier. The Bell 47G 3B1 is a similar aircraft with certain advantages, such as being able to operate at much higher elevations. This feature is quite unnecessary in the Arctic Islands. In the case of an engine failure during flight, the controls of the 3B1 lose their power assistance, unless the aircraft has been specially equipped with a 900 Series E transmission, and they are not so equipped unless specially modified. The 3B2 is similar to the 3B1, but has the advantage of having the new 900 Series E transmission.

If a helicopter will be flying over water, floats are essential for safety reasons. Skids are safer in forced landings because one can ski a little on them, whereas skiing even slightly on floats turns the helicopter over. Skids might be used in spring until the ice has broken up and then a switch can be made to floats. For working in the area of Lower Paleozoic rocks where prickly weathering surfaces commonly are developed, floats should be reinforced with an extra thickness of rubber on the base to resist punctures.

It is a very good idea to get to know both members of the air crew before going to the field. More often than not, they have been told little or nothing about your operation. At best they may come without warm clothing; at worst they may fail to bring spare parts. A standard letter inviting helicopter bids is available and can be adapted to any GSC contract. It specifies an experienced crew and a machine that has recently been overhauled. It is my intention in future years to specify a list of spare parts that should accompany the aircraft. For a Bell 47 G4A the list is as follows:

Contract field spares for 47 G4A model helicopter

1. one starter, all models
2. one generator, all models
3. one turbo charger, B1 or B2 only
4. one auxiliary fuel pump, B1 or B2 only
5. one spare battery
6. one engine tachgenerator
7. one set of points & condensers
8. one set of Tail Rotor control cables
9. one set of elevator cables
10. one servo overhaul kit
11. six Rocker cover gaskets
12. six intake pipe gaskets
13. one carburetor + U joints
14. one Rocker Box drain hose
15. 12 spark plugs
16. two 47-140-252-1 bearings
17. one damper, A13965
18. four 47-140-240-1 bearings
19. four KP4 bearings
20. two KP6A bearings
21. one 51 x 215 seal
22. one 51 x 233 seal
23. two AN5H-14A bolts
24. one set of belts (fan)
25. sprag & spares, bolts, etc.
26. two carb air filters
27. two 47-645-239-1 bearings
28. three 47-644-220-1 covers
29. four 47-140-252-3 bearings

30. one cargo net
31. one barrel sling
32. one Lanyard of 6 ft. nylon
33. one paddle
34. one set of O rings
35. reinforced heavy duty floats
36. interchangeable skids
37. 8 bungee cords with multiple strands

Many parties have been grounded for the want of a tiny \$10 part that could have been sent along with the spares. If you go to the trouble of getting a machine in good condition and with adequate spares, the pilot and engineer will be most grateful, because their objectives are the same as yours - a trouble free contract. They must fly in the machine themselves and get very reduced pay when it is grounded. It is worth noting that the company usually loses nothing, or may even make a little extra if the machine is grounded during a contract.

### Radios

There has been a remarkable improvement in field radios in the last few years, and this has greatly improved the efficiency and safety of Arctic field work. A CH25-SSB receiver transmitter radio is good for base camp. It has six channels, operates on one 12 volt battery, and consistently reaches out 200 or 300 miles.

The frequencies that are recommended for base camp are:

1. 4472.5 Dept. E.M.R.
2. 4982 Dept. E.M.R.
3. 5281.5 Oil Patch
4. 4520 Department of Transport
5. 5680 Department of Transport
6. other

The first two frequencies are for the exclusive use of the Department of E.M.R., but are used also by aircraft the department has on charter. The Oil Patch frequency has been assigned to the

Canadian Petroleum Association, and is used also by Atlas Aviation and Bradley Air Services when they are flying for oil companies. If this frequency is to be obtained for emergency use, a letter of permission should first be obtained from the C.P.A. The first DOT frequency is for ground to ground contact and is useful for sending telegrams to the south. The second DOT frequency is the air to ground frequency in the north, and should be used only in emergency. A sixth crystal could be installed for contact with one of the companies working in the region and for this their approval should be obtained. The SBX-11-SSB is a very small yet powerful radio that is ideal for fly camps. It has 4 channels and should use the two departmental frequencies, the DOT ground to ground frequency, and perhaps one used by a neighboring party.

Radios are important items and often are in short supply, so it is a good idea to request them very early. If one wishes to use a frequency that has been assigned to a private company, prior written approval must be obtained from that company.

Bright flagging should be tied to radio aerials in base camp and flycamps so that they are visible to pilots.

On all occasions that I have chartered a small helicopter and had it equipped with radios, the radio has been useless, yet the equipment weighed 50 or 60 lbs., and decreased the payload accordingly. It could contact the base camp radio only when the helicopter was sitting on the ground in camp. A perfectly adequate though unorthodox solution is to specify that the helicopter come without a radio, and to substitute for it an SBX-11-SSB portable, which complete with aerial, weighs only 8 lbs.



The reasoning in this matter is mainly as follows. The main argument for having a radio in a helicopter is so that camp can be contacted in case of trouble. If you are in trouble during flight, the pilot will be completely occupied with bringing the aircraft down safely, and is not about to use the radio at this time. If you are not in trouble during flight you don't really need the radio. If the helicopter should happen to be involved in a forced landing or crash, a portable radio that is being carried along is more likely to remain operable than a radio that has been installed in the aircraft.

It is wise to mark on a map in camp a generalized route or an area of study for the day. If it is necessary to deviate from this route during the course of the day, the camp manager can be informed of this by landing and quickly setting up the portable radio in the field. If it is not possible to get the message through to camp, then one should stick to the original plan - otherwise, it would have been better to have left no route map at all.

### Fuel

In former years it was necessary to send drummed fuel to Resolute from Montreal by sea lift in the fall preceding a field season. This is no longer necessary, for bulk drummed fuel is available for purchase in Resolute, but it still is necessary to reserve fuel well ahead of time. It might also be advantageous to take delivery of fuel needs upon arrival in the spring, for the supplier may neglect to keep your quota and run out in late July.

In 1972, the fuel purchased in Resolute had less dirt and water than the fuel that had been shipped up from Montreal. Propane was not available for purchase in Resolute in 1972, but heating oil and iosol (naphtha) were.

### Food

Heavy non-perishable staple foods should be sent north from Montreal by sea lift the year before the field operation to save on airfreight costs. During the field season, the cook can then order fresh and additional food to be shipped by air from a food store in Yellowknife as it is needed. Despite this attempt to strike a balance, the cook each year says that the meals suffer because the wrong things were sent on the sea lift; however, this must be accepted as inevitable. The cook should be given the list of staples that are already in Resolute before he goes north, so he can arrange for pick up of the first supplementary grocery order in Yellowknife on the way through. Thereafter, he should have another order sent up every two weeks. A cook takes pride in his work and will do a much better job if he can do his own grocery ordering.

An advance order for a 12 man crew for 2 1/2 months that was prepared by an excellent cook is repeated below.

For Advance Order - 12 man crew 2 1/2 months

|  |             |          |                            |         |
|--|-------------|----------|----------------------------|---------|
| A.P. Flour                                       | 15 x 10 lb. | 150 lb.  | Mazola Oil                 | 1 c.    |
| White Sugar                                      | 15 x 10 lb. | 150 lb.  | Kraft Dinners              | 3 cs.   |
| White Sugar Cubes                                | 10 x 2 lb.  | 20 lb.   | Coffee Canned              | 3 cs.   |
| Pancake Mix                                      |             | 3 cs.    | Tea Bulk & Bags            | 15 lb.  |
| Salt   | 10 x 2 lb.  | 20 lb.   | Instant Choc. Drinks       | 10 lb.  |
| Salt   | 4 oz.       | 5 lb.    | Paper Towels - Scottowels  | 3 cs.   |
| Tang Assorted                                    |             | 2 cs.    | Toilet Tissue              | 1/2 cs. |
| Fr. Dried Pork Chops                             |             | 3 cs.    | Serviettes                 | 6 pkgs. |
| Fr. Dried Beef Steak                             |             | 1 c.     | Tide Soap                  | 1 c.    |
| Converted Rice                                   |             | 2 cs.    | Bleach (1 gal. containers) | 5 gal.  |
| Cake Mixes Assorted                              |             | 3 cs.    | Liquid Soap                | 1 c.    |
| Choc. Bars Assorted                              |             | 360 bars | Foil Wrap                  | 2 cs.   |
| Canned Vegg. Small Cans Asparagus Tips           |             | 3 cs.    | Waxed Paper                | 1 c.    |
| Kernel Corn 1 c., Mixed Veg. 1 c., Peas 1 c.,    |             |          | Saran Wrap                 | 1 c.    |
| Diced Carrots 2 cs., Beets 1 c., Spinach 1c.     |             |          | 10 lb. Paper Bags          | 200     |
| Canned Fruits Small Cans Peaches 2 cs.,          |             |          | Safety Matches Wooden      | 1 c.    |
| Pears 1 c., Pineapple 1 c., Fruit Cocktail 1 c., |             |          | Pork & Beans               | 2 cs.   |
| Strawberries 2 cs., Raspberries 1 c., Apple Pie  |             |          | Canned Weiners             | 1 c.    |
| Fill 2 cs., Raisin Fill 1 c., Lemon 1 c.,        |             |          | Canned Steak & Onions      | 1 c.    |
| Mincemeat 1 c., Cherry 1 c.                      |             |          | Kool-Aid                   | 1 c.    |
| Canned Butter                                    |             | 75 lb.   | Planters Mixed Nuts        | 10 cs.  |
| Crisco   |             | 2 cs.    | Shrimp Large               | 3 cs.   |
| Crab   |             | 2 cs.    | Lobster                    | 2 cs.   |
| Sardines Asst'd                                  |             | 3 cs.    | Salmon (4 1/2 oz.)         | 1 c.    |
| Tulip Bacon (canned)                             |             | 3 cs.    | Canned Pear Hams           | 3 cs.   |
| Prem   |             | 1 c.     | Maple Syrup small cans     | 3 cs.   |

BASE CAMP

Location

It is wise to establish base camp at the head of a long fiord or bay that extends into the middle of the study area. The advantages of this are that: (a) at sea level it is not so likely to be fogged in, (b) one can find the way home in fog or snow by following the coast, (c) marine fog banks often do not roll in as far as the heads of the fiords, and (d) all parts of the area are equally accessible. It is not wise to camp on a flat plain high in the interior of an island, where pilots of fixed-wing aircraft may suggest because they like the landing. Such a place will tend to be socked in by fog, water supply may be a problem, and it will be hard to find the way home in marginal weather.

If a campsite is to be used in excess of 300 man-days a permit must be obtained from the Regional Manager, Water, Forests and Land Division, Department of Indian Affairs and Northern Development, Yellowknife. When choosing a base camp that will be occupied for a long time, it is wise to search for a bit, and to have an experienced Otter pilot like Dick deBlicquy, John Cesnik, or Lee Kristjansson, help to pick it out. They are conscious of wind, weather, landing, and other conditions. An excellent campsite (Fig. 1) at the head of Barrow Harbour on Grinnell Peninsula that was occupied in 1972 was chosen with the help of John Cesnik. During the course of the summer the extra cost and effort in searching for this site paid off amply in economy, convenience, and safety. Most of the tips on building and maintaining a base camp are included in the job instructions of the camp manager.

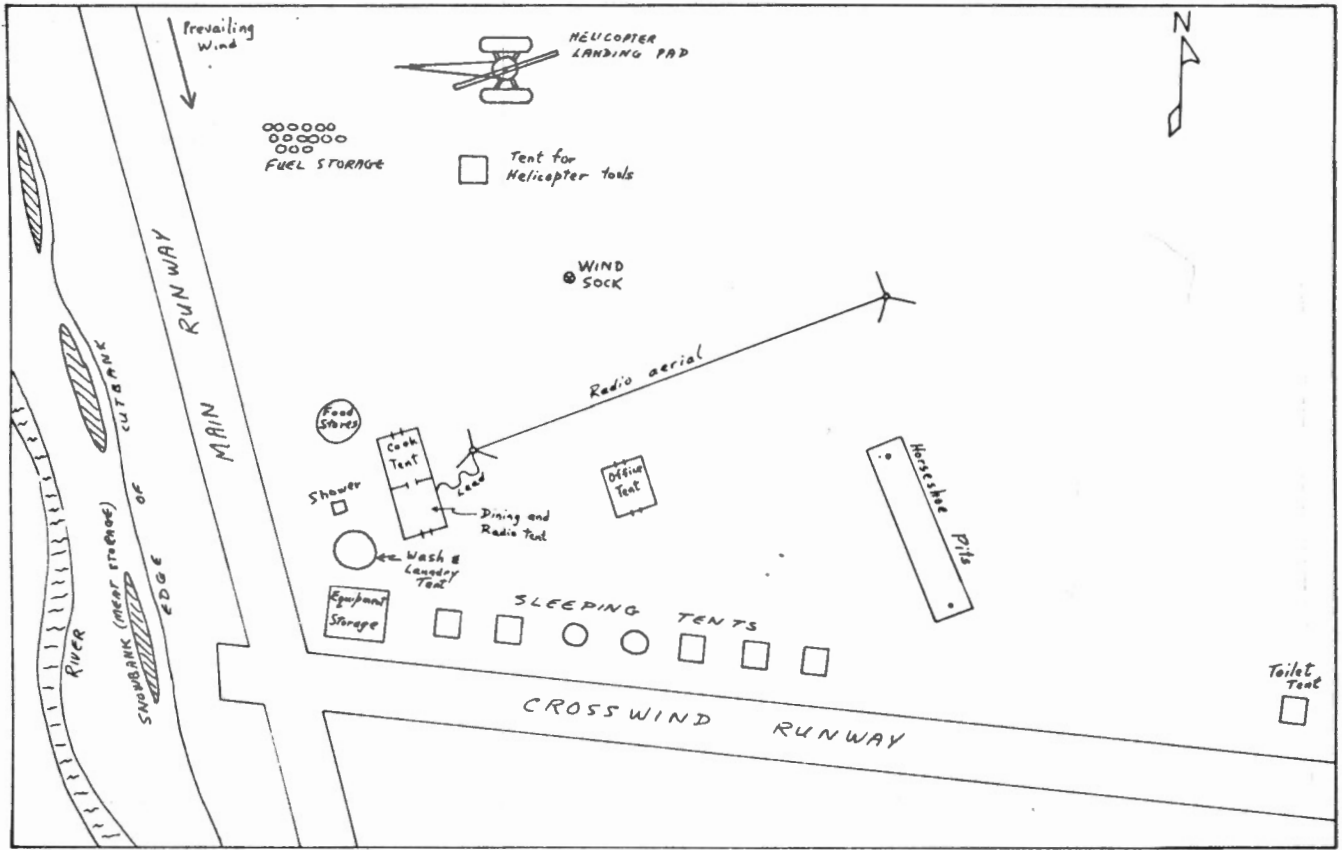


Figure 1. Plan of the Geological Survey of Canada base camp, situated at the head of Barrow Harbour, Grinnell Peninsula, Summer, 1972.

Choosing and designing base camp is always pleasant and interesting. It is the opportunity that town planners always want and are never given - building a settlement from scratch in the middle of nowhere. Figure 1 is a base camp that was carefully planned, and some of its features should be pointed out. It is close to running water. Equipment and fuel storage are right near the runway. The helicopter pad is well away from the other tents and upwind so that small items around camp will not be blown toward

the helicopter. The cook tent and laundry tent which require water are as near to the stream as possible. There are long lasting snow-banks nearby for the storage of meat. The focal point of the camp is the cook tent area, and this is central.

### Equipment

The cook tent area consists of two 12 x 14 foot tents on Jutland frames, placed end to end and with a passageway between them. The tents should be ordered to take the convenient aluminum doors that are available for the outer ends. One is the cook tent and the other the combined dining tent and radio shack.

A four burner propane range with oven is recommended for base camp. The cook tent should have a floor which can be built from 4 by 8 ft. plywood sheets one-half inch thick, for without a floor that tent is impossible to keep clean. The staple food should be sent in sturdy wooden boxes, and the boxes can then be used to build shelves. A few 2 x 4's and nails are also handy. Stainless steel milk cans make good water storage containers. Serving cafeteria style with the men filing out to the stove to take their food and then back to the other tent to eat works very well.

A large square table can be erected in the dining tent from two folding aluminum tables; for stability the legs of the two tables should be wired together. This leaves plenty of room in one corner for the radio setup, and in another for a heater. If a space blanket is taped to the tent wall and roof behind it, the heater will throw a great deal more heat. A dirt floor is acceptable in the dining tent and probably preferable. Tent flys are a good idea to take

along, but are not really necessary on good Jutland tents that have been waterproofed. Tents can be mended with a sewing awl or with a glue called Easisew. A part time door can be rigged up between the two tents with an old piece of canvas rolled onto a rod in the manner of a window blind. In the evenings when the crew is sitting around the dining table, the door can be lowered to seal off the cook tent and keep the dining tent warmer.

A metal framed igloo tent of 11 feet diameter makes a handy wash up and laundry tent. Laundry becomes an easier operation if a metal plunger is used along with the normal washtub and washboard. A simple shower can be constructed by building a frame of 2 by 4's and wrapping canvas around it for walls. A 10 gallon gasoline drum which has had the bottom removed and a shower head attached to the top is inverted and placed atop the frame to hold the water. The shower head is made by having a regular shower head welded to a short length of pipe that is screwed into the smaller bung hole of the drum. The small bung hole incidentally takes a 3/4 inch pipe with fourteen threads to the inch. The only special item that need be taken to the field for a shower is the modified shower head - the Calgary equipment depot made one for me.

A convenient office tent can be set up in another 12 x 14 Jutland with 5 foot walls. Half inch sheets of 4 by 8 ft. plywood sawed down the middle lengthwise can be nailed to up ended food boxes and make great desks. Two sheets are enough to make desks the full length of both long walls. Rocks piled in the bottoms of the opened food boxes make the whole thing stable. A canvas floor designed for the Jutland is recommended for this tent.

Pneumatic igloo tents are nice for sleeping tents because they are dark and keep out the midnight sun. They resist the weather very well if they are in good condition, but collapse in the wind if the pneumatic poles leak. The secret to keeping them really tight is to pump them up very hard and in addition use valve caps. One should never trust taking only an igloo tent to a flycamp; the Logan is best for that purpose because little can go wrong with it. For sleeping tents in base camp, an assortment of pneumatic igloo tents and Logans is best. Magnesium alloy tent pegs are adequate for Logan tents and pneumatic igloo tents. The larger Jutland tents should be anchored to either wooden food boxes or to strong potato sacks that have been filled with gravel. The scars that usually show up most prominently in an abandoned base camp are the small ridges of gravel that are used to hold down the tent skirts. A rake is handy for smoothing these out - one can be made easily with a tent pole as a handle, a wooden slab as a crossbar, and nails for tines.

#### PERSONAL EQUIPMENT

A list should be provided to all personnel to ensure that they are well equipped. Below is the list prepared for geological personnel; it may be altered somewhat for the cook and camp manager. In some cases the number used in the 1972 Field Equipment List has been included.

Geological personnel will be supplied with the following:

Boots - one pair of insulated rubber boots (8430-6831). These are black rubber insulated boots designed for Arctic conditions. I swear by them and wear them every day. Some swear at them because they



are heavy and clumsy. On traverses, you will go through water every day and your feet will be soaked unless you wear boots that are totally waterproof.

Parkas - one quilted parka for cold weather (8405-7823); one orange canvas pullover type anorak for cool days (8405-6646); one waterproof light weight yellow protective anorak (8405-6624).

Mitts - one pair leather outer, one pair wool inners.

Trousers - one pair of insulated trousers (8405-6588; made by Ambridge - Thompson).

Sleeping bag - one Black's Icelandic outer, one Black's Icelandic inner.

Camp cot and foam pad - one of each.

Snow goggles - one pair.

Downfilled vest - one (8415-7485).

Hard hat - one supplied, we recommend using it (8415-6728).

Geological personnel should bring the following:

Boots - one pair of 12 inch rubber insulated boots as a supplement. Logans (rubber bottom, leather top) and all leather boots are useless except for lounging around camp. Boots are an important item insofar as both safety and comfort are concerned, and widely different practices are followed. Be sure you are set up well with footwear.

Trousers - Two or more pairs of heavy duck trousers; blue jeans are not usually very satisfactory because they get wet easily.

Shirts - Two or three work shirts; I find flannel the best.

Underwear - Two pairs of winter underwear. Thermal and thermopyle brands are very good. The two piece style allows you to adapt best to various conditions. Buy this the previous winter, for in June it will not be available in the stores. Some wear long johns all summer, others only shorts. Bring both.

Sweaters - one heavy wool.

Jacket - a quilted down ski jacket should be brought along for camp use and possibly traverse use. Very bright colours are advisable. The anoraks you are supplied with are pullovers and some dislike that feature.

Socks - six or eight pairs of heavy wool socks. If you bring plenty you will need to do laundry less often.

Gloves - two pairs of heavy work gloves. I find the type with leather front and canvas back to be very good.

Towels - one or two, preferably heavy bath type.

Headgear - bring something that keeps your ears warm.

Hunting knife or Pocket knife - bring one.

Extra boot laces

Waterproof match box

Toilet kit - tooth brush, razor, shaving cream, shampoo, etc. Bring a supply for the season (soap is supplied).

Insoles - if desired - order them large and cut them down.

Belt - an extra heavy belt is handy for attaching notebook case and brunton.

Sun glasses - one pair.

Miscellaneous - optional

Reading material - nothing is available for purchase in Resolute; however, everyone in camp brings books and lending goes on. Don't bring your whole library.

Writing material - bring stationery, envelopes and stamps.

Smoking accessories

Playing cards, etc.

Fishing tackle - they go for spinners but the opportunities for fishing are rare.

Camera and film

Glasses - if you use them bring an extra pair.

All equipment used in camping, cooking, geological work or first aid is supplied.

You should have a dental checkup before coming and have any imminent work done. Resolute gets mail service twice a week. We get mail at irregular times, and it may be anywhere up to two weeks between our pickups. The address you should give for the summer is:

c/o Dr. J. W. Kerr,  
Geological Survey of Canada,  
Resolute, N.W.T.

BE AT THE CALGARY AIRPORT AT LEAST 40 MINUTES BEFORE FLIGHT TIME TO CHECK IN, AS THE REGULAR AIR BUS IS USED AS FAR AS EDMONTON. THESE FLIGHTS ARE ALWAYS FULL AT THE TIME OF OUR DEPARTURE AND SEATS CANNOT BE RESERVED. CHECK IN AS WELL AT THE PWA DESK IN EDMONTON IMMEDIATELY UPON ARRIVAL THERE TO GET YOUR BOARDING PASS FOR THE RESOLUTE FLIGHT.

#### JOB INSTRUCTIONS

The party chief could easily spend his whole time organizing, training, and shepherding the crew, or worse, doing many things himself because it is quicker than explaining the procedure. To reduce this problem, a list of job instructions should be given to the field crew and the party chief should insist that they read them. This saves an immense amount of work and trouble, and allows the party chief to concentrate more fully on the geology.

#### Camp Cook

This is a most important position for maintaining camp morale. The whole camp is grateful when the cook uses imagination and care in his work. Food orders should be prepared by the cook and sent out by the camp manager once every two weeks, having been shown to the

party chief before they are sent. Arrival of the order in Resolute should be scheduled so that it soon gets onto an Otter flight coming to camp. The cook should check that everything on the invoice has been received.

Meals should be prepared for those who are in base camp. The camp manager will know how many are expected for each meal. The cook will prepare food orders to be sent to flycamps. The camp manager will help in preparation, for he knows what the flycamps have ordered by radio or note. It is the responsibility of the camp manager to see that the orders go out to flycamps on the right flights.

The cook should wake the camp in the morning and turn the heat on under some washing water. After breakfast he should set out material for lunches; those going on traverses can put together their own lunches from this. Thermos bottles of tea or coffee should be made for those going on traverses.

Washing dishes is a job of the cook. The camp manager or geological assistants who are in camp will help whenever possible. The cook should tell the camp manager when his propane bottles have run out and the camp manager will replace them.

#### Camp Manager

This job includes many diverse duties that result in keeping the camp running efficiently, and the person holding it should have initiative.

1. RADIO. Radio schedules should be set up and maintained with Resolute, with our flycamps, and with other camps that may be appropriate. When a fixed wing aircraft is attached to our camp

the radio should be monitored at all times that he is away until his flight plan is closed. If it is necessary at these times to leave the radio tent, he should ensure that someone else, the engineer, the cook, or an assistant, is monitoring the radio. The 12 Volt storage batteries for the base radio should be kept well charged and the generator maintained properly. In the event that the generator is not operational, it is possible to have the engineer charge the storage batteries from the helicopter. Two batteries must be charged at a time, for the helicopter has a 24 Volt system and one alone will be blown out. For this operation 3 jumper cables are required. Proper radio procedure should be learned by studying the manual and by asking questions of experienced people around camp. Be brief but clear on the radio. It is very important that you take and send telegrams and radio messages accurately. There should be no superfluous traffic on the radio, and definitely no kidding, profanity, or joking. Learn weather estimating and reporting from pilots, and be prepared to give a weather report when one is requested.

2. EXPEDITING. The camp manager should know the location of each flycamp and when it wants to be moved. He should learn where the geologists are going each day and discuss emergency procedures with them. A location map posted near the radio shows the positions of flycamps, rock caches, and fuel caches; it should be updated continually. The flycamps will request orders of food and equipment either by radio or by note. It is your responsibility

to see that both the food and the equipment that have been ordered are on the aircraft the next time it visits a flycamp. The cook will prepare the food order and the camp manager will prepare the equipment. Be sure also that the mail for any flycamp goes out to it as well on the first flight going there.

If men are leaving base camp for a new flycamp, it is of course their own responsibility to see that they take along what they need, but you should help them find things. The camp manager should see that there is an adequate supply of iosol (naphtha), fuel oil, aviation gasoline, aviation oil, propane, sample bags, and wrapping paper in camp. Ten gallon kegs of iosol (naphtha), and fuel oil should be kept full and convenient for use in camp. The cook should be kept posted on the number of people that can be expected at the next meal if it varies from the routine. The camp manager is the official mailman. He also should meet all aircraft that arrive or depart, and help to load or unload them.

3. CAMP MAINTENANCE. The camp manager should maintain the general order and tidiness of camp and have a routine inspection every day. This should include checking the condition of all tents in camp, repairing them, tightening ropes, and banking them when necessary. He will keep a supply of water hauled for the cook and set out hot wash water before meals. Before retiring each night the camp manager should leave some wash water on a stove in the wash tent, and have the stove filled up ready for the cook to simply light the next morning. He should maintain an adequate supply of water for showers and laundry. Each individual

in camp should replace the amount of water he has used in showers and laundry. A most satisfactory yoke for hauling water can be constructed by tying a short piece of aluminum tent frame to a Trapper Nelson packboard (Fig. 2).



Figure 2. Carrying water by yoke made from a Trapper Nelson packboard and the corner brace from a Jutland tent frame

The camp manager will erect and maintain a toilet tent, check it daily, and move it when necessary. The most effective toilet for the Arctic is a 10 gallon drum which has had both ends removed and been sunk in a hole. The drum keeps the sides of the hole

from caving. A seat is built over the drum and a tent is pitched over the whole thing. When full the drum is simply covered with gravel. If the area is hollowed out slightly before placing the drum in the hole, the top of the drum will end up a few inches below ground surface and leave no signs.

An incinerator should be constructed by taking the top off a 45 gallon drum and punching plenty of holes in the sides. Garbage will be burned in it daily and subsequently buried. There will be enough dirty or waste gas and oil as leavings in barrels to incinerate the garbage thoroughly and a supply of this waste should be kept on hand. Nothing should be put into the garbage pit for burial unless it has gone through several burnings, for it will not yet be completely burned and almost certainly will be dug up and scattered by animals. If this is done properly and thoroughly, a very small pit will last the entire summer. Moreover, the bears and foxes will have little interest in bothering our camp and no interest in digging up and scattering the garbage after we have gone. I suggest that garbage be burned once a day only, and that first thing in the morning. Someone who is too ambitious and burns several times a day might find himself pouring gasoline onto a live fire. Empty the garbage cans in the office and cook tents daily, or more often if necessary.

If there is time after his other duties, the camp manager could help the cook to wash and dry dishes. The cook will wake camp initially, but it is your job to bug the pilot and engineer to get up for breakfast if they are late sleepers. They usually are. Keep equipment in orderly piles and covered by tarps. Keep camp clean of



litter, and pick up tools and return them to where they belong. Clean the dining table for the cook before lunch and dinner. The assistants are expected to volunteer to help both the cook and camp manager with chores when they are in camp.

A deep freeze facility for meat should be built and maintained. If there is a nearby snowdrift that will last through the summer, the matter is simple. Aluminum food storage boxes containing meat are placed in a pit in the snowdrift; sheets of insulating material are draped over the boxes and the whole thing is covered with snow. If the snowdrifts all disappear, the same idea can be done in a frost crack, a cutbank, or a simple hole in the ground, trying in any case to get the boxes as close to permafrost as possible.

### Geological Assistants

1. FLYCAMPS. Most of the time of the geological assistants will be in flycamps. Whenever possible the flycamps will be established or visited in the morning so that the helicopter can set you out for a one way traverse back home. When a new flycamp is established it is important to locate it precisely on the areal photograph, and mark it so that you can find the way home to it in bad weather. Try to choose your camp near a prominent feature such as a stream junction or a big rock so that it is easy for you to find it when walking home in the fog. Be sure that the pilot has the location marked precisely on his map

when he leaves. He will transfer this to the camp manager's location map in base camp. This is important, for it may be some other pilot who picks you up. Remember that helicopter pilots rarely use maps, but navigate superbly by memory using the landscape as their map. As a result, they often cannot mark their location on a topographic map when they are sitting on the ground, but nevertheless could find their way anywhere.

A flycamp should be placed on high ground, far enough from a stream so that it will not be washed out in a flood. Furthermore, it should not be built in a slight hollow where a puddle can accumulate in a rainstorm. Be fastidious with garbage! Edibles should be dumped on the ground and soon will be cleaned up by foxes and gulls. Boxes and paper should be burned and buried. Cans and such things that will not decompose should be returned to base camp in a plastic garbage bag for proper incineration. Take both bottoms and tops out of the cans and squash them.

It is a mistake to dig a pit, throw garbage in it, burn it with gasoline, and cover it up. This may look fine when you leave, but it soon will be dug up and scattered by the foxes. Edible things and bits of food attached to cans usually are too wet to burn completely, and just cook a little. The foxes then smell it out and dig the whole thing up, cans and all. Clean up your campsite when you depart and scatter the rocks from the tent ring so that the location looks natural once again.

Learn to estimate wind speeds and ceiling for sending weather reports to base camp. When an aircraft is landing give the pilot the wind direction by standing back to the wind with arms forward, and he will land toward you. Learn to use your flycamp radio, but do not use it for superfluous traffic, and no practical jokes, profanity, or kidding on the radio. Hang some bright cloth on the radio aerial. Treat firearms with the respect they deserve. An instruction session on them will be held in the spring. If you are not completely familiar with firearms do not hesitate to ask for advice. When back in base camp for short spells, geological assistants should take the initiative to help the cook and camp manager with chores.

On traverses one should wear bright clothing to be seen better. An aircraft sees a man more readily when he is on the move, and best of all if against a snow background. An orange smoke generator, a signal mirror, and a bright fluorescent signal cloth should be carried on traverses for signalling aircraft. Never signal an aircraft unless (a) you are in distress, (b) you have a rendezvous with him, or (c) he clearly is looking for you. A mirror gives the best signal, but works only when the sun is out and behind the plane. If a proper signal mirror is not available, a Brunton compass will work, but it is tricky because the hole in the Brunton is not centred. One holds the Brunton in the right hand and looks through the hole in the mirror. The left hand is outstretched with the thumb tip as a foresight. When the shadow of the hole in the mirror is on the thumb tip

and the aircraft, the signal will be hitting him. Often the orange smoke generators (1370-4430) give off only a small invisible flame if they are set upright as they are designed to sit. To get a real cloud of smoke it is best to kick them over on their sides. For some reason this last tidbit is not in the instructions printed on them. Railway flares are useless for signalling in the Arctic Summer - they give a bright flame and are designed for night use.

One must be careful with the fog, which can close in very quickly. If you do happen to be caught in fog, do not proceed unless you are absolutely certain of where you are going. I once walked into a fog intending to go in a straight line. A few hours later I walked back out of it again, and learned to my surprise that I had turned 180°. Ask me sometime to tell you the rest of that story.

If caught in a fog and in doubt about the route, sit down and wait there until the fog lifts. It is better to spend a night out and be uncomfortable, than to be both lost and uncomfortable. Because of the proximity of the magnetic north pole, a magnetic compass is not reliable for directions. If one needs to go only a short distance in the fog he can maintain a straight line by building and following a row of cairns. In this case each new cairn is lined up with the last two behind. Go back later on a nice day and knock them over.

When the spring thaw begins many snow filled valleys have unseen creeks or ponds beneath, and there is a danger of collapsing

into them. One should avoid crossing such valleys just above a lip, for this is a likely place for water to be ponded beneath the snow. The safest place to cross is where the slope of the snowdrift in the valley is steepest. Here the undersnow stream is running very quickly, is shallow, and is not creating either a pond or a cavern. Between about June 20 and July 15 when this problem exists, each traversing team should carry a rope and the two should cross these valleys separately so that one can help the other if necessary. My trick is to carry a nylon rope that has a 2 lb. plastic bag of raisins inside a sample bag wired to one end. This weight helps to throw the rope - and of course you can always eat the raisins.

2. HELICOPTER SAFETY. Learn helicopter safety from the ASPG helicopter manual that is available in camp, and by asking questions. At the beginning of the field season make a special point of discussing safety with each of the helicopter pilot and the flight engineer. It is most important to develop good helicopter habits that become automatic. There are only a few basic rules, and all are common sense.
  1. Watch your head! Approach and leave the machine only from the front (Fig. 3a). This is to avoid the tail rotor, but also so that the pilot can see you. Always leave the machine going downhill and approach it going uphill (Fig. 3b). This is to avoid the main rotor. Because of these two restrictions there is for any position of the helicopter only one

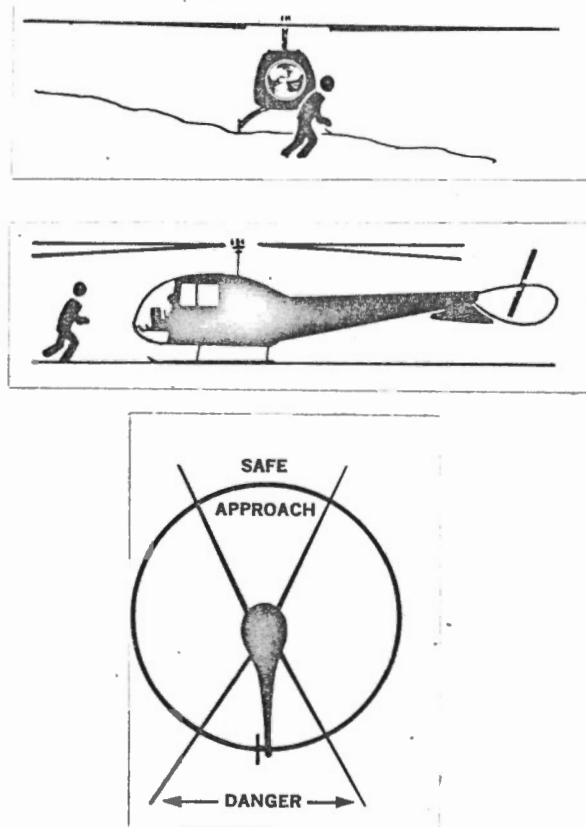


Figure 3. A safe helicopter approach. (a) Approach and leave in front only. (b) Leave going downhill and approach going uphill. (c) For any position of the machine there is one safe quadrant.

quadrant that is the correct one to walk through (Fig. 3a). A good habit is to hold your knees when approaching or leaving the helicopter, for this automatically makes you crouch and keeps your head low.

2. Sit still. Sit still while in the helicopter, particularly during takeoff and landing. If you are on the ground and the helicopter is landing or taking off nearby, once again give the pilot the courtesy of standing still or squatting. If he is landing for a pickup, stop when he approaches and stay there, so as not to distract him until he has brought the machine completely to rest. He will then look up,

thereby signalling that it is clear to approach the machine. If he is taking off get well away from the machine, and sit down where you see each other until he is gone.

3. Loose Equipment. Be sure that no equipment can get in the way of a moving rotor blade or tail rotor. The stories of ways helicopter accidents have been caused by loose equipment are legion. Equipment for loading should be carried close to the ground. A surveying rod that was being carried vertically was hit by the blade, mutilating the man who carried it and wrecking the helicopter. If anything is to be carried on the rack it should be tied down properly. A good habit is - never set anything on the rack unless you proceed to tie it down immediately; never untie anything on the rack unless you proceed to take it off immediately. This way nothing will ever be forgotten there. A lunch box was once set on the rack "just for a moment". When the helicopter took off, the box hit the main rotor, which then threw it into the tail rotor. The result was two fatalities. Don't litter - a shipping tag once got in a helicopter tail rotor and wrecked the machine. Don't hurry around helicopters. A small sleeping bag was once thrown from the passenger's side to save time in unloading; it went too high and hit the main rotor.

In the unlikely event that you are in a forced landing with a helicopter, put your head between your knees, largely to avoid back injury. Then do not get out until there is no more motion, for you could be hit by a flailing rotor blade as you walk away.

GEOLOGY. The party has two complete sets of airphotos of the study area, a red series and a blue series. The party chief works on the red and assistants on the blue series, though there will be occasional trading. Assistants should keep no photographs from the red series with them in a flycamp unless by prearrangement, except for the ones they are camped upon and working upon. When assistants are moved to a new flycamp, they should send back to base camp the photographs used in their previous camp. Plot plenty of points on the aerial photographs and take plenty of notes, as someone else will later use them. Moreover, someone else may want to visit the precise locality where you have made a collection or an observation, and they do not have your memory of locations, so put numerous points on and put them on accurately with a pin prick through the paper. A good punch can be made for this purpose with a needle and a piece of wood. Be sure to not punch two photos or there will be problems when working on the next one. Mark your initials, traverse numbers, and station numbers on the back of a photo, but before doing so erase it with an ink eraser to remove the emulsion so that the numbers will not wear off. These should be done with a lead pencil and lined up neatly so as not to take excess space, for someone else may later use the same photo in the field. India ink does not work well on the backs of photos for it tends to flake off. At the end of the field season when no more information will be added to the back of a photo, scotch magic tape can be put over the numbers and they are permanently protected.

When measuring sections, mark the beginning, end, and important intermediate points such as contacts or fossil localities on the air



photo, and refer to them in the notebook. The formations, their names, and their boundaries will change, but the facts, observations, and collections from each point will not. Plot on the photographs all dips, contacts, faults and other features, and plot your best interpretation of the structure. Work out and plot structure on the photo. Don't leave it all for the party chief to tie together. If it ever is necessary to leave heavy bags of fossils to be picked up later, place them with the numbers down so they will not fade from the sun and rain.

When mapping get problem oriented above all. Sit down, study the photos, and then walk to the outcrop or place that will contribute most to solving the immediate problem. Do not sit on the rocks for long, or you may join the long list of field geologists who have piles. My trick is to sit on one or both ankles, Indian style. When the ankles begin to hurt, you have probably sat there long enough and will learn more by walking to another outcrop.

USEFUL BOOKS

- DOWN BUT NOT OUT;** Available from Information Canada, Ottawa. This is a handbook to assist downed aircrew, prepared for the airforce.
- NORTHERN SURVIVAL;** Available from Information Canada, Ottawa. This is a practical guide to northern survival prepared for the Department of Indian Affairs and Northern Development.
- HELICOPTER SAFETY AND OPERATIONS MANUAL:** Available from Alberta Society of Petroleum Geologists, 612 Lougheed Building, Calgary, Alberta.
- CLIMATE OF THE CANADIAN ARCTIC;** Available from Information Canada, Ottawa. Published by the Canadian Hydrographic Service, Marine Sciences Branch, Department of Energy, Mines and Resources, from material prepared by the Meteorological Branch, Department of Transport, Canada. This shows by table, climatic conditions for Canadian stations north of 60°N latitude.
- GEOGRAPHICAL DISCOVERY AND EXPLORATION IN THE QUEEN ELIZABETH ISLANDS;** by Andrew Taylor, 1964; Memoir 3, Geographical Branch, Department of Mines and Technical Survey, Ottawa. Available from Information Canada, Ottawa.
- ILLUSTRATED FLORA OF THE CANADIAN ARCTIC ARCHIPELAGO;** by A. E. Porsild, 1956; National Museum of Canada, Bulletin No. 146, Department of Northern Affairs and National Resources, Canada. Available from Information Canada, Ottawa.
- RADIOTELEPHONE (LAND SERVICES) HANDBOOK;** Available from Information Canada, Ottawa. Prepared by the Department of Transport, Telecommunications and Electronics Branch. This is a useful guide to those who operate field radios.
- TERRITORIAL LANDS ACT;**  
in The Canada Gazette, no. 22, v. 105; available from Information Canada, Ottawa. This lists the Territorial Land Use Regulations.