THE ICE PATROL

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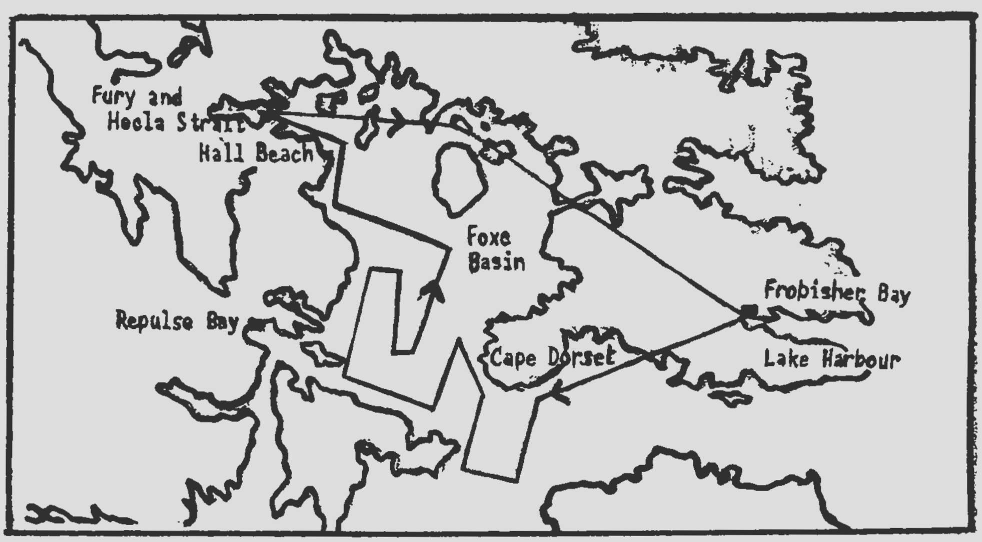
by Gilda Mekler

It's a grey, cloudy day, and threatening to rain in Frobisher Bay. But the 7:00 a.m. briefing in the weather office shows that over most of Foxe Basin the weather will be clear enough for our purposes, so today's flight is on. We climb aboard Nordair's CF-NAZ, a remodeled Electra bristling with complex electronic machinery, and are soon airborne and heading towards Foxe Basin to begin a ten-hour scrupulous watch for ice.

Ice Reconnaissance flights are a service of the Department of Environment, and are the less visible side of sealift. Supply ships and Coast Guard vessels navigating Canada's eastern seacoast and Arctic waters depend on up-to-date information about ice conditions, supplied largely by "Ice Patrol" flights. The data gathered is also useful to meteorologists and oil companies. Flights are undertaken every two or three days, on the average, depending on weather and on requests for information. Today the ice observers have been asked to gather information for the oceanographic ship *Baffin*, which is planning a trip into Foxe Basin.

The four-engine Electra, which as an airliner can carry 92 passengers, seems a bit large for the dozen people on board today. Flight crew is Nordair Captain Bob McIntyre, First Officer Ray Verreault, Second Officer George Idden, and Navigator Stew Freeman. The ice observation team consists of Torben Andersen, the Ice Reconnaissance Field Manager, and ice observers John Comeau, Al Lavinski, Bob Zacharuk and Bert Plante.

Three extra people are on board today – Tom Kilpatrick, the Chief of the Ice Reconnaissance Division, AES, conducting a routine check on Nordair's fulfilment of their contract (they're doing an exceptional job, he says), Pat McMahon, a technologist who spends most of the flight poking into the innards of the laser geodolite to find out why it isn't working as it ought, and your somewhat dazed reporter, who has been invited along in conjunction with a forthcoming Open House on the plane. (Everyone aboard seems pleased to explain the workings of things to help the dazed reporter get oriented, especially the patient tourmaster, Torben Andersen.)



The Ice Patrol

The Flying Lab ...

The interior of the big turbo-prop is a far cry from its airliner days. About ten seats from the first-class section have been left in place for crew members to eat, read and relax in; and four bunks have even been added for anyone needing real rest. (Sometimes a ground crew will be on board when the plane overnights in different locations, such as on the spring "round-robin" tour to get an overview of ice conditions, which stopped in Montreal, Frobisher, Thule, Resolute and Inuvik. The ground crew's work is done at night – when the plane is on the ground – and in the daytime they can sleep on real beds aboard the plane.)

All the rest of the seats have been removed to be replaced in the front by enough gadgetry to fill a Hollywood-style laboratory, and in the centre of the plane by two enormous fuel tanks carrying 7000 lbs. of extra fuel to extend the aircraft's range.

The plane could cover about 5000 miles if it were flying at 25,000 feet as it is designed to. But even at the lower altitudes necessary for observations – about 3000', dipping down to 1000' or even 500' at times to get under cloud cover – the plane can travel up to 2750 miles without refueling. This extended range is very important to cover the long zig-zag courses required by the Ice Patrol.

Even with all the equipment in place, there's room on the aircraft to stretch your legs, or stand in the small kitchen area and make yourself a sandwich.

And What It Does ...

Visual observations are the most important way of gathering ice information, I was told; but sometimes, although the plane can get down to 500', it is not possible to get underneath the cloud cover, and then radar information is used. Fog banks over Baffin Bay for the last couple of weeks have made most of the ice information on the east coast of Baffin Island dependent on radar.

There is always an observer manning two radar screens in a little area curtained and sealed to block out light for better observation. The main radar screen is a very sophisticated device, the largest of its kind ever built in Canada; the smaller back-up screen is identical to the one used by the pilots.

The radar observation system is based on the fact that water is a poor reflector of radiation, and ice a better reflector, though not as good as land. To me, the brightening of the sweeping line of light on the radar screen as it passes over an ice-filled area is barely perceptible, but the trained eye of the ice observer can analyze the signal as representing a three-tenths concentration of one-year ice over a certain area!

The rest of the equipment provides further refinements on ice information.

The *laser geodolite* (when it's working) sends out laser waves with a 10' wave-length. If the wave is reflected from a distance an exact multiple of 10' (1000', 1010', 1020' etc.) the instrument will read 0'. But when the wave hits a surface at any other height, it will reflect "out-of-phase". The instrument thus picks up minor variations in topography, down to an inch or two, which gives information about surface roughness or smoothness and ridges or bumps on the ice.

The *precision radiation thermometer* measures the water or ice temperature directly below the plane. This temperature information is useful to meteorologists in making forecasts about ice conditions; for example, in the fall if the water is approaching −1.8° C, the freezing point of salt water, freeze-up can be expected soon.

The *infra-red line scanner*, on the other hand, measures *comparative* temperatures in a 120° arc sweeping the path of the plane, by picking up the infra-red radiation given off by all warm surfaces and beaming it onto a highly sensitive chemical, indium antinomite. The plate must be kept specially cooled by liquid nitrogen on board the plane to remain sensitive to radiation in these quantities. Since thicker ice is colder and gives off less radiation than thinner ice, this instrument gives a picture of ice formations. It is sensitive enough to pick up such minor variations in temperature as the subsurface water brought to the surface in the wake of a ship or iceberg.

Motor-driven cameras are suspended from the belly of the plane, to take pictures in areas where meteorologists or oil companies have requested specific information.

The ice observers have two radios – one similar to a radio telephone and a VHF air-to-air link. The plane can communicate by radio with any ships in the area, but regularly reports only to the icebreakers. Today, the icebreaker D'Iberville is stationed near Repulse Bay, but cannot be reached on the staticky radio.

A standby frequency is always open for ships requiring ice information or lost and in need of aid. (It was an Ice Reconnaissance plane which was first on the scene when a small plane was forced to land on the ice off Cape Dyer earlier this year, and in fact gave the pilot ice information which helped her to land safely.)

And, at certain scheduled times, or on request, an up-to-date ice-map of the day's observations is sent out to any ship, on a facsimile transmitter which can send a visual image over the radio.

The Bubble

For all the impressive technological paraphernalia, the heart of the Ice Reconnaissance operation is a simple clear "bubble" sticking out of the top of the aircraft.

Four of the five men take one-hour turns in rotation sitting in the bubble. The observer climbs up, using a foot-ladder against the wall, pokes his head up above the aircraft ceiling, pulls the seat up into place and bolts himself in. He then sits, legs and feet dangling into the body of the plane, performing the main task of the ice patrol: keeping a constant watch on the ocean's surface, and marking down how much ice there is, where, and what kind.

The observer first marks on a map the path visible from his post. Within that path, he notes ice conditions, using a special language of ice symbols.

Ice is divided into six categories according to its age: new ice just forming, thin and flexible; grey ice grey in appearance, 4 - 6" thick; stiffening white ice – 6 -12" thick; first year ice -- anything thicker than one foot formed in the past year; second year ice ice which has survived last summer's melt, recognizable by a greenish-blue colour and more rounded surface features; and multi-year ice, still older, a turquoise colour. The age of ice is significant to ships, since older ice becomes less and less saline and consequently harder.

The observer must also note the concentration of ice in terms of the surface area: one-tenth concentration a scattering; and ten-tenths solid ice.

He also notes such features as roughness, ridging, hummocks, snow cover, puddling and thaw-holes.

Even what would be called by the untrained observer "open water" is broken down into classifications; "open water" means there are occasional bits of ice scattered about; "bergy water" means there are icebergs or "growlers", bits of iceberg barely clearing the water; and "ice-free" water means no ice at all.

Off the coast of Newfoundland, patrollers even count and note the location of icebergs, but this is impossible in Arctic waters.

A Glorious Panorama

Later on in the flight, when we were doubling back over an already-covered area, and no observation was necessary, they let me climb up into the bubble.

The dome is about 4 feet in diameter, and only the bottom several inches are left clear. The top part is covered with Turtlewax to cut down the sun's glare, which would otherwise make the bubble unbearably hot.

The streaky brown surface is covered with pencilled graffiti, presumably scrawled by observers awaiting a break in the clouds – most notably, right in the centre, the admonition "There's no ice up here, so look down."

When I got my turn in the bubble, we were flying over the narrow Hecla and Fury Straits, north of Igloolik, bordered by rugged mountainous country, and the sun was shining. The view through the bubble was a glorious panorama, strangely elating.

"Unserviceable"

The plane is also equipped with two smaller side bubbles – bulging windows which allow an observer or guest to put his head out from his seat and look straight down.

The bubble windows have been provided with holes to prevent condensation. But those aboard the plane find the noise of air rushing through the holes annoying, and condensation not really much of a problem, so the neat round holes have been sealed off – by large yellow cardboard tags reading "Nordair – Unserviceable".

Visual Best

Visual observation, since it provides the most precise information, is used when possible in making up the ice-map which is the final result of a day's work.

Today we have been quite lucky; despite an inauspicious beginning, we have had fairly good weather throughout much of the flight, and more than half of the information of today's map is based on visual observation.

Background

During the flight, Tom Kilpatrick gives me some background on Ice Reconnaissance. The first ice observer was appointed in 1956, and the operation has now grown to 55 staff, including observers, technicians, forecasters and support personnel.

These staff are all based at Ice Branch headquarters in Downsview, Ontario.

The observers spend about 60% of their time in the field, divided between aerial duty and icebreakers.

Ice observation is done in the Maritime and Great Lakes areas in the winter, and in Hudson Bay and Canadian Arctic from June to November.

During these five months, about 15 men of the Ice Reconnaissance program are lodged in Frobisher at any one time.

Up to 1958, military Lancaster aircraft were used for ice work; then about 10 commercial air carriers in rapid succession provided planes on a contract basis. From 1967 to 1973, Kenting Ltd., of Malton, Ontario, held a contract using DC-4 aircraft, and in 1973 two larger, more powerful Nordair Electras took over the job.

Flight Crew

For the pilots flying the plane, the job isn't too different from any other flying job; less busy and hectic than shorter sked flights, involving frequent takeoffs, landings, cargo calculations, and, in the south, tight traffic above, below and ahead. Flying the ice patrol for 10 hours or more, with little to do but monitor the array of dials and lights in the cockpit, check the weather, make a position report every hour, and occasionally take the airplane down under cloud cover or turn it, can get monotonous. And ten hours in a row in a pilot's seat can be tiring.

Navigation

While the actual job of piloting may be simpler than on some flights, the demands of ice patrol work require another member of the aircrew not even present in most passenger flying.

Navigator Stew Freeman sits behind an impressive panel of computer displays, representing two computer-operated Inertial Navigation Systems, and two computer-operated Omega Navigation Systems.

The Inertial Navigation System needs only to be fed the position at the point of takeoff. It can calculate up to nine turns ahead.

Drawing information from three accelerometers within the INS, the system's computer calculates speed, direction, and position, and can at any point give an accurate reading of position, as well as telling the auto-pilot directly when to turn.

To keep the information even more accurate, the navigator updates the INS information every hour by checking with the Omega Navigation System, a system getting a position fix from eight ground stations throughout the world, in Norway, Liberia, Hawaii, North Dakota, Reunion, Argentina, Trinidad and Japan. Between these two systems, the navigator can know within half-a-mile where the plane is at all times.

And if all four sophisticated systems broke down, the navigator could resort to the sextant mounted in the roof of the aircraft for old-fashioned navigation by the sun, moon and stars. A transatlantic jetliner would probably carry INS, but not ONS. A domestic passenger liner would not be likely to carry either. Standard equipment aboard a domestic passenger liner could lead to position errors of up to 30 – 40 miles over a long flight; not too serious, since the plane will be guided to its destination by an airport beacon.

But on this flight, the navigator must supply much more precise position information to the ice crew; ice information 10 miles out of place would be useless to a ship.

Homeward Bound

After almost 10 hours in the air, we have covered most of Foxe Basin in a long, jagged line, passing near Cape Dorset, Southampton Island, Hall Beach, Igloolik and Longstaff Bluff, and, on reaching land, we climb higher to get back to Frobisher quickly.

The observation is over, and the observers are drafting the day's final map, a mass of dots, squiggles and numbers full of meaning to one who understands them.

This map will be available as it is, and will also be sent to Ottawa to be worked into composite maps giving the latest information over the whole Arctic.

Open House

Not many of the public get a chance to go along on an actual ice patrol, but there will be a chance to tour the plane at an open house to be held in Frobisher. The open house was originally planned for this week, but requirements for ice observations in the High Arctic have forced a change in schedule, and the open house will be held later in the summer.