January/February 1983

ZEPHYR

Resolute: the changing Arctic

Environment Canada
Environnement Canada
Canada

NEWS

Letter to the Editor

"Probability of Precipitation a reality" stated a headline in the September-October 1982 issue of ZEPHYR.

"Probability of Precipitation a disservice" is my reaction to six months' exposure to this forecast parameter. The following explains why:

(1) POP predictions already appear to be the forecasters' ultimate hedge. With every forecast including a statement of POP, including many which read "mainly sunny with a 20% POP", the forecaster seems to be almost totally relieved of the necessity of arriving at a "rain-no rain" decision;

(2) As a user of forecasts I have never had explained to me the meaning of the forecast POP;

(3) No citizen whom I have met, (and I encounter many who stop me for a weather-related conversation), can define POP. Here is an illustration: while waiting out a heavy downpour on the golf course in August a would-be player was heard to suggest that the morning's forecast of 20% POP must have meant that it would rain 12 minutes of every hour;

(4) Up to the time that I left Canada for the winter season I did not hear a single forecast that specified the percentage probability of snow vs. rain, an item of major interest to residents of the eastern Maritimes, and one which might justify a carefully determined percentage format;

(5) As a former practising forecaster I am wryly amused by successive forecasts for tomorrow which move from a 20% to a 30% to a 50% to a 60% and, ultimately, when it is already raining, to an 80% POP;

(6) Finally, I wonder how it was determined that ". . . public demand for such information (POP) is high." I can understand the Radio Television News Directors lobbying for this parameter; their stock-in-trade is gimmickry. From almost 30 years of close contact with them I can attest that their appraisal of the public's true needs and demands is highly suspect.

In closing I hope that a full description of the POP verification technique and the verification results for each regional forecast area will appear in a forthcoming issue of ZEPHYR.

Dr. R. A. Hornstein
Halifax, N.S.

Zephyr Highlights

Cover: As a high Arctic weather station, Resolute is just a dot on the map or a row of huts along a main street, but John McBride turns it all into an exciting saga told by AES meteorologists over a 35 year period (see Page 7).

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NOTE from Field Services Directorate

Dr. Hornstein's criticisms of the probability of precipitation forecasts are no doubt shared by others. We do, however, have some indication that the probability forecasts have been well received and understood by the general public, the ultimate user.

In a public opinion survey conducted for AES across Canada in November 1982, 81% of those polled were able to correctly define the meaning of "40% probability of precipitation", 86% found the forecasts very or quite useful and 70% claimed to have heard the term in most or all forecasts. Further details of this survey will be published in a future issue of ZEPHYR.

Field Services Directorate plans to evaluate the probability of precipitation forecasts in April and May 1983 and the results of that evaluation will also be published in ZEPHYR.

New radar installations a success

From April to December 1982, AES installed and commissioned four new weather radars. From equipment procurement to commissioning, these installations have been completed in a very short time and at a cost which compares most favourably with that of previous radar installations.

The four Canadian Weather Surveillance radars — (CWSR-81) are all installed in newly constructed facilities, (i.e. buildings with adjacent radar towers). The installations are at Elbow, Sask.; Broadview, Sask.; Upsala, Ont. and Britt, Ont. The Saskatchewan sites are manned AES weather offices, whilst the Ontario sites are unattended.

A simple data remoting system is installed with all of the radars. It supplies

Radome being installed at Britt, Ont.

data for displays of radar information on colour TV monitors installed in AES weather offices in Saskatoon, Regina, Winnipeg, Thunder Bay, Sudbury, North Bay and Malton. Also a number of outside users such as TV stations, hydrologists and public utilities are preparing plans to receive and process the radar data.

Five CWSR-81 radars were ordered from Enterprise Electronics of Enterprise, Alabama in late May 1981. (The fifth radar will be installed in 1983). All of the radars were delivered by the end of February 1982. Site preparation work, which was managed on behalf of the AES by Public Works Canada, commenced in the fall of 1981.

The radar towers, built to AES and Public Works specifications were manufactured and installed by the Wind Turbine Company of Elmira, Ontario. Enterprise Electronics has been so impressed with the tower design and the ease with which it is errected that they are planning on purchasing future towers — (estimated value $200,000 a year) from this Canadian Supplier.

The radar installation and commissioning proceeded smoothly and quickly as a result of the enthusiastic efforts of George Wakelin and Mel Melanson of Data Acquisition Services Branch. This two-man team, assisted by personnel from Enterprise Electronics and AES regional electronics technicians, had to solve numerous problems and work long hours in order to complete the installations effectively. Work included the assembly of the 5.5 metre diameter radome, the positioning of all of the equipment, the installation of all power and signal cabling, waveguide installation, and the testing and calibration of all the equipment. At each site, the installation and commissioning work took less than eight weeks from the arrival of the equipment at the site to the deployment of all the remote equipment and the start of continuous operations.

Thus, in nine months of 1982, AES placed four new radars into service. By comparison, when five Raytheon WSR-807 radars were deployed in mid-1975 during the last major expansion of the AES radar network, installation and commissioning was not completed until late 1978. In addition, even though inflation could have been expected to increase costs by 50 to 100%, each CWSR-81 was deployed in 1982 at the same cost (about $600,000) as each WSR-807 in 1975-78.

Further CWSR-81 installations are planned for 1983 and 1984. In 1983 new radars will be installed in the Calgary and Sault Ste. Marie areas and the existing radar at Halifax will be replaced. In 1984 the existing Edmonton and Winnipeg radars are to be replaced. In addition, a contract was recently placed for the development of the prototype of a new radar data processing system. This system is to supply a wide range of radar products to AES and non-AES users, and it is currently scheduled for deployment on all AES radars by 1988.

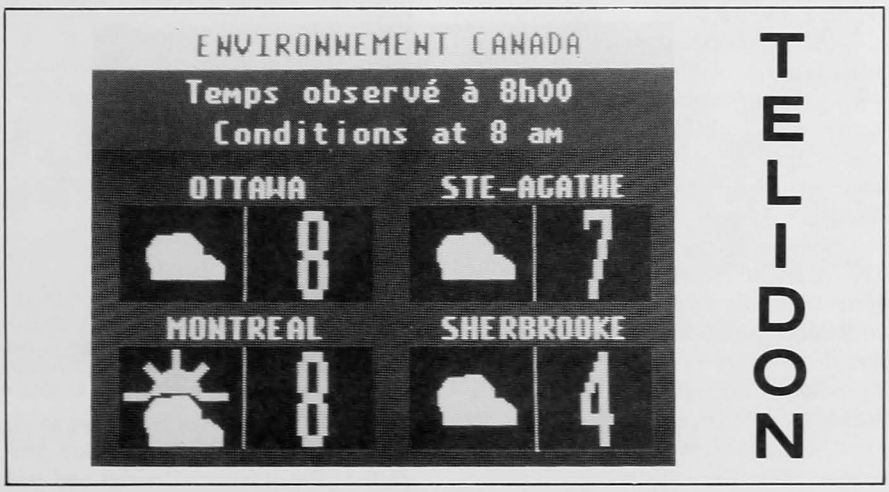
Eric Aldcroft
AFRP

Telidon at the Quebec Weather Centre

When TELIDON began to be tested, AES decided to explore the possibilities of this new technology and participate in Bell Canada's VISTA experiment (see Zephyr, July-August 1980). The Quebec Weather Centre was subsequently given the task of providing the material for the French language data bank for the VISTA experiment. The Telidon subsection of QWC was established at the end of 1981. The team members have completed the learning phase and are now developing the system.

Vista is one of the main projects examining the various possibilities of the Telidon system. Vista is a data bank that may be accessed by selected users from their homes. The user logs into the computer by telephone and selects the "pages" he wishes to view. These are then projected onto his television screen. Users may choose from a wide variety of subjects, such as news, games, advertising, tourist and government information, and of course weather. QWC's set of pages covers the following: forecasts, meteorological dictionary, climatic information, and services and information available through AES.

Vista is not the only project experimenting with Telidon. More and more people are exploring this new technology. Radio-Canada will soon start on its own experiment, IRIS, scheduled to begin in January 1983. INTERVISION, a consortium of cable distributors serving a large area of Quebec will use Telidon instead of its current method of presenting weather forecasts. QWC is involved in each of these experiments and may participate in others in the future.



Example of a TELIDON weather presentation.

NEWS

Two new radar weather stations in Saskatchewan

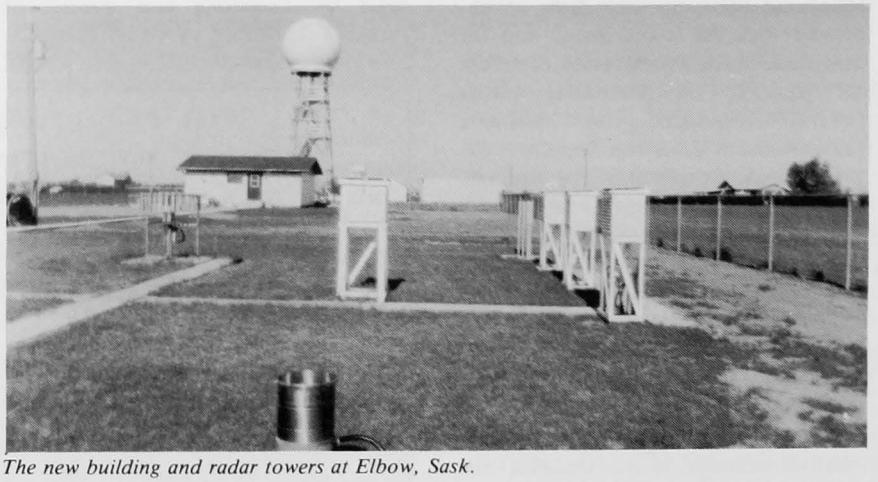
In a scene reminiscent of the "weatherman's picnic", inauguration of Saskatchewan's two new radar weather stations, situated at Broadview and Elbow, had to be postponed because of an early winter storm that dumped nearly 19 cm of snow in the former location and 40 mm of rain in the latter as well as making access roads and parking areas impassable.

Instead of coinciding with the official commissioning in Regina September 29 by Dr. Andrew MacPherson, director general, Western and Northern regions, DOE, the ribbon cutting ceremonies took place October 21 on site at both stations.

In Broadview the honours were performed by the Officers-in-Charge of the Regina Weather Office and the Broadview Weather Station Fraser Hunter and Gerald Shauf, while in Elbow the ribbon was cut by Saskatoon Weather Office and Elbow Weather Station OICs Don Bauer and Dennis Malcujk. An open house followed, attended by more than one hundred local dignitaries, citizens, members of the media, staff and family.

The two CWSR-81 radars are housed in new offices constructed in 1982. Both systems operate on the 5 CM band and have a maximum range of 450 km although precipitation is not normally detectable beyond 300 km. Together the two systems provide radar surveillance over most of the populated areas of southern Saskatchewan and southwestern Manitoba.

Radar observations from Elbow began June 12 while those from Broadview got underway September 21. In conjunction with local surface weather observing programs, the Elbow radar is manned 11 hours per day while the Broadview scope is attended 24 hours per day. Aside from the local displays, the radars are equipped with a remote monitoring capability. Weather Offices in Regina and Saskatoon as well as the Prairie Weather Centre have access to the systems through a "dial-in" mode which allows forecasters and briefers to view a quantitative computerized version of the scope image displayed at the station.



The new building and radar towers at Elbow, Sask.

The radars have already become an integral part of the data acquisition program in the southern Prairies and will provide an important contribution towards meeting AES's number one priority — Improvement in Day One Forecasts and Warnings.

Don Sumanik

Don Sumanik died of a heart attack in Whitehorse on December 1, 1982. Mr. Sumanik was Supervisor of the AES Yukon Field Inspection Unit. He underwent heart surgery two years ago and recuperated to the point of carrying out the full slate of duties and it was while on the job that he met his untimely death. Don leaves behind his wife Elsie and two sons, Don Jr. and Ronald.

Mr. Sumanik joined the Service as an Upper Air Technician at Port Hardy in 1958 and served in Whitehorse, Moosonee and Ft. Smith before returning to Whitehorse in 1968. He was the Officer-in-Charge at Moosonee and Ft. Smith. In 1974 Don transferred to the Whitehorse Weather Office as Senior Technician and in 1979 became the Supervisor of the Yukon Field Inspection Unit. While in his last two positions he was particularily active in promoting and expanding the data network throughout Yukon and northwestern B.C.

Don, an active outdoorsman was also well known for his boundless energy and involvement in many community activities. Recently he received the Yukon Commissioners Award medal and was nominated 1980 Citizen of the Year by Whitehorse Kiwanis. He also received a letter of congratulation from Environment Minister John Roberts for his efforts in arranging the 1980-81 World Cup Cross-Country Skiing and North American Cross-Country Ski Championships in Whitehorse. Don was also instrumental in establishing a square dance club, the Whitehorse Sourdough Stompers in 1970 and had been their caller since then. At the time of his death he was also a Director in the Arctic Winter Games Corporation. Since his death he has been honored by the City which renamed a street in Hillcrest to Sumanik Drive and the Whitehorse Cross-Country Ski Association has set up an annual competition for the Don Sumanik Memorial Trophy.

Also the Canadian Permanent Committee on Geographical Names in Ottawa have named a mountain peak some 15 kilometers west of Whitehorse Mt. Sumanik. This peak was selected since it is visible from the Ski Chalet and cross-country ski trails Mr. Sumanik helped establish.

Fuel savings in the High Arctic

The remote Atmospheric Environment Service weather stations of Eureka and Mould Bay, N.W.T. are definitely not among the warmest places in the world, and fuel for heating has been a major factor in the million-dollar yearly operating budget of each station.

With a view to reducing heating costs, and at the same time conserving fuel resources, construction began in late 1981 on experimental heat recovery systems at both sites. The project was a continuation of the experiment that had previously been tried, with considerable success, at a former weather station in Isachsen, N.W.T.

The principle of the heat recovery system is relatively simple; it uses heat developed by the diesel electric power generators to help heat the station's buildings. Heat produced by the generators is used to heat water which is then circulated through each building. There, air handling units, similar to automobile radiators, force heated air through building ducts. Each of the air handling units is controlled by a thermostat and the regular hot air furnaces in the buildings only come on when the heat recovery system does not supply sufficient heat.

Construction of the systems was completed in late summer 1982, at a cost of $400,000. Initial indications are that the systems could result in at least a 45,000 litre reduction in the annual heating fuel consumption at each site.

In the past, approximately 450,000 litres of diesel fuel was used every year at each site for heat, power and vehicles. Heating fuel alone consumed about 30% of the total (114,000 litres at Eureka and 182,000 litres at Mould Bay). Eureka is supplied via an annual sealift, at a cost of 52¢/litre, while Mould Bay, which is inaccessible by sea, requires an airlift at a cost of 93¢/litre. The cost savings of even a 45,000 litre reduction at each station are obvious.

Spin-offs from the project have also proven advantageous to the weather station's staff. An enclosed corridor containing the heat recovery piping now connects the three largest buildings at Mould Bay, allowing staff access to each without having to go outside in the –40C Polar night. And at both sites, as teething problems are resolved, the system will provide a reliable, odorless, safer and less expensive source of warmth.

From a report by AES aerological technician Peter Gunst, published in Exchange, newsletter of Environment Canada's Western and Northern Region.

Rough and Ready user's guide to POP

Probability of precipitation

0%	No precipitation even though it may be cloudy.
10%	Dry weather with only one chance in ten of snow or rain falling.
20%	Dry weather still expected.
30%	Go ahead with your picnic, boating or ski plans but you may have to take shelter.
40%	An umbrella is recommended. Make alternate plans for outdoor activities that are conducive to rain. Not a good day to pave the driveway. Keep your fingers crossed!
50%	It's even Steven on whether it snows or not. Be prepared for all eventuallities.
60%	Want to water your lawn? The odds are favourable that Mother Nature might give you some help.
70%	Suggest cancellation of outside events. The chances for dry weather have shrunk to three in ten.
80%	Wet weather likely. Make appropriate plans.
90%	The occurrence of precipitation is a near certainty. Venture out if you enjoy walking in the rain or playing in the snow.
100%	Precipitation is a certainty.

(Taken from the fact sheet produced by the Weather Services Division, Field Services Directorate)

Qualification Enhancement Program develops job skills

Merrianne Crowell has been selected as the new Assistant to the Coordinator of the Qualification Enhancement Program (QEP) replacing Susan Falla who has helped run the program since its implementation in January 1978. Merrianne will be assisting Chris Green, the Training and Development Officer, who is the new QEP Coordinator.

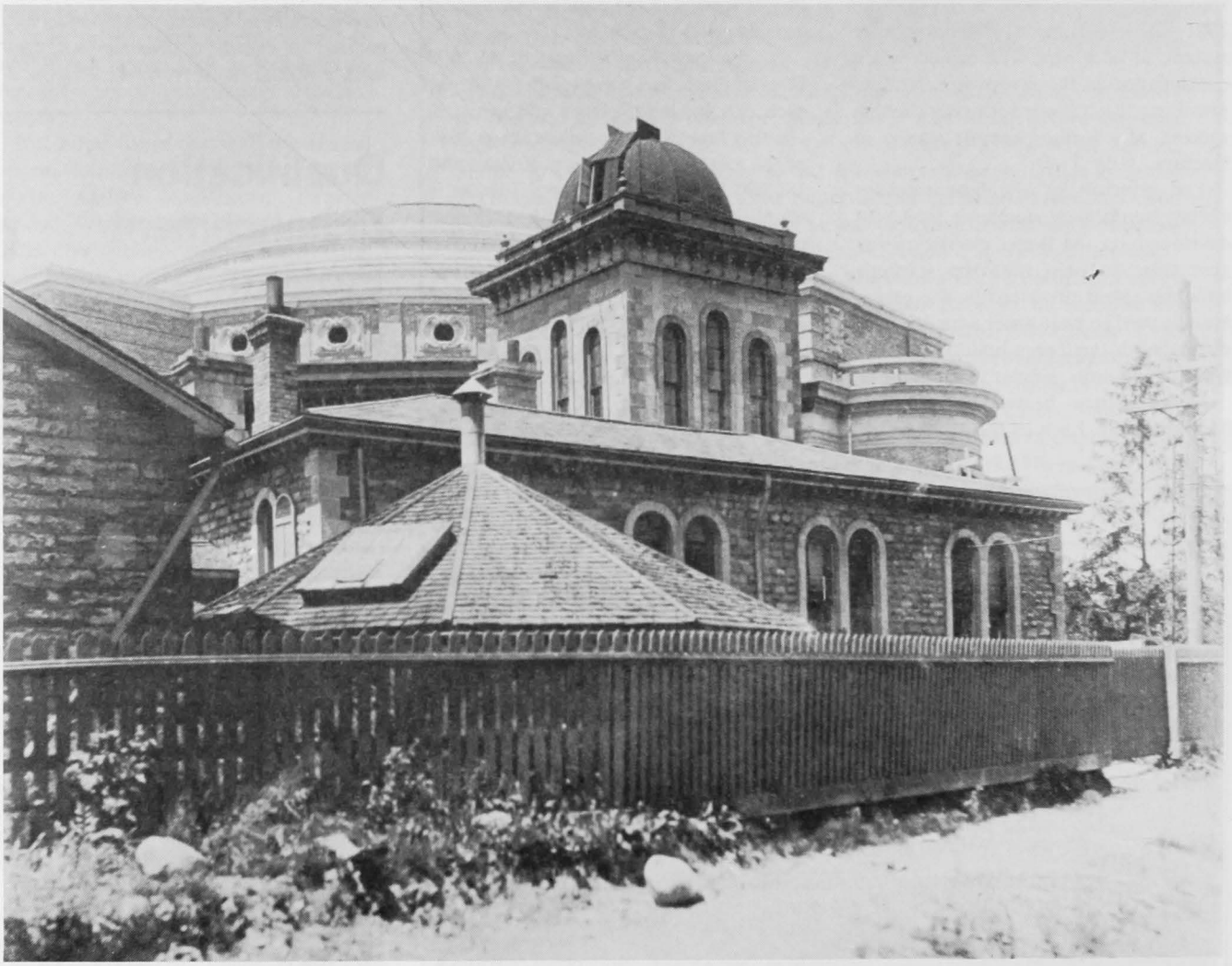
Merrianne Crowell.

The Qualification Enhancement Program was conceived by the EOW Committee in conjunction with the Ontario Area Personnel Office, and with the approval of AES union representatives. The intention of the program is to provide an opportunity for employees to

develop a broader range of skills and experience through short-term voluntary assignments which may be carried out in conjunction with an employee's normal duties. The program also gives AES managers the opportunity to propose projects which will expose employees to interesting tasks or challenges. QEP benefits both the employee and the manager, and the organization stands to benefit from this type of approach to employee development.

Information on the Qualification Enhancement Program may be obtained by contacting Merrianne Crowell or Chris Green. Assignments are posted in the Career Centre across from OAP. As well, these assignments receive wide distribution to the Directorates. Application forms are available in the Career Centre or from Merrianne, who can be reached at 667-4883.

AES managers are being reminded that QEP can be a major alternate avenue for providing career development. To this end, suggestions on future projects would be appreciated.



First weather observatory abandoned in 1908.

Anniversaries

125 years ago: under a scheme worked out by early Canadian Meteorological Director John Lefroy, grammar schools in Upper Canada began taking systematic climate observations.

100 years ago: as part of the 1882-83 International Polar Year, Capt. Henry Dawson of the Royal Artillery led a British-Canadian expedition to establish a magnetic and meteorological observatory at Fort Rae (on Great Slave Lake) and succeeded in operating it for a year.

75 years ago: the Canadian Meteorological Service's first weather observatory on the campus of the University of Toronto was abandoned and a move prepared to a new mid-town Toronto location.

50 years ago: a tropical storm struck the Maritimes, destroying 300,000 barrels of apples in the Annapolis Valley, N.S.

25 years ago: 528 hours of bright sunshine were recorded at Sachs Harbour N.W.T. for the month of June 1958 alone — a Canadian record.

Resolute staffed by meteorologists for 35 years

by John McBride

For 35 continuous years the Canadian government has staffed a weather station at Resolute, N.W.T. From the establishment of the Joint Arctic Weather Stations (JAWS) until just last year, it was the practice to staff the Officer-in-Charge (OIC) position with a meteorologist. Then, on September 26, 1981 AES Central Region began rotating senior meteorological technicians through the OIC position at Resolute on short-term postings of three to four months. Almost 60 meteorologists have served in Resolute and their contributions to aviation, marine transportation and other activities in the Queen Elizabeth Islands must be saluted and significant moments in their High Arctic service recalled.

Resolute, located on Cornwallis Island facing the Northwest Passage (about 2500 km north of Winnipeg), is one of the few inhabited sites in the Queen Elizabeth Islands, home of such Arctic animals as polar bears, musk oxen, lemmings and caribou, as well as of many birds. There are four old Inuit village sites near Resolute and indications that in past centuries there must have been a considerable population. Temporary visitors have included British naval expeditions in search of the Northwest Passage, Norwegian explorers, North Pole adventurers, Greenlanders on hunting trips and Canadian government officials.

Five weather stations — Resolute, Eureka, Isachsen, Mould Bay and Alert (the JAWS) were established on the islands after World War II. When heavy ice prevented an icebreaker and supply ship from entering Winter Harbour on Melville Island, two years supplies and equipment were landed in Resolute Bay along with 16 men on August 31, 1947.

Meteorologist Bill Ray was part of the team, and his tour of duty was two years. Why two years at such an isolated site? Stu Dewar who replaced him in 1949 says: "The job was deemed difficult, complex, requiring diplomatic skills with staff and visiting dignitaries from Ottawa and Washington as well as continuance of scientific programs and managing the station. It was felt that the OIC might achieve efficiency of operation the first year, but that the second year would be a "piece of cake" and HQ staff could rest more easily." Although a policy change was not implemented until 1952, few meteorologists served as OIC longer than a year.

Cliff Hannah (left) is the senior met tech who replaced Steve Ricketts, the last meteorologist to serve as OIC Resolute Weather Office on September 26, 1981. They are seen together in front of the briefing display.

Airport was 2 km gravel strip

The first years were characterized by construction and lots of flights. The original Upper Air Weather Station was established at "South Camp" in September 1947. Stu reports that many improvements were made to existing buildings during his tour of duty. A new power house was built, a new 'hotel' was erected and several Jamesway and Quonset huts removed. The Upper Air Station was moved several times while Charlie Goodbrand and Mike Webb were OICs and the latter recalls changes in Resolute operations: "Construction was completed in October 1963 of a spacious, new building and separate inflation shelter for the upper air station at "Mid Camp" about two km south of the airport base. The ozone observatory was re-located on the second floor of the operations building. The aerologists were pleased with their new facilities, though at first they were a little apprehensive about the remoteness. Transportation was by truck or "Bombardier" ski-track vehicle along a gravel road marked by 200 litre oil drums."

Despite its extreme isolation, the Resolute weather station had some "neighbours". The Dept. of Energy, Mines and Resources ran a base near "South Camp" doing ionospheric research and other scientific programs. Stevedores arriving to offload bulk cargo from ships during summer resupply stayed at "South Camp". The Resolute airstrip, situated about five km north of the weather station was built in 1949 and originally maintained by the RCAF as a 2 km gravel strip. While piston-engined transport aircraft restocked the JAWS with fuel, food and equipment each spring, several meteorologists such as Bill Markham, Don Storr, Fred Burbridge and Horace Wilson served as forecasters at RCAF base. Then in 1953 Inuit from Pond Inlet (in northern Baffin Island) and Inoucdjouac on eastern Hudson Bay were uprooted and transported to Resolute to occupy a single row of tiny wooden houses set along the beach two km west of "South Camp".

OIC had many duties

The life of the meteorologist/OIC was busy. Following the sealift, there were forecasts to prepare for the fall airlifts to Mould Bay and Isachsen Polar Continental Shelf Projects on many islands would be ended for another season and expeditions would strike camp and head south. Messages flowed in a steady stream from weather stations reporting damaged or missing supplies. Spares and replacements had to be ordered from the south and they had to be flown in before the end of October when the Polar night ended almost all flying until the follow-

ing March. Throughout the winter there was a weekly RCAF flight into Resolute, on to Alert via Thule and back. Weather en route and frequent mechanical breakdowns kept the forecaster busy most of the week. Since Resolute was near the Magnetic North Pole, reception of facsimile charts from Edmonton was poor. Mike Webb comments; "facsimile reception was often better from Orly, Paris than Edmonton."

January and February were usually quiet months. However, in 1950, long before the sun first appeared at noon on February 7, a USAF C-54 piloted by Col. Burt Balchen, touched down in Resolute. The crew were royally received by all station staff and stayed for dinner and overnight rest.

There were administrative matters to attend to and mail to be handled (the OIC was also the postmaster). Fortunately, he rarely had to exercise his duties as justice of peace or as customs adjudicator. The OIC maintained daily liaison with the RCAF base commander and with weather stations via weekly ham radio contacts. As soon as light returned in March, flights were made by C-47 Dakotas on skiis or Otters using oversize wheels, dropping 200 litre fuel drums in preparation for summer expeditions.

The spring airlift in early April was also very busy until in 1969 monthly flights to the JAWS began and there was less activity during the spring and fall airlifts. By late April expeditions would arrive and construction would begin requiring aviation forecasts around the clock. In the sixties and seventies it was common for a second forecaster to serve a short term assisting the OIC during peak periods. John Mulvenna was the first of these in Resolute, assisting Hugh McRuer in the summer of 1969.

Occasionally there were requirements for special forecasts; for the RCMP who used to travel by sled and dog team overland from Resolute to Grise Fjord; and for the RCAF when they ran an Arctic Survival school at Crystal City nearby.

The RCAF Central Navigation School arrived each spring from Winnipeg and for over a week, crews navigated to every part of the Queen Elizabeth Islands, including flights to the North Pole and back. The North Star aircraft never shut down — it was simply refuelled and supplied with a fresh crew. Parachute airdrops were arranged before Christmas over Mould Bay, Isachsen and Eureka. Emergencies and medical evacuations were not uncommon. In the fall of 1961, an Inuit youth was accidentally shot when a bullet from a .22 rifle bounced off some stones and entered his abdomen. A C130 Hercules with skiis arrived from Thule and a green-clad medical team raced to the patient. As I recall them by the bed of the startled Inuit boy, I felt I was watching a scene from TV's 'MASH'. The boy received excellent medical treatment in Thule and when he returned weeks later dressed in an RCMP outfit, he was the village hero.

Resolute has had its share of severe and difficult weather to predict: winter blizzards, wind gusts, turbulence and low stratus. "The worst blizzard I have ever experienced," said Jack McCabe "was on November 11, 1965, when the anemometer needle stayed at 140 km/h for hours. The airport manager confined everyone to barracks except radio operators, Met. Techs and essential maintenance men. When visibility hit zero, a lifeline was strung between the barracks and the operations building." Snowfall in Resolute is light compared to Southern Canada, but high winds drive snow crystals against buildings which can easily be buried in concrete-like snowdrifts.

The runway at Resolute has improved considerably since the early gravel strip days.

Programs required extra forecasters

Besides his forecasting duties, the OIC assisted by the U.S. Weather Bureau officer, managed the upper air and surface observing programs and participated in special JAWS programs. Jack McCabe enjoyed taking weekly sea ice thickness measurements with the U.S. officer. He adds, "It was a five km trip to the beach and a one km walk on the ice even in the coldest weather (down to -50°C). We took as many Met. Techs as we could muster for the trip in the Bombardier to do the drilling." The sea ice was often two metres thick. The ozone program began in Resolute in 1958 and OIC's made ozone observations until upper air technicians took over.

Around 1957, Meteorological Branch started an ice reconnaissance/forecast program. By the mid-sixties it was usual for four or five ice observers with a specially equipped chartered aircraft to come on station during August-September. In the early years ice forecasters such as Dick Hill, Art Cooper or Mike Burslem would do ice forecasting in the Resolute area. However, direct contact with ships was limited so these assignments were soon discontinued.

There were always dignitaries, scientists, government officials and "VIPS" visiting Resolute. The first women were two army nurses from Fort Churchill who visited Cornwallis Island in August 1950 and were written up in the Montreal Star. That same month saw the tragic death of U.S. Colonel Hubbard, instigator of the JAWS stations, and the entire RCAF crew in the crash of an RCAF Lancaster at Alert. Roy Woodrew recalls that, in 1960, Judge Jack Sissons arrived from Yellowknife on circuit and a High Court session was held in the schoolhouse. It was a colorful ceremony because the magistrate wore his robes, the RCMP constable his scarlet uniform and flags were displayed. Frequently the OIC was able to join visitors on flights to the JAWS, and expedition bases; and occasionally he could board a flight to Thule, Greenland for a brief visit to the weather station and the Danish aeradio station there.

OICs did not have much time for leisure and recreation. Nevertheless, they could go for long walks, curl, fish, read, play cards, photograph nature, do photo processing, spend time on ham radio, attempting to ski, tinkering with electronic equipment or doing handicrafts in the RCAF hobby shop. I myself dared become a member of the polar bear club by having a chilling dip in Resolute Bay. One feature of the early days was a small outdoor sauna built by an ingenious Finn using wooden packing cases. The interior was large enough to take three as Stu Dewar, Horace Wilson and Bill Markham discovered in April, 1951. After a suitable time in the 'oven', one experienced the thrill of towel drying outdoors at -30°C in nothing but shoes, yet not feeling cold, (only realizing one's hair had frozen solid!).

Change was inevitable

Resolute is essentially a government complex. Change is normal. Mike Webb says: "The second significant event in my tour was the departure of the RCAF as custodians of the base and airport and hence the end of the RCAF station. Their 60 men were pleased to head south as Resolute became the responsibility of the Dept. of Transport before Christmas under an airport manager with station maintenance provided by commercial contract. All RCAF facilities were turned over to DOT. In retrospect Mike says the most significant event was the drilling of a test oil well east of "South Camp". Although abandoned, it foretold a new era for the Canadian Arctic.

The period of 1960-1975 saw steady growth in exploration activities in the western Arctic Islands, so much so that a second forecaster was often sent to assist the OIC in summer. In 1972, after 25 years involvement in joint programs, U.S. personnel left Resolute. The Inuit were moved to a new settlement east of "South Camp" and there were plans for a large, modern complex to be built around the settlement. It was never completed due to lack of funds. Resolute is almost certain to expand rapidly when year-round marine transportation becomes a reality.

When meteorologist Steve Ricketts left Resolute on September 26, 1981, he was replaced by a senior qualified Meteorological Technician, Cliff Hannah. To mark this change in staffing level, a list of all meteorologists who served in Resolute as OICs, for resupply, during the summer, or as ice forecasters, was prepared from records and personal contacts and accompanies this article. What drew these men to the Arctic? For some the job was challenging and the pay great. For others it was the unique geography and climate. Eldon Oja says, "You have to live through the seasons — the light and the dark — and experience the flowers in July and the blowing snow in winter. There is something to experience in the unconquered forces of nature."

List of meteorologists who served as OICs at Resolute, N.W.T.

Aug. '47-May '49, R.W. Rae; May '49-Apr. '51, S.W. Dewar; May '51-Feb. '52, H.W. Halburt; Feb. '52-Jul. '52, S.W. Dewar; May '52-Jul. '52, J.L. Lewis; Jul. '52-Jun. '53, M.G. Hagglund; Jul. '53-Mar. '54, C.G. Goodbrand; Apr. '54-Mar. '55, K.R. Hardy; Apr. '55-Nov. '57, R.W. Longley; Jul. '57-Sep. '57, S.W. Dewar; Nov. '57-Sep. '58, R.B. McDonald; Aug. '58-Sep. '60, R.J. Woodrow; Aug. '60-Sep. '61, J.H. McBride; Sep. '61-Feb. '62, B.A. Coulcher; Feb. '62-Mar. '63, D.W. Strang; Feb. '63-Jul. '63, V.G. Beirnes; Aug. '63-Sep. '64, M.S. Webb; Sep. '64-Oct. '65, V.E. Stashko; Oct. '65-Oct. '66, H.J. McCabe; Oct. '66-Jul. '67, N.A. McFarlane; Aug. '67-Sep. '68, J.F. Stutchbury; Sep. '68-Nov. '69, W.H. McRuer; Oct. '69-Sep. '70, A. Pohl; Sep. '70-Jul. '71, C.A. Odegaard; Mar. '71-May '71, A.R. Fisher; Jul. '71-Sep. '71, L.D.F. Chu; Sep. '71-Aug. '72, C.A. Odegaard; Sep. '72-Oct. '72, H.J. McCabe; Oct. '72-Nov. '73, P.A. Lachapelle; Nov. '73-Oct. '74, R. Winterer; Oct. '74, T.J. Barluk; Nov. '74-Dec. '74, J. Tissot van Patot; Dec. '74-Aug. '75, G.D. Machnee; Sep. '75-Aug. '76, R.J. Woodrew; Sep. '76-Oct. -76, M. Shewel; Oct. '76-Sep. '77, R.D. Holham; Sep. '77-Feb. '78, M. Shewel; Feb. '78-Aug. '79, G.W. Hykawy; Aug. '79, E.D. Hoeppner; Aug. '79-Sep. '79, E.D. Holdham; Sep. '79-Aug. '80, E.J. Oja; Feb. '80-Mar. '80, C.E. Spelchak; Jul. '80-Aug. '80, D.J. Bauer; Sep. '80-Sep. '81, S.C. Ricketts.

Served as specialist meteorologists

(at RCAF base during spring re-supply, as ice forecaster during the shipping season, as assistant forecasters during the summer or fall or spring re-supply, or as Christmas leave replacement — all between May '49 - Aug. '78):

W.E. Markham, H. Wilson, F.E. Burbridge, D. Storr, D.L. Holyoke, M. Burslem, M.N. Parker, A.B. Cooper, R.H. Hill, S.M. Checkwitch, G.R. Schram, F.R. Bowkett, K.W. Daly, C.D. Machnee, W.H. McRuer, R.L. Raddatz, R.J. Lee, T.J. Barluk, E.T. Hudson, T.F. Mullane, G.W. Hykawy, P. Scholefield.

Mr. McBride is Arctic coordinator, AES Downsview and from August 1960 to September 1961 was OIC at Resolute.

AES scientists part of four nation wind experiment

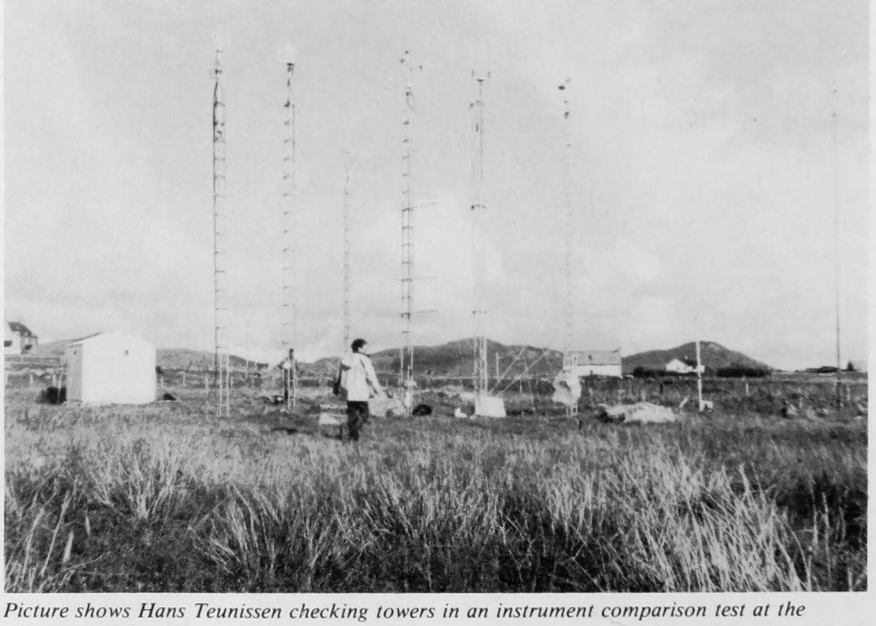
by Peter Taylor and Hans Teunissen

Askervein is a relatively isolated 126 m hill located on South Uist in the Outer Hebrides, a chain of islands located about 100 km off the northwest coast of Scotland. It is usually a fairly quiet isolated spot populated by ravens, sheep and the occasional grouse. For four weeks this fall, however, it was a scene of relatively intense activity as an international group of about 20 scientists and technicians from Canada, Denmark, Germany and the United Kingdom carried out the first phase of a two-part experiment to measure how wind and turbulence vary with location.

These field experiments, together with numerical and wind tunnel modelling of the flow, form part of the International Energy Agency Programme of Research and Development on Wind Energy Conversion Systems (WECS). The object of the exercise, which for the Canadian participants is a sequel to the Kettles Hill experiment mounted in February 1981 (see Zephyr May/June 1981), is primarily to collect field data for comparison with model predictions and theoretical studies of boundary-layer (near surface) flow over low hills. The aim is to confirm the validity of the models and theories so that they can then be used on other hills or similar terrain to accurately predict local variations in wind and turbulence. These variations are important for selecting and evaluating possible sites for large wind turbines, and they are also the key to studying such phenomena as wind forces on tall buildings and communication towers and pollutant dispersal. The experiments will also play a substantial role in improving our basic understanding of boundary layer flow in complex terrain.

In the wind energy context Canada is in the forefront of the design and manufacture of large vertical axis wind turbines (such as the 250 kw machine on the Isles de la Madeleine) and the next decade or two should see the introduction of large numbers of megawatt (1000 kw) range turbines in the windier parts of the country. AES is already involved in the selection and evaluation of sites for these large (100 m high) machines as a part of its objective to support renewable energy programmes. With available energy varying as the cube of the wind speed (i.e. if the wind speed is doubled, the energy goes up by a factor of eight) the meteorological aspects of turbine siting will play an important part in ensuring their commercial viability.

The helicopter airlifts an instrument shelter to the hilltop.



Picture shows Hans Teunissen checking towers in an instrument comparison test at the reference station.

AES is the lead agency for the ongoing Askervein project and hence is responsible for the overall planning, organization and implementation of the experiments. The project is organized on a 'task-sharing' basis which, simply put, means that each country bears the costs of its own tasks. Canada's costs are being shared by AES and the National Research Council.

This year's experiment was directed mainly toward obtaining *wind* data. It involved the deployment of two 50 m towers, one on the hilltop and one at a "reference" location upwind, eight 10 m climbable towers at various locations, and another thirty-five 10 m portable towers spaced typically at 100 m separa-

tions along two radial lines across the top of the hill. AIRsonde releases and kite flying provided additional data while one of the U.K. participants brought along a radio controlled eagle to seek out local updrafts and generally to confuse and distract us all!

The transport of towers and other heavy equipment to and from the hilltop was performed by helicopter due to the steepness of the slopes and provided an exciting spectacle for the local residents, as well as the occasional moment of anxiety for the participants. In the end, however, all lifts went extremely smoothly and we were all suitably impressed by the skill of the two pilots involved.

In addition to the overall planning of the experiment, the Canadian team (6 AES personnel and one contractor) was responsible for the operation of sonic anemometers and other instruments at the upstream reference station, as well as the collection of wind data from the hilltop 50 m tower, the deployment and operation of twenty-five of the 10 m portable towers, the operation of two standard rugged anemometer systems (U2As) and two 10 m towers equipped with three-component propeller anemometers and fast-response cup anemometers. Last but not least, they arranged for AIRsonde releases to provide temperature, humidity and wind profiles to heights of about 2 km.

All things considered, we are able to rate this year's experiment as highly successful even though the wind did not blow from the 'right' direction as often as we would have liked. It certainly rained rather more than we would have wished and operating a delicate minicomputer in the middle of a peat bog for on-line turbulence data analysis was not always easy. Nevertheless, we did get many hours of excellent data and the analyses performed to date look very encouraging. In addition, not a single participant was attacked by the dreaded local sheep tick and only a few midges (a sort of Scottish blackfly) were still around to trouble us.

Mounting a major field experiment overseas is always a headache from the logistical standpoint and we certainly had our share of shipping and customs problems. However, the rewards from this collaborative venture have so far easily outweighed the difficulties and all participants are looking forward to the second experiment next year.

Drs. Taylor and Teunissen are research scientists with the Boundary Layer Research and Aerospace Meteorology Divisions of AES, respectively.

BOOK REVIEW

Wind Waves — their generation and propagation on the ocean surface.

Blair Kinsman, Prentice-Hall, Inc. U.S.A. 1965, 676 pp. AES Library No: GC.211.K56.

Waves in the Ocean.

P.H. LeBlond and L.A. Mysak, Elsevier Scientific Publishing Company, Amsterdam-Oxford-New York, 1978, 602 pp. AES Library No: GC.211.2.L43.

by M.L. Khandekar

Here are two excellent books for those who wanted to know everything about ocean waves but — were afraid to ask.

Wind Waves by Blair Kinsman, although published seventeen years ago is still the only comprehensive book on wind-generated waves to-day and presents a very readable account of some of the classical wave generation techniques of Sverdrup-Munk and Pierson-Neumann-James. The book is highly mathematical as any good book on waves should be, however the mathematical development is clear and easy to follow; furthermore the mathematical development is amply supplemented by interesting physical discussion of results and a large number of diagrams. In addition, the book is generously sprinkled with amusing and humorous footnotes and anecdotes which make it so readable. As an example, on page 20 of the first chapter the author explains the difference between a plunging wave breaker and a spilling wave breaker using an artistically drawn schematic. As one reads, "A long swell with a steepness less than 0.005 and an offshore wind are conducive to formation of plunging breakers[16]." The number 16 leads to a footnote, "also conducive, we are told, to the absence of surfers from classes at the University of Hawaii."

The first chapter gives an excellent account of the physical properties of the sea waves, surf zones, wave refraction etc; the account is laced with interesting facts on fastest waves, highest waves and spectacular energy of the surf zones. Chapters two, three and four deal with basic hydrodynamics, techniques of wave solution, approximation for deep and shallow-water waves and capillary waves. A very good mathematical account of the classical wave analysis by Gerstner, Stokes and Crapper is given in chapter five. Chapter six deals with the pioneering development of Sverdrup-Munk theory leading to the first operational technique of wave generation and prediction. Chapter seven deals with the specification of random sea using mathematics and statistics leading to the development of a wave spectrum.

STAFF CHANGES

Promotions/ Appointments

D. Allsopp (DA-PRO-3) Data Processor, CCAA/D, Downsview, Ont.

D. Blakey (CS-3) Computer Systems Analyst, ACPS, Downsview, Ont.

B. Dugas (CS-1) Computer Systems Analyst, CCRN, Downsview, Ont.

B. Flemming (CS-3) System Coordinator, AFFS, Downsview, Ont.

D.W. Gullett (PC-2) Physical Scientist, Head, Climat. Tech. Dev., CCAS, Downsview, Ont.

S.A. Hattie (MT-5) Meteorologist, Shift Supervisor, METOC Halifax, N.S.

A. Hoeller (PC-1) Physical Scientist, Climatological Analyst, CCAS, Downsview, Ont.

F. Keyte (MT-7) Meteorologist, Program Analyst, CCAA/F, Downsview, Ont.

D. Lynch (AS-3) Head, Management Info. & Contracts, AFON, Downsview, Ont.

B. Stenton (MT-5) Meteorologist, Shift Supervisor, METOC Halifax, N.S.

K. Stewart (MT-5) Meteorologist, Project Officer, AETE, Cold Lake, Alta.

B.W. Veale (MT-5) Meteorologist, Staff Officer, Special Services, DMETOC, Ottawa, Ont.

A. Zito (CS-3) Computer Systems Analyst, CFFC, Trenton, Ont.

Transfers

E. Adamson (MT-2) Meteorologist, CFFC, Halifax, N.S.

Y. Durocher (MT-6) Meteorologist, Head, CCAA/P, Downsview, Ont.

J.R. Gillespie (CS-2) Computer Systems Programmer Analyst, ARPX, Downsview, Ont.

M.J. Newark (MT-6) Meteorologist, Head, Bldg. and Construction Research Unit, CCAI, Downsview, Ont.

Temporary or Acting Positions

D. Bentley (MT-4) Meteorologist, CFFC, Edmonton, Alta.

B. Brisebois (MT-4) Meteorologist, CFFC, Edmonton, Alta.

M. Hall (CS-4) Computer Systems Analyst, Manager Operations, ACPP, Downsview, Ont.

A. Hunt (CS-3) Computer Systems Analyst, Project Leader, ACPT, Downsview, Ont.

M.B. Lazare (MT-4) Meteorologist, Research, CCRN, Downsview, Ont.

R. MacKay (EG-3) Quality Control Tech. CCAA/Q, Downsview, Ont.

J.E. Mullock (MT-3) Meteorologist, Base Met. Instr. CFB Moose Jaw, Sask.

Departures

L.J. Marion, ACPN, Downsview, Ont. January 1983

D. Ristic, CFFC Edmonton, Alta.

Chapter eight discusses the well-known Pierson-Neumann-James technique of wave generation and prediction using the wave spectrum concept. The next chapter discusses wave measurement techniques for determination of wave spectrum. Chapters ten and eleven deal with effects of vorticity and viscosity on wave motion, wave energy and related topics. An excellent discussion on wave generation by wind follows in chapter twelve and the last chapter thirteen discusses some of the recent developments on non-linear wave-wave interactions by Hasselmann and Phillips among others.

Wind Waves by Blair Kinsman is an ideal book for an AES scientist who wishes to learn the basic developments in wind generated waves. For a scientist working in the atmosphere-ocean interface the book makes an interesting and informative reading.

The second book 'Waves in the Ocean' by LeBlond and Mysak, two well-known oceanographers of the University of British Columbia, is an up-to-date text dealing with all aspects of ocean waves ranging from capillary waves on the ocean surface to planetary waves induced by bottom topography. The book is intended primarily for graduate students in the fields of oceanography and related disciplines. The first four chapters of the book deal with various aspects of free waves (long and short wave-lengths) together with lateral boundary effects like coastal trapped waves, wave trapping by islands, wave diffraction and scattering, and waves in channels and bays. The last four chapters of the book deal with wave statistics, wave spectrum, wave-wave interaction, wave-current interaction and generation and dissipation of waves.

Waves in the Ocean is an excellent reference book for scientists working in atmosphere-ocean wave dynamics. LeBlond and Mysak have sifted a large number of research papers and reports to provide the reader with a broad but concise review of various aspects of ocean waves.

Dr. Khandekar is a research scientist with the Meteorological Services Research Branch, Downsview.