# news feature

## The McGill Weather Radar Observatory

The McGill Weather Radar Observatory, recently completed at Macdonald College, was formally dedicated on 19 August 1968 with ceremonies at which Dr. J. Stewart Marshall, Macdonald Professor of Physics and Meteorology, McGill University, was the principal speaker.

While the building and radar equipment are new, the weather observations connected with McGill University go back almost a century and a quarter. In the 1840's, Charles Smallwood, M.D., built his own meteorological observatory at his home in St. Martin, outside Montreal. In 1858, when he had accrued 12 years of records, Dr. Smallwood wrote:

"Observations for the purpose of Meteorology, are taken by the usual instruments, at 6 and 7 a.m., 2, 9 and 10 p.m. daily, besides extra hours, on any unusual occurrence. Constant tri-daily observations are also taken on the amount and kind of atmospheric electricity, also on the amount of Ozone, and likewise particular attention is directed to the phenomena of thunder storms—all of which observations are regularly recorded. Besides these daily observations, record is kept of the temperature of springs and rivers and the opening and closing thereof, by ice; also on the foliation and flowering of plants and trees, and the periodic appearance of animals, birds, fishes and insects, besides the usual observations on auroras, haloes, meteors, zodiacal light, and any remarkable atmospheric disturbances.

"Many of the instruments are self-registering and to some the photographic process may be applied, being constructed for that purpose."

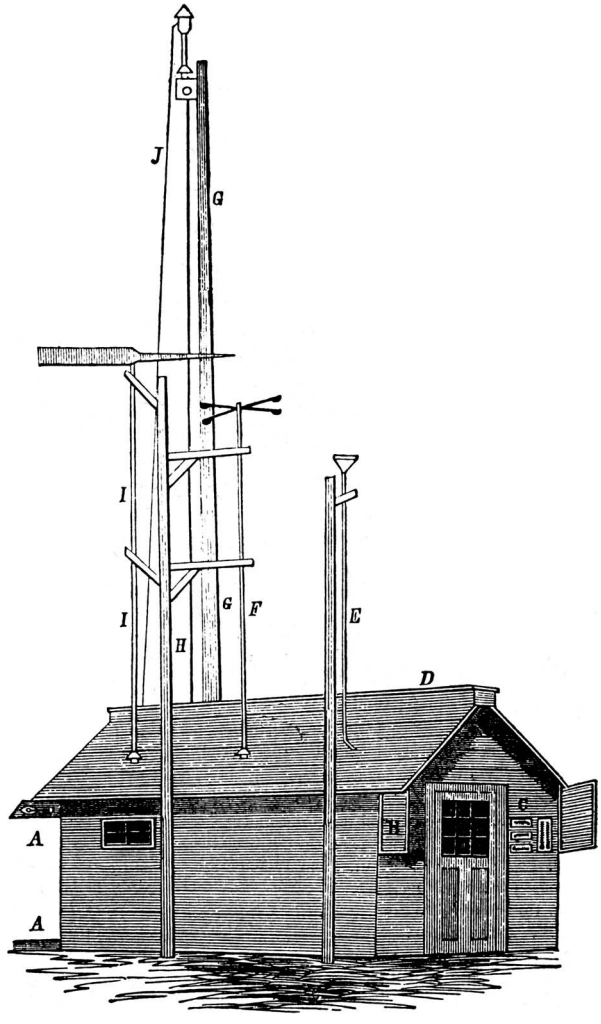
A wood engraving shows the Smallwood Observatory and the disposition of its equipment as described in 1858.

A—Solar radiation thermometer at southern end, bulb blackened with India ink. B—Venetian blinds for shading C (air temperature, dry and wet bulb thermometers) from the summer evening sunshine. D—Opening along the roof ridge allowing use of a transit telescope inside the building for time from the stars; shutters cover the opening when not in use. E—Rain gauge, receiver 13-in. diameter, 20 ft above ground; a separate snow gauge was placed at ground level in an open space. F—Wind velocity shaft. G—An 80-ft mast on which a copper lantern was raised to the top by a cord (H) for measurements of atmospheric electricity. The flame of the lantern provided the ionization around the lantern needed so that electric current could be exchanged between the atmosphere and the lantern. J—A conducting wire leads down to a gold-leaf electroscope and three electrometers. The Volta electrometer, Dr. Smallwood noted, could be rendered self-registering with great facility by the photographic process.

The inside of the building contained the recording machine for the anemometer, the transit telescope, four barometers, a quadrant and artificial horizon, a microscope for ascertaining forms of snow crystals, a chemical ozonometer, and a grounding device. All this equipment was the result of Dr. Smallwood's own handicraft.

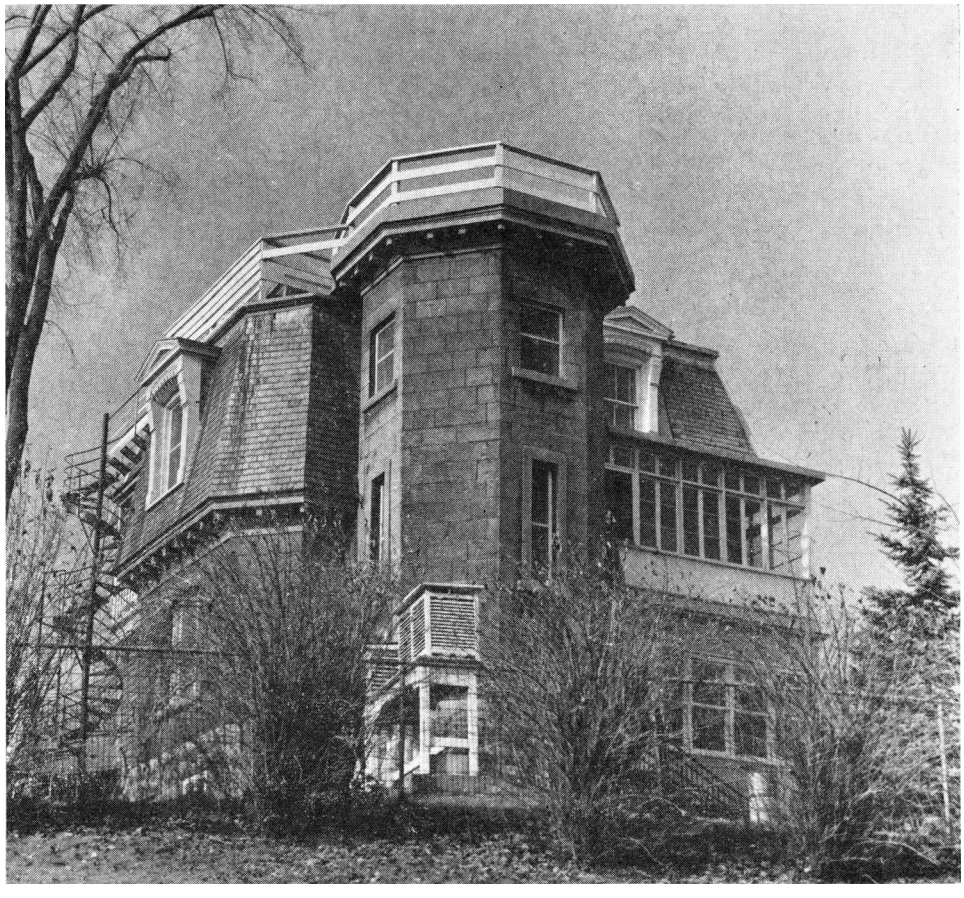
In 1862 Dr. Smallwood, by then professor of meteorology at McGill Observatory, offered to move his instruments to the University, and before the year was out the stone tower of the McGill University had been built. Until he died in 1873, Dr. Smallwood taught at McGill, implanting in younger minds the spirit of enquiry of the scientific observer and embodying in the McGill Observatory the qualities of his personal establishment at St. Martin.

The work of the Observatory went on without a break, thanks to C. H. McLeod, an assistant observer under Dr. Smallwood who became the observatory's superintendent for forty years. A house was attached to the stone tower and later enlarged to accommodate the growing McLeod family.




Wood engraving of Dr. Smallwood's observatory, 1858.

McGill Observatory before 1886.



McGill Observatory in 1962. ***Photo by D. McGregor***

The whole building was torn down a hundred years after the observatory proper was built, but the McGill Weather Observatory continues active on the McGill campus, relocated in the Physics Building.

In his address at the dedication of the new McGill Weather Radar Observatory, Professor Marshall recounts the trials and satisfactions of bringing it to completion and refers to the history of its predecessors.

## Opening of the McGill Weather Radar Observatory

Mr. Chancellor and guests:

I speak for all the members of the Stormy Weather Group and for our graduate students. My purpose is to recall our benefactors and to express our thanks. There have been benefactions of private wealth and of commonwealth, and benefactions of talents.

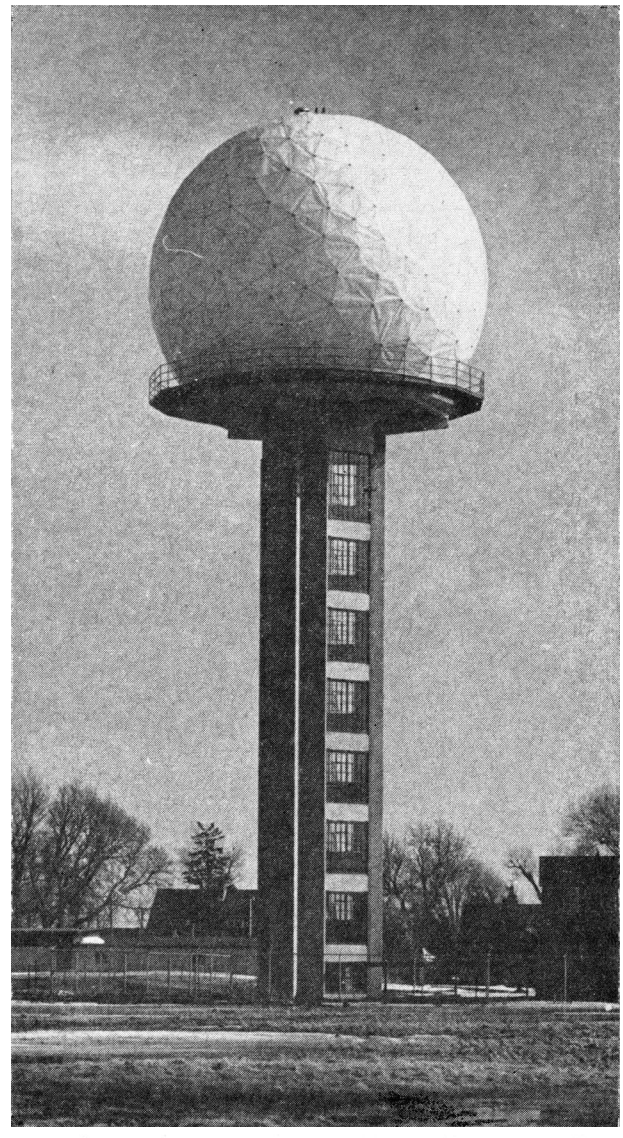
We are most aware this summer of the talents of the radar engineers, in particular those of Dick Fetter and Ernest Ballantyne, who have assembled this radar and made it sing. They in turn join with us in gratitude to the builder and to George Eber and his fellow architects, and to those sons of Martha at McGill, our directors of physical plant, Philip Gross and Douglas Elliott. Builders meriting special attention are the erection crew for the radome, who clung tenaciously to their schedule when they had little else to cling to on a windy November day. Windjamming sailors may have had their hairier moments, but not by much.

A different sort of builder again are the architects of the new McGill: Professor Winkler, Dean Frost, and the Principal. Their problem was our finances. Agencies who support research can on occasion make capital grants—for equipment, but not for buildings. A radome, yes. A tower to hold up a radar, probably. A building to house people, no. The Principal took this problem to our benefactor from private wealth, who donated by return of courier the sum of money that was really needed, which he saw in his wisdom to be half as great again as had been sought to bridge our gap.

That action was in the great tradition of the original benefactor of Macdonald College. We thank the college and Vice Principal Dion for allowing us to come among them and to join their community. If our friends at Mac see in this place any resemblance to a cuckoo egg, no mention has been allowed to cross their lips. We thank George Wright, who is responsible for buildings at this college.

Now for the radar, the lovely radar. Apart from the antenna and the data-processing devices that we are adding, the radar is an FPS-18 of the United States Air Force, made available to us by the Air Force Cambridge Research Laboratories. That has been the source, too, of the CPS-9 Weather Radar which we have used continuously since 1954. That has been the source, too, of annual contracts that over the years have provided half the finances for our research. The operational use of that radar is to the advantage of the Canadian Meteorological Service, which supports that aspect of our operation appropriately, and has undertaken so to do with this new radar.

Returning to pure research, the Canadian half of our support came in earlier years from the Defence Research Board. For many years now it has come from the National Research Council, which this year is the source of almost all of the support of our research. Well, several years ago we made application to the Council for a capital grant for a large new weather-radar installation. The Council set up a committee,



McGill Weather Radar Observatory at the Morgan Arboretum of Macdonald College, St. Anne de Bellevue, Quebec, Canada. Wavelength 10.7 cm, FPS-18 klystron transmitter 2 MW, antenna diameter 30 ft, radome diameter 48 ft, antenna axis height 112 ft above ground.

of course: Tuzo Wilson, Patrick McTaggart-Cowan, Paul Lorrain, Pierre Gendron. It was Tuzo Wilson who had suggested weather-radar studies twenty-five years ago. McTaggart-Cowan had taken an early interest as director of weather operations for North Atlantic flights, located at the new airport at Dorval. Ten years later we had come to know Pierre Gendron as a chemist in cloud physics at the University of Montreal. Paul Lorrain is a Montrealer with innate knowledge that Mount Royal has two sides so that it can support two universities, his two alma maters, working in harmony. The committee recommended in our favor, and a capital grant of $300,000 was made.

It is amazing the delays there were on our part in spending that money. Members of the Stormy Weather Group became involved in special undertakings in the changing university, and for a year or two, apart from the demands of

Alberta Hail, our research depended more on momentum and graduate students than on ourselves. That's sorted out now, as are the technical problems that arose.

For a six-month period, Dr. Walter Palmer came back to help us between vice presidencies in industrial research. Walter Palmer had graduated from McGill in 1943 in honours physics and mathematics, and to his chagrin had been directed by the wartime selective service authority to be a civilian operational research scientist in Ottawa, rather than to go to Europe. He arrived just in time for Project Stormy Weather. Because of his first time-lapse pictures of the radar scopes and his early measurements of raindrops and snowflakes, for reasons ancient and modern, he is indeed our benefactor.

Seventy years before Walter Palmer, young Bunty McLeod graduated from McGill in civil engineering. Already involved as an undergraduate in the McGill weather observations, he remained at McGill for forty-five years and pursued two parallel and complementary courses, both with distinction. There was a teaching career as professor of civil engineering, and a career as scientist-engineer in the McGill Observatory. He was its director, or superintendent as it was called in those days.

Weather observations were kept meticulously. Time was determined even more so, and a time service provided to the railways and to the nation. Experiments in conjunction with Harvard University established the longitude of McGill relative to Harvard. Experiments with the trans-Atlantic cable, borrowed for the purpose, established the longitude absolutely, which is to say, relative to Greenwich. Putting the two together, he improved, albeit slightly, the figures for Harvard, and so for the whole American continent. In his meteorological research with Howard Barnes he found that temperature changes atop Mount Royal anticipated changes at McGill by hours, by anything from 4 hours to 24. Thus he detected the passage of cold fronts and warm fronts before such things had been discovered or conceived.

Ths McGill Observatory was not built by McLeod or for McLeod, but the development of the observatory by him and his scientific career within it quite justify our referring to it as the McLeod Observatory. The anguish at seeing that century-old building torn down five years ago—is it only that?—was real to all of us, but peculiarly so to Bunty McLeod's son, Kirk, who had grown up in it, in the director's residence, had watched with admiration his father's work there, and indeed taken some part in it. Kirk McLeod interceded with the University to save the stones of the demolished building. We tried to have that observatory rebuilt here on the Macdonald campus. We failed in this, through no fault of Kirk's. We failed to incorporate the old stones in the fabric of this new and different observatory.

We have succeeded, however, in finding a spot for an observatory rock garden that can make appropriate use of the historic stones. That spot is beside our new tower, which takes its shape from the tower of the McLeod building. We have moved just a few stones to the garden site to make a bench and a base on which to mount a sun-dial. There is a plaque in the Leacock building, where the observatory stood, marking the longitude, and commemorating its establishment by Professor McLeod. Our sun-dial mounted on the old stones will provide more intimately for us a memorial of the man who counted hours of sun and stormy weather too, and kept the nation's time by the stars.

The observatory that we associate with Professor McLeod was built for Dr. Smallwood, and used for its first decade by him. But the observatory that I associate with Smallwood, and which quite captivates me, was the little wooden building that Dr. Smallwood, a medical doctor, built for himself in the grounds of his residence at St. Martin, nicely away from the city. It had an 80-ft mast, with a lantern at the top to serve as an electrode for measurement of atmospheric electricity. It had a chemical ozonometer. It had a microscope for snow crystals. It had everything for physical meteorology. And Smallwood made good scientific use of it. In 1856 he was made professor of meteorology at McGill. In 1863 the new observatory was built in the city. As I see it, Dr. Smallwood was inveigled downtown to establish its operation, and at a sacrifice to the attention that he could give to his place in the country.

Now, a century later, we in the Stormy Weather Group are being given the opportunity of the reverse move, from city to country, for part at any rate of our activities. We appreciate the possibilities of this rural interest, this Centre for Balmy Weather. And we do heartily thank our benefactors, one and all. Come to think of it, that includes all taxpayers north of the Rio Grande. Well, thank you all.