hail hunting

The Research Council of Alberta has the responsibility for organizing and operating the summer operations at Penhold as well as designing and evaluating the cloud seeding experiments. Much of the analysis of the field operations, as well as theoretical work on hailstorms and hailstone growth, is conducted by the Stormy Weather Group at McGill University under contract to the Canadian Meteorological Service. The Meteorological Service also provides broad operational support for the group in the form of forecasting services, personnel and equipment.

The National Research Council, in addition to providing the radar-equipped T-33 jet aircraft and a six-man aircraft support group, supplies the project's key piece of equipment — a ground weather radar system. NRC's Radio and Electrical Engineering Division has developed this radar to the point where its many unique features make it ideal for hail storm study. One of these is its ability to take ascending slices through a cloud to obtain a three-dimensional echo pattern of a thunderstorm. The radar has a range of 100 to 150 miles.

Snowflakes, raindrops or hailstones all serve as good targets to bounce back radar waves. The time for the echo to return to the antenna is measured electronically and then converted into a distance from Penhold. The storm's position is displayed on a circular TV screen. Polaroid pictures of the screen are taken every 20 minutes and then projected onto a large geographical map of the project area. In this way an up-to-the-minute plot of the storm track is maintained.

Another three cameras are continuously photographing other displays of the radar information. The miles of film accumulated during the summer provide the archival data records which are then used for later detailed storm analysis.

A specially-instrumented meteorological research aircraft carrying a three-man scientific team from the university of Wyoming has been used for the last three years to fly under storm clouds to make measurements in the air flow feeding the storm, just below the cloud base. Data is recorded in digital form on magnetic tapes. Pertinent information is radioed back to Penhold where it is telexed to Edmonton and run through a computer. In minutes back come graphs of the updraft, temperature and liquid water content in the storm's interior.

This data enables ground control to establish the level at which cloud seeding should take place. In a typical seeding operation Mr. Mather takes his plane up to 30,000 feet about 30 minutes before a storm is due over the area. He orbits the storm, observes its development and determines if it is seedable. If ground control concurs, and he has been given instructions on the level for seeding, he ignores the fully developed storm cloud, identified by its extreme height and anvil-shaped top or turret, in favor of the newly developing part of the storm cloud. Flying at a speed of around 500 feet per second, he has about 30 seconds to drop his flares into the top of the turret. Each flare has a one-minute delay allowing it to drop 8,000 feet before beginning a 30-second burn of silver iodide.

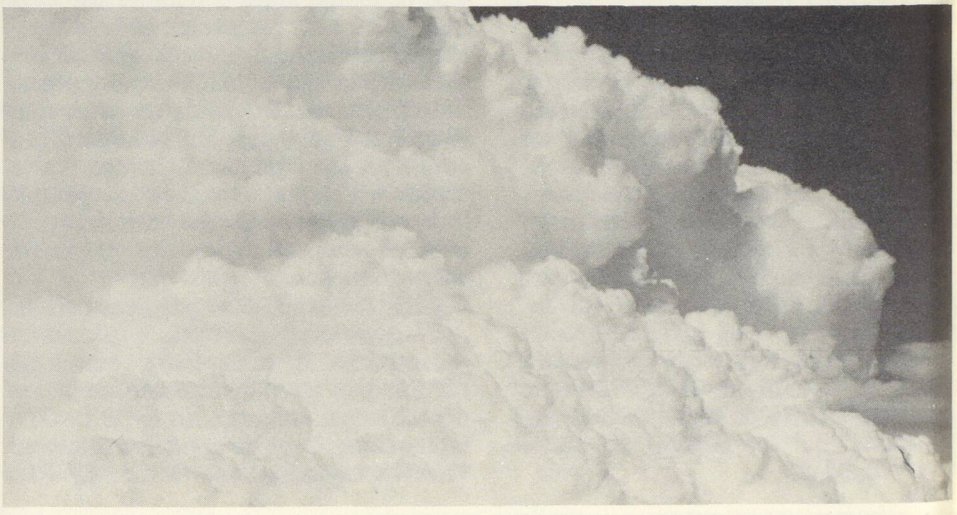
On the ground, once a storm path is predicted, a fleet of instrumented trucks is deployed along the predicted route to collect rain and hail samples and make various other meteorological measurements. They are constantly repositioned by radio information from Penhold as the storm position shifts.

Another vehicle takes up a position several hours in advance of the storm to record the phenomena that precedes a hail shower. A truck, bearing movie cameras is positioned to permit the filming of the cloud movement from a distance of 40 miles. Still another, manned by atmospheric physicists from the Saskatchewan Research Council, measures the electrical activity associated with hailstorms.

Essential to the study are reports from farmers in the area. Since 1957 over 43,000 reports detailing where when and how much hail fell in any given storm have been recorded on tape. This body of data is by far the largest of its kind in existence and has proven vital both for the basic research studies and for cloud-seeding evaluation.

Field Co-ordinator Dr. Peter Summers of the Alberta Research Council estimates that enough data is collected in one experiment to keep a laboratory worker busy for three months.

"We are now in a position to conduct some really meaningful experiments with cloud seeding," he says. "And we have the best chance of anyone in the world of detecting what effects, if any, are produced by cloud seeding."



Above, Aerial photograph taken by T-33 crew of new storm development, right foreground, just before seeding. Below, the new development on southern flank of storm just after seeding.

En haut, photographie, prise du T-33, de la partie en "choux-fleurs" qui va recevoir l'iodure d'argent.
En bas, vue de la même partie du nuage après action de l'iodure d'argent.