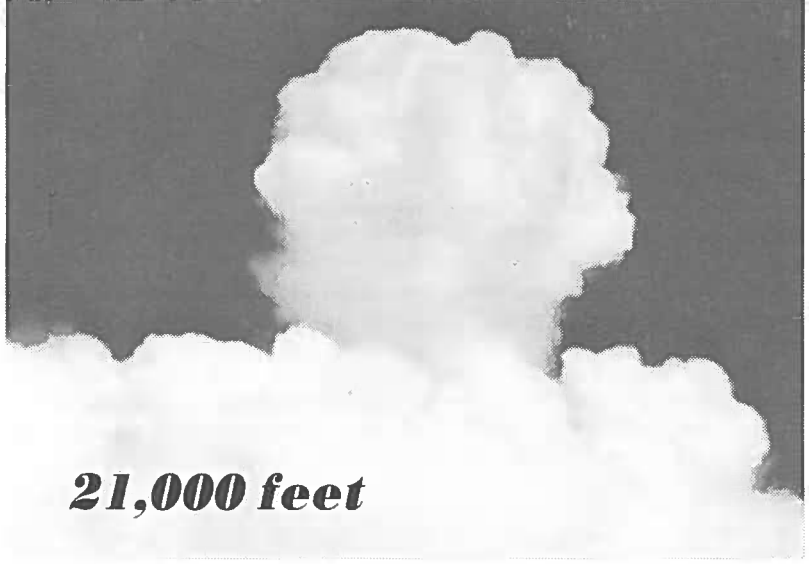
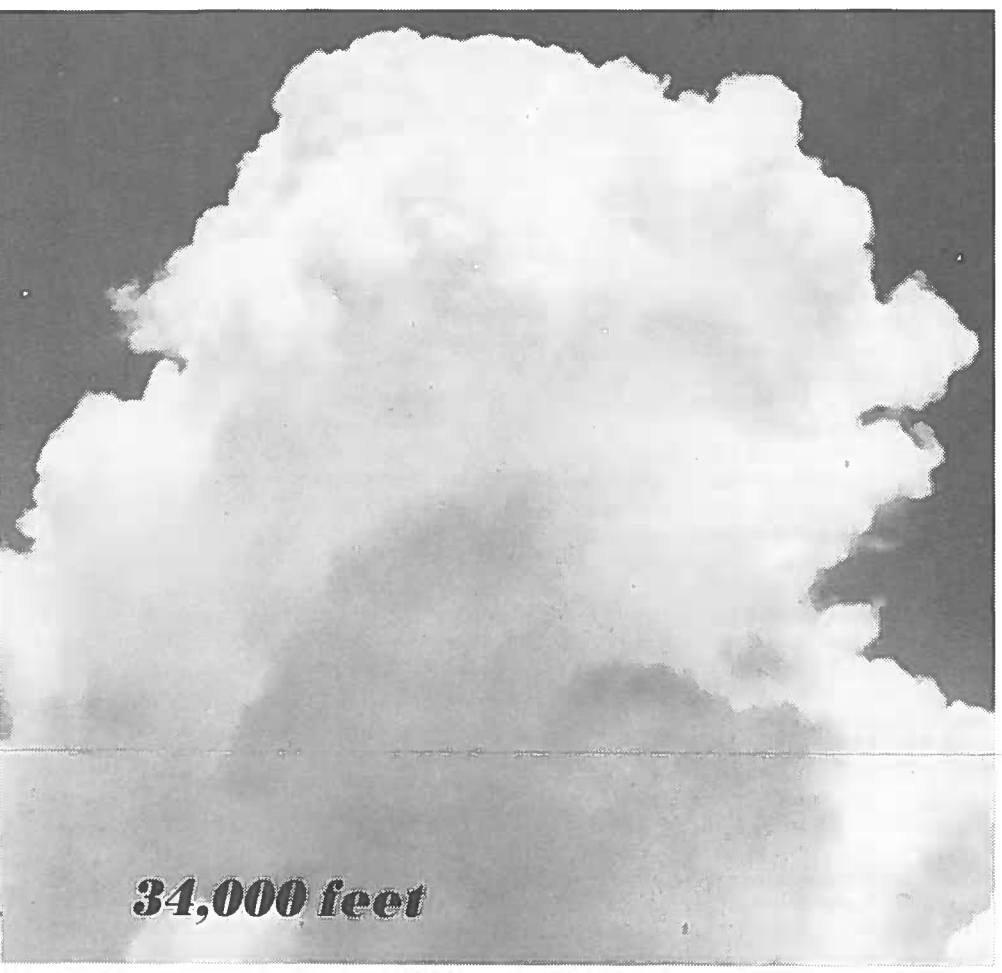


This fluffy white cloud about 21,000 feet above Florida Everglades puts out a "bubble" after being seeded with silver iodide crystals.



Nine minutes later, the top of the cloud had risen to about 34,000 feet, says Environmental Science Services Administration, which made the test.

Rain Clouds Can Be Made to Grow!

By Ferdie J. Deering

Editor & Manager,
The Farmer-Stockman

NEARLY TWO years ago the current drouth was forecast in The Farmer-Stockman by our long range weather forecasting service, Dr. Irving P. Krick and associates. They have been providing reliable weather information for our readers for more than 25 years.

So we asked Dr. Krick how long the drouth might be expected to last. His reply caused us to conclude that something ought to be done about the weather. Dr. Krick said:

"In our opinion this drouth started in 1970 and will continue to spread, probably peaking out around 1975. Characteristic signs are readily apparent in areas such as western Oklahoma, West Texas, and southern New Mexico. We anticipate the drouth, as it develops, will spread northward and eastward, working on up into states as far north as Illinois."

Southern California had the driest January, February and March in some 80 years and Florida has been trying to increase rainfall to keep rivers flowing into the Everglades to save birds and animals. The drouth already is extensive and, if it should be prolonged as Dr. Krick's calculations indicate, we face a serious time ahead.

FEDERAL AID, in the form of loans, grants and cut-rate livestock feed, has been made available in many counties in the drouth areas. A recent issue of U.S. News & World Report quoted D. W. Fryrear, director of the USDA soil and water research station at Big Spring, Texas, as saying "the prospects are that we're going to hit some pretty dry periods in perhaps five of the next seven years."

Newsweek magazine quoted John White, Texas agriculture commissioner, as saying "It may be the worst drouth in our history."

Municipal water supplies are being rationed in numerous cities and towns this summer, and many of them face critical shortages. Their lakes and ponds are filled with runoff water from pastures and fields, and in many areas there just hasn't been enough rainfall to produce substantial runoff. One rancher joked: "Out our way, we'd need two inches of rain just to make it run off the black top road!"

The city of Lawton, Okla., which had a successful experience with cloud seeding by Krick's firm in the 1950s and 1960s decided to try again, but with a newly formed company. For various reasons, apparently, the project missed favorable cloud seeding opportunities during the spring rainy season.

An editorial in The Lawton Constitution and Morning Press said: "It should be apparent to all by now that the City Council made a mistake when it hired a local group to conduct weather modification operations in the Lawton area this spring." It went on to say that in view of the "disappointing performance" the council "would do well to cancel this contract and again consider hiring a firm experienced in the art of rain making."

A SOUTHWESTERN Oklahoma rancher made a deal with a Coloradoan who declared his mission was to help subdue the drouth. The rancher agreed to pay $250 if the efforts produced at least 1.5 inches of rain within 15 days on his ranch. At last reports, he had not had to pay, although the rainmaker was proposing to contract rain for all of Jackson county at 10 cents per acre.

In Florida and also in various parts of Texas, efforts were being carried on to produce rainfall by cloud seeding from airplanes, a method declared

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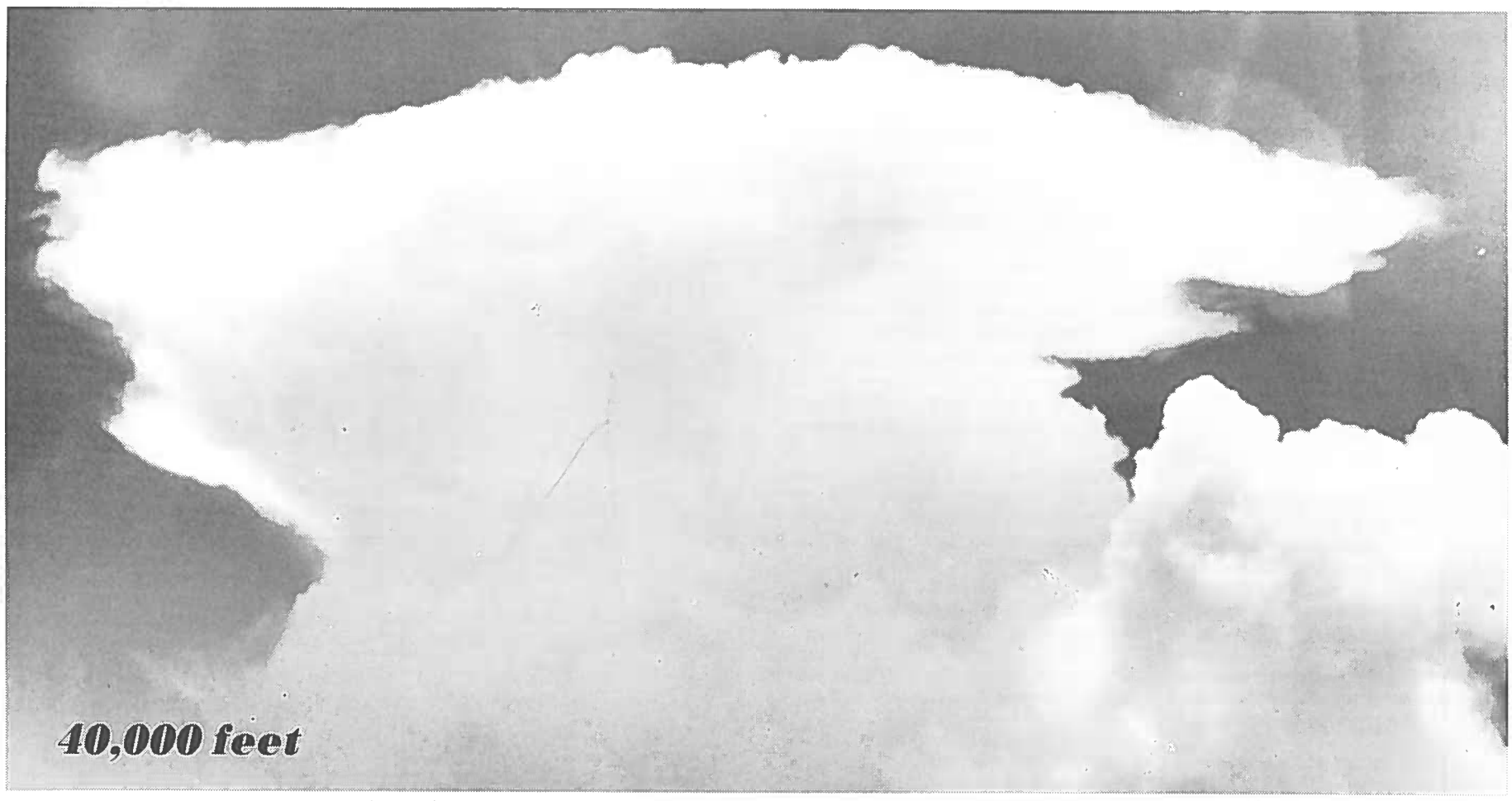
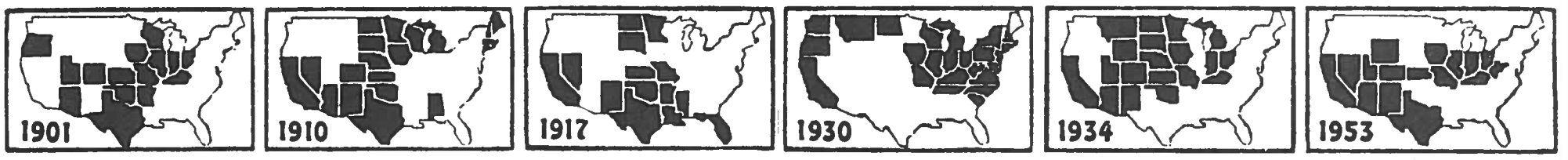


Forty minutes after seeding from a plane, this cloud had reached 40,000 feet, where jet wind had leveled the top into anvil shape.



Major Drouth Areas: Black areas show where annual rainfall was less than 85 percent of normal.

Maps prepared by Dr. Irving P. Krick and Associates

Cloud Seeding

Continued from opposite side

inappropriate for economically sound large scale operations by meteorologists more than 20 years ago. Not that silver iodide crystals, the materials principally used as nuclei to produce moisture condensation in convective cumulus clouds, cannot be distributed by plane; they can be. But only under limited conditions.

"Seeding operations 24 hours each day are impossible when seeding with aircraft," said Water Resources Development Corp., Pasadena, Calif., in 1950. "When conditions are most favorable for seeding, they are most dangerous for flying." Subsequent experience has shown this to be the case, and use of ground generators properly located to take maximum advantage of seeding opportunities at lower cost are now the more acceptable method.

Nevertheless, on June 23, it was reported that two Air Force C-130 planes had been flying daily cloud-seeding missions since June 6 in an experimental project to stimulate rainfall. Francis X. Tobin, an official of the executive office of the President, said that the government is not claiming that the missions have resulted in additional precipitation but noted that the San Angelo, Texas, reservoir which was dry in early April, contained 16,000 acre-feet of water.

SUCCESS HAS been claimed for a federal weather plane in cloud seeding operations in Florida this spring. Meteorologist Joanne Simpson reported that thunderstorms followed cloud-seeding flights over South Florida early in May but the rain failed to break a record drouth or douse a 15,000-acre brush fire west of Miami.

Still she said: "It looks as if we have been very successful. We tried to get the rain to hit that fire near Miami but the clouds just wouldn't co-operate." This project also is called experimental.

An interesting experiment was reported recently by Energy Systems Division of Olin Corp. near St. Louis in southern Illinois. Technicians there had observed a visible plume of smoke from an intentional fire on their premises develop into a cloud with sufficient activity to cause rain and cloud-to-ground lightning.

Subsequent experiments confirmed the observation. In one case condensation occurred at 5,000 feet and the resulting artificial cumulus cloud measured 2600 feet in diameter and 1600 feet thick. Materials involved in this test were magnesium oxide particles, which apparently performed a function similar to that of silver iodide crystals. This does not prove that rain clouds can be formed, but it does demonstrate the effectiveness of certain nucleating materials.

In tests at the University of Denver, some 75 different compounds have been tested as cloudseeding nuclei, and 22 were reported to be effective.

IN THE 1950S, the City of Oklahoma City contracted with Water Resources Development Corp. to alleviate a critical water reserve shortage. When cloud seeding started March 15, 1955, Canton reservoir held only 1,411 acre feet of water. Three months later impounded storage was figured at 56,200 acre feet. A few days after termination of the contract, when water from the upper part of the drainage basin had reached the reservoir, storage amounted to 119,000 acre feet.

Two other Oklahoma City lakes also were filled prior to the end of the 3-months cloud seeding contract. Cloud seeding was accredited with 25 percent of the total gain, or about 50,000 acre feet, obtained at a cost of about 50 cents per acre foot.

As of Oct. 1971, the Big Bend Water Development Corp., Connell, Wash., will begin its 22nd year of continuously operated weather modification. Acting Secretary Ben F. Klindworth stated that officials feel they have had an average 20 percent increase in rainfall in the 220,000-acre project area.

The basic potential of cloud seeding to increase rainfall has been well known for more than a quarter of a century. In 1951, General Electric scientists were quoted in U.S. News & World Report: "There is no doubt whatever that heavy local rainfall can be brought about by seeding suitable clouds."

The distinction between making clouds and increasing rainfall from available clouds should be noted. In 1950, Dr. Irving P. Krick declared: "No one can make it rain when it isn't going to rain anyway. What the trained meteorological scientist can do is to help nature along by increasing the volume of rainfall available from any favorable cloud formation."

THE U.S. WEATHER bureau, now the National Weather Service, has resisted, denied and ridiculed the entire idea for years, and is widely regarded as being largely responsible for delaying application of weather modification knowledge.

In 1961, Congress authorized the Bureau of Reclamation to assume central responsibility for studying weather modification. Since then many millions of dollars have been spent on contract research projects, verifying what had been stated earlier, but to date the Bureau has not announced any plans for immediate use of what it has assembled in its voluminous research reports.

Much of this information has been published in a 531-page report titled "Project Skywater" (REC-ERC-71-2), available from Bureau of Reclamation, Division of Atmospheric Water Resources Management, Denver, Colo. It was briefly reviewed in the July 1971 issue of The Farmer-Stockman.

Earlier, April 10, 1971, to be exact, a news story from Washington quoted James L. Kerr, specialist in the Bureau's Atmospheric Water Resources Management program, as saying "it will be 1990 before rainmakers will be able to perform reliably in any part of the country."

Elsewhere in the same story, it was noted that the Bureau is increasing rainfall on a limited scale in experimental projects in several locations. Meanwhile, the Bureau's expenditures are running about $6.5 million per year to keep the research going.

IN A SPEECH delivered at Denver June 15, 1971, before the annual conference of the American Water Works Assn., Dr. Krick challenged the justification for the delay in application of research results. He said:

"It would appear that the lag in government acceptance of weather modification until the later 1960s has not given the various agencies involved sufficient time to carry out the necessary research and development, the training of personnel and other requirements to match the skill and experience available within the private sector of weather modification."

He cited evidence from operating projects where benefits are running as high as 200-to-1 in some agricultural areas. He also noted that benefit-cost ratios of the same order have been attained in municipal water supply, power production and forestry.

Editors of The Farmer-Stockman have examined much, but certainly not all, of the evidence that might be available on this subject. Here are our observations to date:

- 1. A need exists for continuous weather modification programs;
- 2. Research indicates the potential value of such a program;
- 3. To succeed, cloudseeding must be established on a long range basis, probably several years, over a wide area, probably several states;
- 4. Financing must be arranged for on a long-range basis;
- 5. Experienced private firms are available to do a good job.

(To be Continued)

from New Mexico

Cloud Seeding Eased Drouth

THE DROUTH of 1971 was considerably eased in northeastern New Mexico as a result of cloud seeding from ground generators. This is in an area where weather modification work has been going on for 21 years under direct contract between farmers and ranchers and Irving P. Krick, Inc.

While all other areas of New Mexico remained dry in June 1971 (as were large parts of Texas, Arizona and Oklahoma), cloud seeding was credited with bringing moisture to this local area, approximately 100 by 150 miles.

It was explained that cloud seeding over dry areas in the late spring and summer set up mechanisms for repeatedly recycling moisture once natural thunderstorms occur. The seeding process tends to amalgamate individual local storms into a broader, more widespread rain pattern. This process wets down large areas, subsequently providing moisture by evaporation which is then recycled as new storms occur.

This method, which had been developed in the drouth of the 1950s, was begun in April 1971 and initial moisture for evaporation and recycling had been obtained prior to the grass-growing season, which normally begins in June in the area.

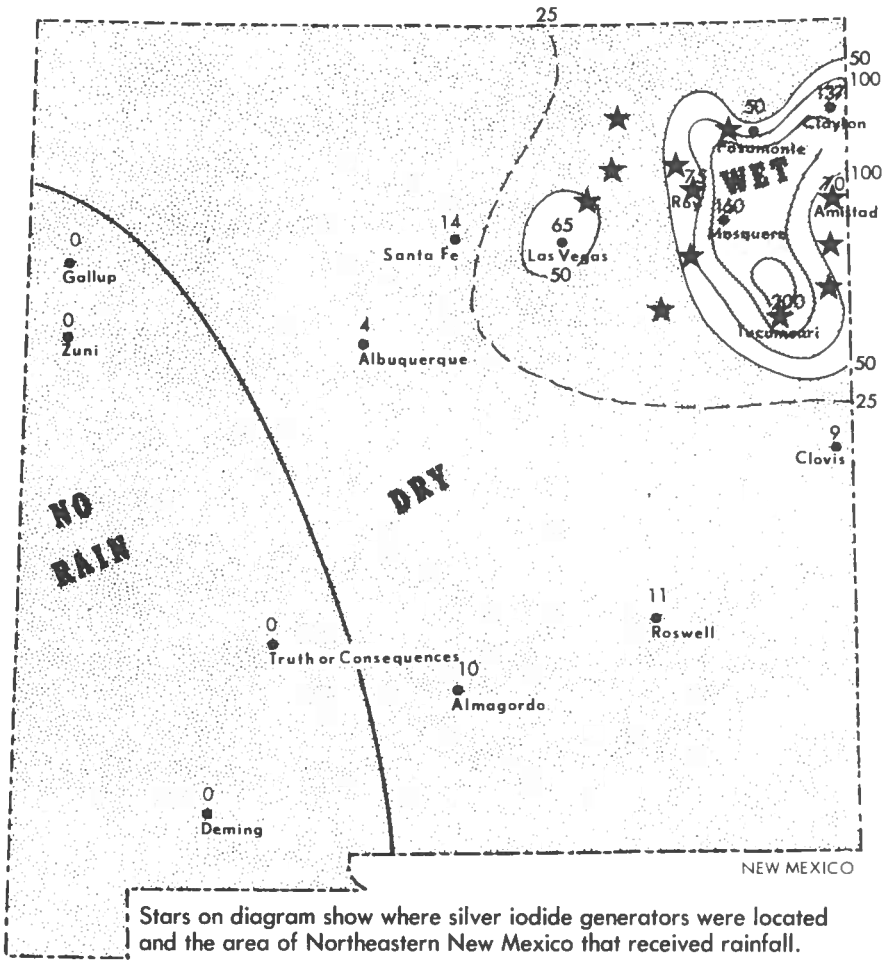
The effects of the operation extended some benefits to areas in the Texas and Oklahoma panhandles because the local squall lines developed from the seeding moved eastward under the influence of upper air streams.

Details of the operations show that some of the generators were used on only nine days during April. These produced precipitation ranging from a trace to 1 inch.

During May, more generators were used and on more days, producing two rains of 1/10 inch, one of 1/4 inch and one the latter part of the month of more than 1 inch.

The payoff came in June, when opportunities came to utilize all of the generators at one time or another. These efforts yielded 1/10 inch June 3-5; 1 inch June 8-12; 1 to 2 inches June 14-20; and 1 to 2 inches on June 30.

Results obtained in this operation were not unexpected, as they followed the patterns established in prior research and field experience, spokesmen for the weather modification group said.



Stars on diagram show where silver iodide generators were located and the area of Northeastern New Mexico that received rainfall.