

THE RISE AND FALL OF THE SOUTH DAKOTA

WEATHER MODIFICATION PROGRAM

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ABSTRACT

There has been much interest in weather modification in South Dakota since the late 1940's. In 1971 the state legislature initiated an active statewide operational cloud seeding program for the purpose of providing a net economic benefit to the state. The 1976 legislature failed to appropriate funds to continue state support of the program.

Since the South Dakota program has been viewed by many as a model operational program it seems to be appropriate at this juncture to explain to the scientific community how this program developed, was organized, and what caused its demise, albeit a temporary setback.

This is not a technical paper. Rather it is a discussion, largely, of the legislative history of the South Dakota program and its dependence upon public opinion and political whim. The reader should keep in mind that 1976 is an election year!

INTRODUCTION

South Dakota's weather modification program, as we know it today, started in 1971. In reality, however, it started long before 1971. We must go back to the early 1950's. We must talk about South Dakota's Mr. Weather Modification - Mr. Marion Bruce. We must consider the contributions of Senator Francis Case. We must look at the contributions of the Institute of Atmospheric Sciences. All of these things were integral parts of what led to what we think of today as South Dakota's weather modification program.

BRIEF HISTORY OF CLOUD SEEDING IN SOUTH DAKOTA

In the late 40's and early 50's there was much cloud seeding activity in the Great Plains. Indeed, in the early 50's as much as 50% of the state of South Dakota was "under cloud seeding". These early projects were financed by voluntary contributions from farmers and ranchers, and some city folks. The primary supplier of cloud seeding services during this period was Dr. Irving P. Krick. The technique employed - ground based silver iodide generators.

A South Dakota farmer became interested. There was, in his judgement, a possibility of increasing the rainfall in this state and nothing was going to stop Marion Bruce until he accomplished his task. He became the "in-house" authority. His efforts had much to do with the first weather modification legislation in South Dakota which was enacted by the 1953 legislature.

This initial legislation created the South Dakota Weather Control Commission and instructed the Commission to promote and regulate cloud seeding activities. Marion was appointed to the Commission, serving for nearly 20 years.

In the early 50's Senator Francis Case became interested in cloud seeding. He actually promoted a few experiments with dry ice in the Northern Black Hills of South Dakota. Although the experiments were not conclusive, Senator Case believed this technology had potential. As a result he returned to Washington to promote Federal support of weather modification research.

Weather modification activities continued in a spotty manner throughout the 1950's and into the 1960's. Through the mid 50's there was no governmental support of cloud seeding activities. Consequently all activities continued to be supported through voluntary contributions. In 1955 the legislature amended SD Compiled Law 10-12 by adding Section 18 which provided authority to each county to levy up to one mill on assessed valuation for support of weather modification activities.

From 1955 numerous counties took advantage of this authority, some joining together to form contiguous blocks of counties to conduct cooperative cloud seeding programs. In the late 50's and into the mid 60's more contractors became active and the cloud seeding techniques were becoming more varied and sophisticated.

An airborne acetone generator had been developed by an airport operator in Montana, Ora Lohse. The generator wasn't terribly reliable in the early days but persistence and fortitude and imagination paid off - airborne dispensing of silver iodide became the dominant application technique.

Senator Case's efforts began to bear fruit. In 1958 his Cloud Seeding Modification Act of 1957 became law. In 1959 the South Dakota Board of Regents established the Institute of Atmospheric Sciences at South Dakota School of Mines and Technology, and in 1961 the first Federal funds were made available to the Institute of Atmospheric Sciences for research in weather modification. A modest research effort continued through 1962 and accelerated in 1963 as a result of an additional Federal grant in the amount of \$95,000.00.

Dr. Richard A. Schleusener was appointed as the first Director of the Institute of Atmospheric Sciences in 1964. Staffing of the Institute commenced immediately and research efforts were stimulated still more as a result of a \$200,000 Federal grant in 1964, a \$425,000 Federal appropriation for FY-66 and a \$500,000 appropriation for FY-67.

The Institute's major research effort began the summer of 1966 with the implementation of the massive, one summer, cooperative effort which was named Project Hailswath. This was an intensive effort by university groups, Federal

agencies, and private organizations from all over the country to study the characteristics of Great Plains thunderstorms which was beautifully developed and coordinated by and through the Institute of Atmospheric Sciences.

Following Project Hailswath the Institute developed several research projects, perhaps the best known of which is the Rapid Project, which were actively pursued until the early 1970's.

Through 1970 over \$3,800,000 in Federal funds were invested in South Dakota to study Great Plains summertime cumulus clouds and thunderstorms and to develop weather modification techniques. Most of these funds came from the U. S. Bureau of Reclamation but substantial funding was also provided by the National Science Foundation, the Department of Defense (mostly the U. S. Navy) and the National Atmospheric and Space Administration.

The Institute of Atmospheric Sciences research efforts from 1966 through 1970 produced results which were most encouraging. These results plus encouraging research results which continued to pour in from all over the world quite logically led to thoughts of utilizing this technology to obtain economic benefit. Studies showed that if rainfall could be increased by an inch or so during the growing season the cost/benefit ratio was well in excess of 1 to 10 and if hail damage could be significantly reduced the benefits would obviously be most dramatic.

Most of the scientific evidence indicated that cloud seeding could increase rain and decrease hail damage and that an economic benefit could be derived.

PRELIMINARY PLANS FOR A STATEWIDE PROGRAM

In December of 1969 the Weather Control Commission instructed the Institute of Atmospheric Sciences to develop a plan for an operational weather modification program to increase precipitation for the state.

In February of 1970 individuals representing diverse sections of the South Dakota economy were invited to review the possibilities of such a program and to give direction in its formation and eventual implementation. From those assembled, the South Dakota Water Development Association was selected to coordinate efforts for the logical development of the proposed program.

On April 20, 1970, the Executive Committee of the Legislative Research Council agreed to include this program as one of its studies for the year and on June 15, 1970, the Agriculture and Conservation Committee of the Legislative Research Council heard the initial testimony in support of a statewide weather modification program.

Again, on September 14-15, 1970, the Agriculture and Conservation Committee of the Legislative Research Council held a second hearing at which lengthy and detailed testimony was presented, mostly in favor of a statewide operational program.

At both hearings the primary testimony was presented by the Institute of Atmospheric Sciences with much supporting testimony from representatives

of agriculture and water oriented groups as well as representatives of the political arena, including the Governor and a state senator who was to become Governor.

Finally, on October 12, 1970, the Committee met and gave final approval to the legislative amendment to the existing weather modification law in which "the Weather Control Commission is directed to carry out a statewide program..." of precipitation management with the goal of providing net economic benefit to the state of South Dakota. This amendment also appropriated \$100,000 in state funds for the purpose of developing the proposed program.

Following due and proper consideration of the proposed legislation by the South Dakota Appropriations Committee and subsequent approval by that Committee the bill (HB 550) was introduced and approved by at least a 2/3 majority of both houses of the legislature, as must all special appropriations bills, on March 17, 1971.

A landmark decision was made.

DEVELOPMENT OF THE STATEWIDE PROGRAM

On March 29, 1971, the Weather Control Commission held its first meeting to begin the process of selecting a Director. At the Commission meeting held April 14, 1971, that decision was made.

Mr. Merlin Williams, a native South Dakotan, was chosen to be the first Director of the first statewide weather modification program ever to be attempted - an awesome task.

For the record, the membership of the Weather Control Commission which made these historic decisions was:

Mr. Marion Bruce, Chairman
Mr. Burton Ode, Vice-Chairman
Mr. William Schroeder, Secretary
Mr. Emil Carstensen
Mr. Gladwin Paulsen
Mr. Art Holsing
Mr. F. Stearns Tait
Mr. Harold Dean
Mr. Joe Grimes
Dr. Duane Acker

Membership of the Commission was composed of 7 members, appointed annually by the Governor, and three permanent members: The Secretary of Agriculture (Schroeder), the Water Resources Engineer (Grimes), and the Dean of Agriculture at South Dakota State University (Dr. Acker).

The Commission was attached to the Department of Agriculture, for administrative purposes, but maintained full authority to direct the design and development of the newly authorized statewide program.

On July 1, 1971, four new appointments to the Commission were made by the newly elected Governor Richard F. Kneip. The new appointments were:

Mr. Theodore Lerew
Mr. Walter Kleinlein
Mr. Palmer Bader
Mr. John Donnan

LEGISLATIVE SESSION OF 1972 (FY-1973)

Mr. Williams, the newly appointed Director of the Weather Control Commission, assumed his position September 1, 1971, and immediately began planning and designing the statewide program for the summer of 1972.

In developing the program the philosophy of "grassroots" support was strictly adhered to. Every attempt was made to contact, inform, and obtain the active support of agriculturally oriented organizations, water oriented organizations, and the South Dakota County Commissioners Association.

Counties were invited to consider participation in the proposed program. To insure local input and control it was proposed that one county commissioner from each participating county serve on the Weather Modification Advisory Committee. It was proposed that each Advisory Committee member would, in effect, have complete control over cloud seeding activities over his county.

In the fall of 1971, the Weather Control Commission established a county/state cost share ratio of 25% county/75% state. The Director was instructed to inform all counties of this decision. Since SDCL 10-12-18 was passed in 1955, amended in 1963, and again in 1969, which authorizes, "the board of county commissioners to levy a tax of not to exceed one mill upon assessed valuation...." or "counties which have sixteen million dollars or less in assessed valuation... may levy... not to exceed two mills...." for conducting a program of weather modification, the Weather Control Commission decided it fitting and proper that those counties desiring to participate in a state supported program should contribute financially to the effort. It was further recommended that the county assessment be based strictly on an assessment by acre. As plans progressed the Weather Modification Advisory Committee was given the prerogative to decide upon the "formula" to be used to establish the county assessment and for simplicity the Committee agreed to the straightforward cost per acre per county without regard to assessed valuation or ability to pay. While inequities were recognized to exist in this plan it was the most clear cut plan to implement and thus was accepted. (Subsequent attempts to change this assessment formula to make it more equitable have been resisted by the Advisory Committee to which the Commission delegated the decision making authority).

The county commissioners governing all 67 of South Dakota's counties were contacted and invited to consider participation in the state program.

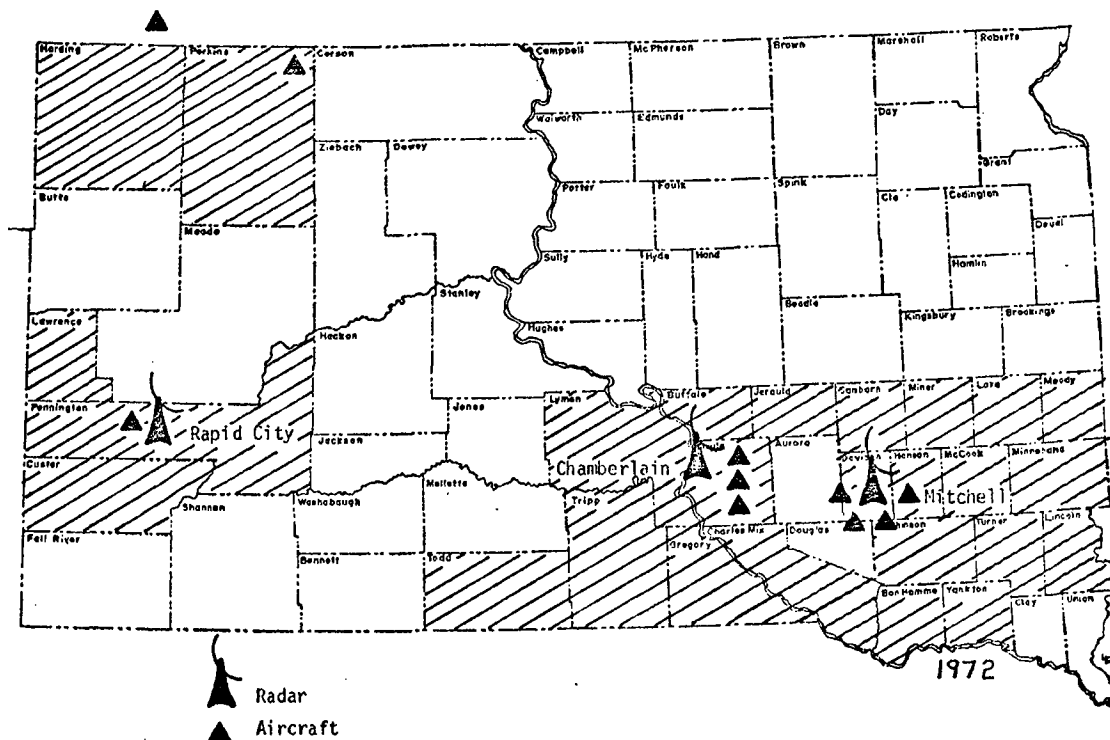


FIGURE 1

Of those, 26 agreed to participate. Contracts were duly drawn and signed between the Weather Control Commission and each county commission, which effectively constituted a contractual agreement to commit a share of the funds to conduct cloud seeding operations from May 1 to August 31, 1972. It was understood that no county funds were to be designated or used for administrative support of the Weather Control Commission or the Division of Weather Modification.

Of the 26 counties which entered into contract with the Commission in 1972 most of them (21) constituted a nearly solid block of counties in the south central and southeastern portion of the state. (See Figure 1.) In addition a block of 3 counties in the Black Hills and 2 large counties in the northwestern corner made up the remainder of the participating counties - constituting a combined land area of 17,181,000 acres.

In addition to these 26 counties there were 7 counties in the north central part of the state which constituted a solid block of 4,893,000 acres which expressed an interest in participation in 1972.

The 1972 legislature considered and passed an appropriation measure (SB 192) in the amount of \$250,000 to support the proposed 1972 operational program and the administrative functions of the Weather Control Commission and the Division of Weather Modification for FY-73. Again, this bill was introduced as a special appropriation which required support of 2/3 of both houses of the legislature.

The amount appropriated was insufficient to meet the requests of all counties expressing an interest in participation. The decision was made to provide full scale funding to District 1 (Mitchell area), District 2 (Chamberlain area) and to provide supplemental support to ongoing county programs in District 4 (Black Hills) and District 5 (northwest). District 3 representatives (north central) agreed to develop the administrative organization but to forego field operations until 1973 when adequate funds might be made available.

Cost-share funds from the 26 participating counties amounted to approximately \$90,000.00, resulting in a total budget of about \$340,000.00. These funds were intended to provide support for the operational program (May 1 - August 31) plus support of the Division of Weather Modification and Weather Control Commission throughout FY-1973 (July 1, 1972 to June 30, 1973). Cost of the operations was shown to be 3.2¢ per acre.

In February 1972 Mr. Martin Schock joined the Division of Weather Modification staff as Assistant Director.

Contracts with private operators for equipment and personnel were awarded in March in preparation for field activities during the period May 1 through August 31. Aircraft acquired under these contracts were of the turbocharged, light twin-engine type, fully equipped for high altitude and instrument operations. Complete navigation equipment provided the capability for day or night, all weather flights to meet the proposed requirement for seeding operations at any time. Each of the three aircraft provided to each complete district was equipped with both acetone-silver iodide type generators with a capability of dispensing silver iodide at a rate of 150 to 300 grams per hour and pyrotechnic devices capable of dispensing 200 grams per minute. Thus, a wide range of capabilities was provided for two types of seeding materials to permit either rainfall increase or hail suppression activities. Aircraft safety was stressed throughout the contract specifications.

Equipment contracts also provided for radar equipment with multiple capabilities. One radar system was located in each complete district with the capability for both storm monitoring and aircraft tracking. Radar storm surveillance provided the capability to detect storm characteristics, determine hail potential, provide seeding direction and coordination and provide continuous recording of all radar information by time lapse photography. In addition, each radar system included standard observing instruments for measuring meteorological parameters.

The requirement for experienced personnel was stressed in both the radar and aircraft contracts. A fully qualified individual with an academic degree in meteorology and experience in radar and/or weather modification work was provided for each district. A radar operator was provided by separate contract to assist the meteorologists at each site, and an electronics technician was provided to maintain and calibrate all radar systems. Three instrument rated, commercial pilots were provided for each site. Basically, these criteria have been followed each year.

All equipment and personnel were ready to begin operations on May 1; however, above normal rainfall resulting in difficulties to farming operations just prior to the strating date necessitated a delay. This circumstance provided a major test of the effectiveness of the organizational structure which utilized decision-making inputs from local coordinating committees. Normal operations required a full coordinating committee meeting once a month during the season with a telephone poll of each district representative once a week to determine recommended operations. On May 1, all district representatives except one requested that nothing be done to aggravate a situation where excessive rainfall was hampering farm operations. (It should be noted that the representative from Gregory County consistently requested full operation on the basis that the additional rainfall should be obtained whenever possible.) The suspension on rain enhancement activities extended throughout most of May and June, and periodic suspension of rain enhancement activities continued throughout most of the summer.

Crop development by mid-May had reached a stage where the occurrence of hail would cause damage. Accordingly, the Coordinating Committees were consulted regarding the advisability of initiating hail suppression at any time a clear cut indication of hail potential was identified. This action represented a departure from the original plan, and was made possible only by the flexibility provided by the local-state cooperative organization.

Excessive rainfall was not the only operational problem during the summer of 1972. The Institute of Atmospheric Sciences was still conducting research activities in the Black Hills area from the 1st of June through the middle of August. Therefore, the Division of Weather Modification and the Institute of Atmospheric Sciences entered into a three way contract with the Black Hills District (District 4) for a cooperative effort for the month of May after which the Institute of Atmospheric Sciences conducted daylight research operations for the remainder of the season, except as restricted due to the disastrous flood which occurred on June 9, 1972, in the Rapid City area. The radar shown in District 4 (Figure 1) was provided by the Institute of Atmospheric Sciences.

Contractors for the 1972 season were Atmospherics, Inc., Weather Modification, Incorporated, Lawrence B. Youngren and Raymond Kolb who, collectively supplied two radar units, nine cloud seeding aircraft and the necessary personnel to conduct the operations.

Mr. H. Robert Swart, the radar meteorologist at Chamberlain during the 1972 season, joined the Division of Weather Modification staff on September 1, 1972.

LEGISLATIVE SESSION OF 1973 (FY-1974)

Even before the 1972 season was completed plans for the 1973 season had begun.

Because the administrative function of South Dakota counties is conducted on a calendar year basis, each county is required to formulate its budget in July and August. Therefore, the Division of Weather Modification

once again contacted all county commissions in July of 1972 requesting each interested county to respond with a "letter of intent to participate in the state program in 1973" and to provide for such participation by budgeting for "weather modification" as provided by law.

The fall and winter of 1972 was devoted to developing an evaluation technique which would be meaningful and to the development of plans for the summer of 1973.

The purpose of obtaining the letter of intent was to permit the Director to develop a realistic estimated budget for submission to the Bureau of the Budget by early October.

Based on letters of intent from 42 counties a budget was prepared and submitted to the Bureau of the Budget.

There were two weather modification bills placed before the 1973 legislature. One was SB 39 to provide funds to support operations during the summer of 1973 and to provide funds to support the Division of Weather Modification through FY-74.

As the year before, the 1973 appropriations bill was submitted to the legislature as a special appropriation which required, for the third year, a 2/3 vote of both houses of the legislature for passage. SB39 was passed by the senate 27 to 8 and the house 67 to 1 and provided funding of \$643,818.00. These state funds were supplemented by \$190,141.00 in county funds and \$7,000.00 in Federal funds.

The second bill, SB 177, provided for a rather extensive amendment of the existing weather modification law, SDCL 38-9. This amendment changed the name of the Commission from the Weather Control Commission to the Weather Modification Commission, provided for two year appointments, and revised the districts which each of the 7 members represented. The amendment also provided for the license and permit requirement and for penalties for violation. Finally, the amendment provided for the Commission and all of its functions be transferred to the Department of Natural Resource Development. The Commission had previously been administratively attached to the Department of Agriculture.

Prior to the legislative session contracts were drawn and signed with the 42 counties which wished to participate in the 1973 program, each contract being contingent upon funding by the 1973 legislature.

Based on these 42 counties, which constituted 26,612,000 acres, operational plans were developed and a request for bids prepared and issued. Contracts were let for 5 radar units plus arrangements to share a sixth radar in the northwest with North Dakota, seventeen cloud seeding aircraft, and all necessary personnel. These contracts, too, were contingent upon funding being provided by the 1973 legislature. Figure 2 shows the equipment locations.

The appropriations bill (SB 39) was passed as was the amendment (SB 177), and plans were rapidly formulated for the operational program to start May 1, 1973.

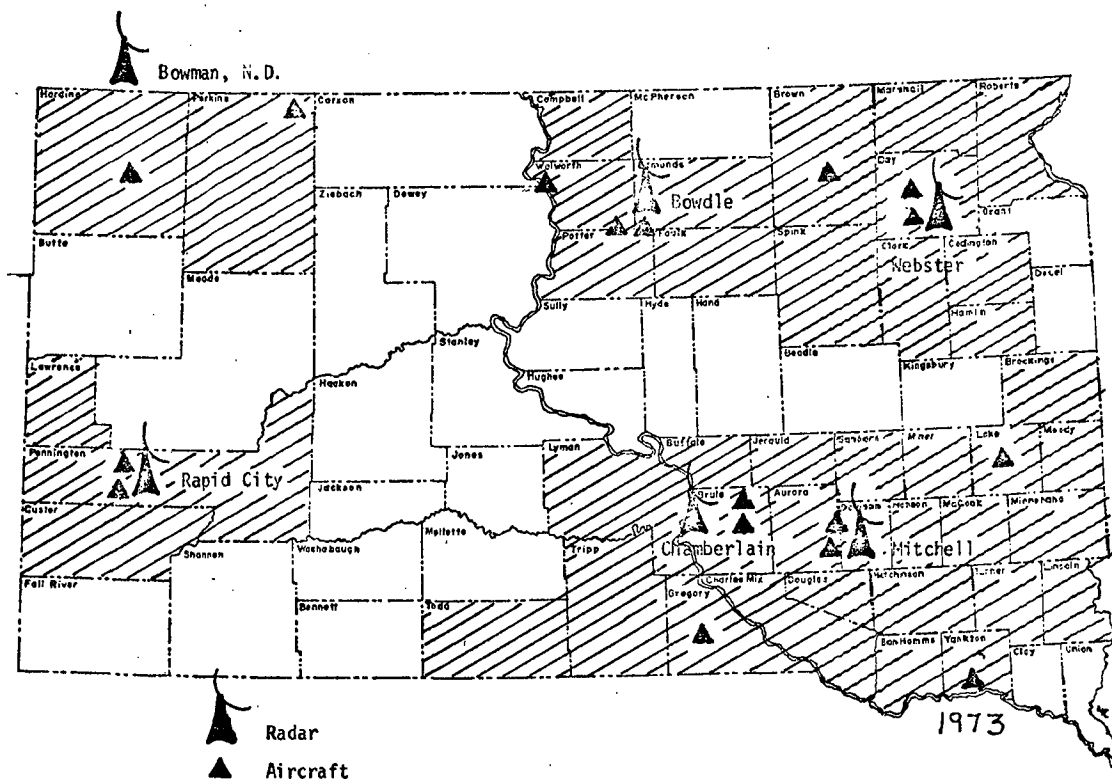


FIGURE 2

Plans progressed quite smoothly and operations got under way on May 1, as planned. The state was divided into 6 operational districts, numbered in the order in which the organized district entered the program.

District 1 was the southeast district with the radar located at Mitchell and 4 aircraft.

District 2 was the south central district with the radar at Chamberlain and 3 aircraft.

District 3 was the north central district with the radar at Bowdle and 3 aircraft.

District 4 was the Black Hills district with a contracted radar (not the IAS radar) at Rapid City and 2 aircraft.

District 5 was the northwestern district with the "shared" radar at Bowman, North Dakota, and 2 aircraft.

District 6 was the northeastern district with the radar at Webster and 3 aircraft.

Operationally all went well. Although understaffed for a 24 hour a day - 7 day a week program for 4 months, there were sufficient breaks in the weather to give the personnel a break so that they could come back reasonably refreshed and alert. It is hard to match the dedication of people in weather modification!

Contractors for 1973 were: Atmospherics, Incorporated; Weather Science, Incorporated; and Weather Modification, Incorporated.

LEGISLATIVE SESSION OF 1974 (FY-1975)

Once again plans for the 1974 season were begun before the 1973 season was over. Letters of intent indicated that 46 counties desired to participate in the 1974 operations - constituting 29,547,000 acres.

Again contracts were drawn and signed with the 46 counties, contingent upon the legislature appropriating funds. Bids were also requested for equipment and services. Contracts were signed - also dependent upon legislative approval of funding.

Special arrangements were made with air traffic control centers in Minneapolis and Denver to streamline the methods of identifying seeding aircraft and granting and assigning flight plans for "instrument" flights. An improved ground-to-air and air-to-air communications network was established as was a complete "hot line" telephone network between the Pierre office, the forecast office and each of the radar units. A five day training session was planned for the week prior to May in order to familiarize all summer field personnel with the Division's Operations Manual.

The Operations Manual is a comprehensive "instruction book" on how northern Great Plains summertime cloud seeding operations should be conducted.

Six radar units and 19 cloud seeding aircraft were utilized during the summer of 1974 (Figure 3). The Bowman radar site was shared by North and South Dakota.

In order to comply more closely with the law, the Director added two new staff members for the purposes of conducting close surveillance of contractor operations. J. Donnan was assigned District 1 and 2 (Mitchell and Chamberlain), J. Pellett was assigned District 3 and 4 (Rapid City and Bowman), and H. R. Swart, already on the staff, was assigned District 5 and 6 (Bowdle and Webster).

Considering budgetary matters, there were two significant changes in the fall of 1973.

A most important change was that the Governor considered the weather modification program to be sufficiently well established to become an integral part of his General Appropriations Bill. The significance of this decision is that programs which are included in the General Appropriations Bill require only a majority vote of the legislature as opposed to a 2/3 vote for any special appropriation. The Governor approved, and included in his budget an appropriation for \$803,700 to support the weather modification program for FY-1975. This appropriation was intended to support field operations for July and August, 1974 and May and June 1975, and to support the Division of Weather Modification throughout FY-75.

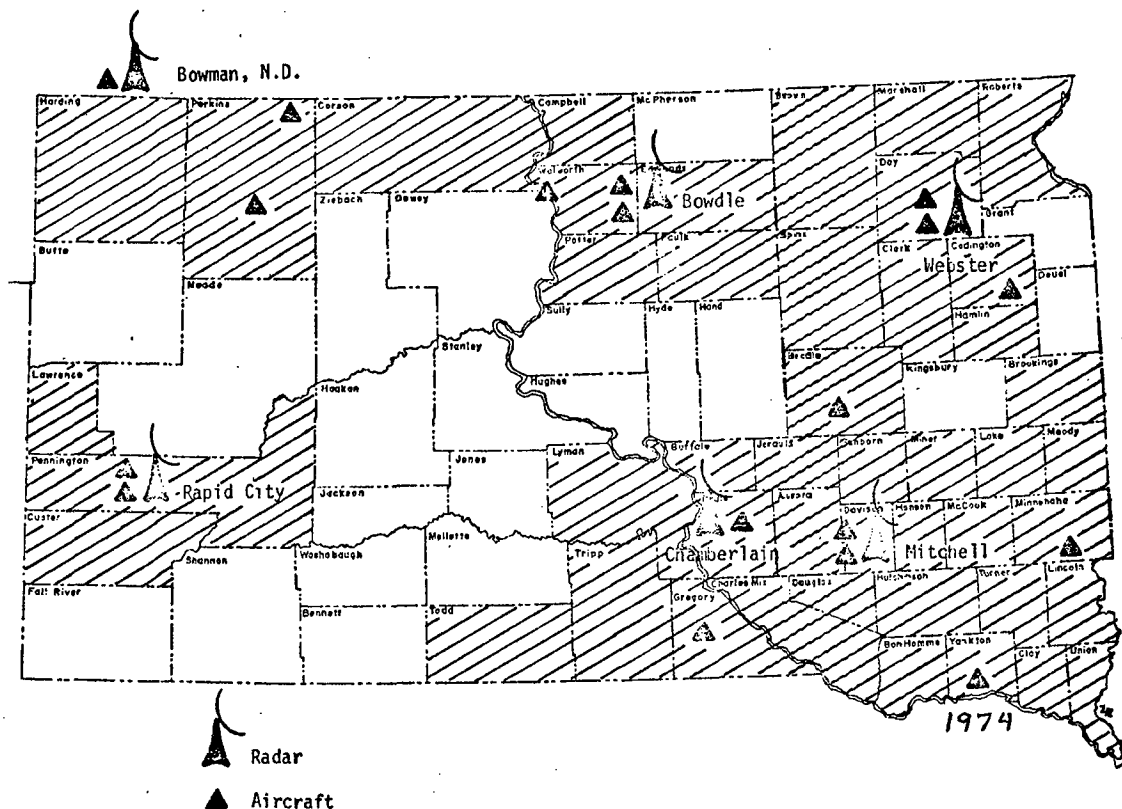


FIGURE 3

However, there were insufficient funds available in FY-74 to pay for anticipated expenses for contractual services for May and June, 1974. Therefore, a special appropriation (SB 262) with an emergency clause, to permit spending prior to July 1, 1974, was also introduced in the 1974 legislature. The special appropriation was for \$171,000.00.

Both passed the 1974 legislature.

Supplementing these state funds were \$243,600 in county monies which constitute the county 25% share of the expenses of the program. After the fact, the overall cost of the 1974 program was computed to be 3.6¢ per acre when all 29,547,000 acres were considered. In addition, \$30,200 were available from the Bureau of Reclamation for the purposes of conducting an evaluation of this program.

After the successful completion of the 1974 season, evaluations efforts were once again emphasized with Jackson Pellett assuming the primary responsibility.

Simultaneously, plans for the 1975 season were underway with 45 counties expressing an interest in participating.

LEGISLATIVE SESSION OF 1975 (FY-1976)

The proposed budget for FY-76 was, again, accepted by the Bureau of the Budget and included in the General Appropriations Bill.

The program design, curtailed to a degree by budgetary considerations, proposed the utilization of 5 weather radar units and 18 cloud seeding aircraft. The state was again divided into 6 operational districts.

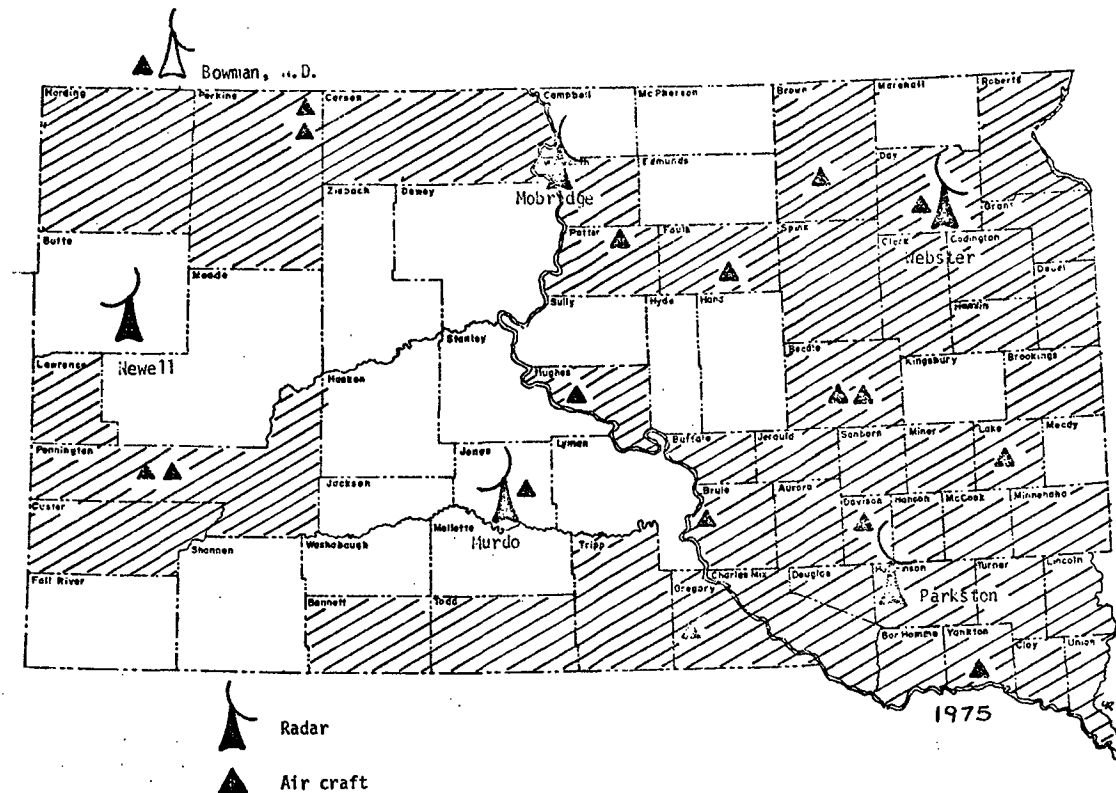


FIGURE 4

District 1, southeast, radar at Parkston, 4 aircraft.

District 2, south central, radar at Murdo, 4 aircraft.

District 3, Black Hills, and District 4, northwest, while considered as two operational districts, were both served by the same radar located at Newell. There were 2 aircraft assigned to District 3 and 2 aircraft to District 4.

District 5, north central, radar at Mobridge
2 aircraft located in northern Perkins County was assigned to Corson County.

District 6, northeast, radar at Webster, 3 aircraft.

Contractors for the summer of 1975; Weather Modification, Incorporated, (Districts 1, 2, 5 and 6) and North American Weather Consultants (Districts 3 and 4).

During the fall of 1974 there were some changes in policy and personnel.

The primary policy changes were: A much greater emphasis on public information (Division of Weather Modification staff conducted over 100 public

meetings during the fall and winter of 1974 and instituted a daily news release program during the 1975 operational season) and the expansion of the Advisory Committee to include representatives of all counties in a district - both participating and non-participating.

Merlin Williams accepted a position with NOAA in October of 1974. Martin Schock succeeded Williams as Director of the Division of Weather Modification, assuming that position November 4, 1974.

Leo Ritter joined the division staff in February, 1975. Robert Swart left the staff to accept a position in Texas the same month. Richard Leblang came on board in April, 1975.

The legislative session of 1975 created a bit of apprehension because even though the existing evaluations indicated positive cloud seeding results, the fact was becoming very evident that South Dakota was suffering from a potentially severe drought.

There was a better organized move to oppose the weather modification program. The mood of the legislature was less supportive than in previous years. There were attempts to remove the weather modification appropriations from the General Appropriations Bill in order to give the program the 2/3 political test once again.

Such actions were defeated. The weather modification program remained in the Governor's budget and received the necessary approval. The budget approved in the Governor's budget and passed by the legislature for FY-76 was \$776,500.00. The county funds which supplemented this budget were \$258,800.00, to constitute a total budget of \$1,076,800.00 for FY-1976. In addition, \$41,500.00 in Federal funds were made available for continuing support of evaluations efforts.

The 1975 cloud seeding program was successfully concluded on September 1, 1975. A significant change in operational philosophy during the 1975 season was that the state decided to provide the radar meteorologists rather than have them provided by the contractor. This change worked well and proved quite beneficial from the standpoint of state/county relationships.

During the 1975 season an intensive daily and weekly public information program was initiated and a professionally prepared slide/sound program was completed.

The 1975 season was completed and, as during previous years, plans for the next summer started early. Indeed, plans had to be accelerated in the fall of 1975 because the Bureau of the Budget required Department budgets nearly a month sooner than in previous years.

LEGISLATIVE SESSION OF 1976 (FY-1977)

Plans progressed with some 42 counties providing letters of intent to participate in the state program during the summer of 1976. A proposed budget was presented to the Governor of which an approved budget of \$855,000 was included in the General Appropriations Bill for FY-77.

Map of land contracts in the Texas Panhandle for 1976. The map shows county boundaries and names. Areas with diagonal hatching represent 'Letters of Intent' and areas with cross-hatching represent 'Final Contracts'. The legend at the bottom left shows these patterns. The year '1976' is printed in the bottom right corner.

Legend:

- Letters of Intent
- Final Contracts

1976

It soon became obvious that the group opposing the weather modification program in South Dakota had become well organized and quite influential.

Consequently, of the original 42 counties which indicated a desire to participate in 1976, only 22 initiated signed contracts with the Weather Modification Commission.

However, the legislature had a few surprises in store for weather modification.

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While weather modification, it is fully recognized, is prone to controversy it was clear early in the 1976 legislative session that the real question was not weather modification but the resolve of the opposition party to make every effort to trim the Governor's budget.

When the Division budget was removed from the General Appropriations Bill, a special appropriation was immediately introduced in order to give the program an opportunity to be heard on the floor of the legislative houses.

At the same time two other bills were introduced in the House. One, HB 692, to repeal the entire, existing weather modification law and the other, HB 838, to amend the existing law to require hearings by each county commission prior to the issuance of a permit.

HB 692 died in the House Agriculture Committee.

HB 838 was approved by the same committee, passed by the house, sent to the senate, referred to the Senate Agriculture Committee, sent back to the senate floor, amended on the floor, debated in a lively manner, and finally tabled.

SB 208, the special appropriations measure, failed to receive a "do pass" recommendation from the Appropriations Committee. Thus it required a majority vote to be considered on the floor of the senate. It received a vote of 21 for, 12 opposed, 2 excused. Of the 12 "nays", 11 were of the Governor's opposition party.

After a lively debate, SB 208 was voted upon. It received a vote of 19 yeas (3 R-16 D) and 16 nays (13 R-3 D).

It is significant that a majority vote was received but 2/3 or 24 yeas, was required for passage. Since this measure failed to pass the senate it was never received by the house of representatives, thus no measure of sentiment from that body is available.

The consequences of this legislative action simply means that no funds are to be made available to conduct a weather modification program during FY-77. Further, it means that on July 1, 1976, the office of the Division of Weather Modification will cease to exist as an active, operational group.

Since the law remains intact the Weather Modification Commission will continue to function as the state regulatory agency responsible for issuance of licenses and permits and the Division will essentially become a "ghost" agency under the Secretary of the Department of Natural Resource Development.

Unless individual counties decide to support cloud seeding activities independently, there will be no such activity anywhere in the state of South Dakota during the summer of 1976.

No such statement can be made at this time with regard to the summer of 1977. It depends so much on what happens, weatherwise, during the summer of 1976.

Where does one start in putting an acceptable weather modification program together?

The first step must be to obtain a law. Generally, without a law there is no state agency with the authority or time to organize any activity. But, not just any law. Insist upon a comprehensive regulatory piece of legislation which, the first time, addresses every conceivable problem area. There is ample precedent. The Model Law which has been prepared by the Weather Modification Association as well as various existing state laws such as Illinois, North Dakota and South Dakota. A comprehensive law provides a base from which to operate and appears to be the logical first step. A mechanism for acquiring legislation can be accomplished in several ways.

Through years of interest and active cloud seeding operations on the part of individuals and counties in North Dakota, "grassroots" support grew, gained momentum and through a logical, responsible cooperative effort resulted in the drafting and eventual passage of a totally comprehensive law.

As a result, North Dakota has initiated a statewide cooperative program which is scheduled to begin May 1, 1976.

Minnesota has taken a slightly different approach. The primary concern in Minnesota appears to be to get a responsible piece of regulatory legislation on the books. There are no immediate plans to promote or conduct a state sponsored cloud seeding effort. The interest was generated within the Minnesota legislature. Through the Department of Agriculture a Task Force was appointed consisting of representatives from the legislature, the university system, the agricultural community, the business community, and agencies, such as the National Weather Service, with interest and/or expertise in the field. The Task Force has conducted a series of hearings over a six or eight month period. With the resulting information, this advisory group has assisted in the drafting of proposed legislation and is providing advice and direction in a most responsible manner.

Regardless of how it is done, a responsible law is imperative.

Once this plateau is reached, and assuming that there is interest in developing an operational program, there are three very important considerations.

Beginning with the basic premise that any proposed operation will be planned in a scientifically and technically sound manner - let us consider what is necessary for a politically successful program.

It may not be a particularly pleasant thought to our scientific colleagues, but we, in South Dakota, have learned that in 1971 the technology of weather modification suddenly changed from a serious scientific effort to an equally serious political-sociological effort.

There is no substitute for educating the people - and the education must start early. Not "brainwashing", but honest, consistent information. Facts!

Weather modification shall forever be controversial. Consequently, were one to develop a new operational program two areas are of utmost importance -

development of a long range public information program in an effort to obtain strong grassroots support. The two are inseparable. The grassroots support will be maintained over the years only if they are informed people who constitute that support.

Of equal importance, and this too can be closely associated with both the public information and grassroots support concept, is the establishment of an expanded and extensive state operated rain gauge network.

A terribly disturbing, but distressingly common problem is the tendency of critics of weather modification efforts to evaluate the overall effects of the program based on a few, random personal observations which a particular observer has interpreted as a negative cause/effect relationship.

Even if we assume that weather modification works and need not be proven year after year, the people who pay the bills are going to require an accounting of how well the technology is being applied. Measuring rainfall is totally essential to developing any kind of evaluation procedure. A network of cooperative raingauge observers will or can serve as a firm basis for the "grassroots" support because they are contributing and because it is necessary to communicate with these people on a regular basis - so here - is the beginning of the truly informed.

PERSONAL COMMENTS

Since this is not a technical paper, the authors wish to present a few subjective observations concerning the recent turn of events in South Dakota.

We firmly believe that the decision to discontinue weather modification operations in our state was made without full consideration of the merits of weather modification.

There is active opposition of the state program, but the arguments used today are the same as the arguments which were presented to the Legislative Research Council in 1970. The opposition has, and always will have, two tremendous advantages: No requirement to be accountable and no need to rely on facts.

Much of the opposition's support comes from people who attempt to evaluate the program by personal observation. If it is dry, then in their eyes the program is a failure. Their position is strengthened by the belief that weather modification promises ample precipitation for all. This belief is often the result of "over-selling" the program or just wishful thinking. The scientific subtleties of precipitation statistics are viewed as just a lot of double talk by those people who believe that weather, visible to all, can easily be understood.

The demise of this program in 1976 was encouraged by the professional opponents but was the result of the resolve of a certain political faction to substantially trim the proposed state operating budget.

This program has always been proud of the bipartisan support within the legislature. Contrary to the partisan votes which were discussed earlier the bipartisan support still exists but for political-financial reasons most all votes on appropriations measures were oriented along party lines.

Weather modification is not dead in South Dakota.

There is no question that stopping the program has been a serious setback, but we are certain that an active program will return and when it does it will be on firmer ground than ever.

The basic message that we wish to pass on is to remember weather modification will always be faced with opposition.

The only defense is honesty, integrity, and factual information disseminated in a clear, concise, professional manner. This cannot and will not happen by accident. Plan ahead with the full knowledge that the critics are present. Establish a well planned public information program and use it wisely - before, during and after any program.

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APPENDIX A

HISTORY OF WEATHER MODIFICATION LEGISLATION IN SOUTH DAKOTA

1953	HB-711	CREATING WEATHER CONTROL COMMISSION, SDCL 38-9.
1957	SB-232	Amendment enlarging the powers of the Commission and providing a two year appropriation for its operation.
1964	HB-679	An implied amendment - name change of the state university.
1965	SB-60	Providing per diem, expenses and travel expenses for Commission.
1971	HB-550	Providing for a statewide program of weather modification.
1972	SB-177	Updating existing law and refining the language of most sections of the existing law.
1955	HB-801	Adding Section 18 to SDCL 10-12 which authorizes a county to levy to support weather modification activities.
1963	HB-677	Amendment to authorize a mill levy not to exceed one mill upon assessed valuation.
1969	HB-881	A one sentence amendment authorizing counties with less than \$16,000,000 assessed valuation to levy up to two mills to support weather modification.

HB: House Bill
 SB: Senate Bill
 SDCL: South Dakota Compiled Laws

APPENDIX B

HISTORY OF APPROPRIATIONS FOR THE SOUTH DAKOTA WEATHER MODIFICATION PROGRAM

<u>LEGISLATIVE SESSION</u>	<u>FISCAL YEAR</u>	<u>BILL</u>	<u>SESSION LAW CHAPTER</u>	<u>APPROPRIATION</u>	<u>TYPE</u>
1971	1972	HB-550	Ch. 222	\$100,000	Special
1972	1973	SB-192	Ch. 297	250,000	Special
				3,652	General
				44,000	Federal
				90,000	County
1973	1974	SB-39	Ch. 356	643,818	Special
				3,652	General
				17,000	Federal
				160,000	County
1974	1975	SB-262	Ch. 381	171,000	Special/ Emergency
		SB-263	Ch. 335	803,700	General
				30,200	Federal
				243,600	County
1975	1976	HB-842	Ch. 354	776,500	General
				41,500	Federal
				258,800	County

GENERAL: The General Appropriations Bill introduced by the Governor requires a simple majority vote of both houses of the legislature.

SPECIAL: Any appropriations measure not included in the General Appropriations Bill (requires a 2/3 vote of both houses).

SPECIAL/EMERGENCY: An appropriation measure with special spending authority prior to July 1, of the year in which appropriation was authorized.