2026 OPERATIONS REPORT

NDCMP

NORTH DAKOTA CLOUD MODIFICATION PROJECT

NORTH DAKOTA DEPARTMENT OF WATER RESOURCES



WEATHER MODIFICATION INTERNATIONAL

NORTH DAKOTA CLOUD MODIFICATION PROJECT
2026 FINAL OPERATIONS REPORT

Report prepared for

NORTH Dakota | Water Resources
Be Legendary.

State of North Dakota
Department of Water Resources (DWR)
1200 Memorial Highway
Bismarck, ND 58504

By

WEATHER MODIFICATION INTERNATIONAL

Weather Modification LLC
3802 20th Street North
Fargo, ND 58102
Phone 701.235.5500
Fax 701.235.9717

weathermodification.com

OCTOBER 2026

Cover Credit: Composite of images from Elan Azriel, Noah Harbarth, and Collin Kennedy.

EXECUTIVE SUMMARY

This report details the activities of Weather Modification International (WMI) during the 2026 North Dakota Cloud Modification Project (NDCMP) field operations. This was the 66th consecutive summer season of the NDCMP and the second of a three-year contract with WMI and the North Dakota Department of Water Resources (DWR). WMI provided specially modified aircraft, cloud seeding equipment, pilots, aircraft maintenance, aircraft tracking and telemetry systems, intern co-pilot training, and communications equipment in the DWR radar office.

The North Dakota Cloud Modification Project operational area in 2026 remained the same as it had been in 2025. Cloud base-seeding operations were managed from Bowman, utilizing three Piper Seneca II aircraft. WMI contracted two aircraft for the service and proactively supplied a third as a spare at no additional cost to the DWR, ensuring operational continuity in the event of mechanical downtime. Operations were continuous (24/7) throughout the project period, which spanned from 1 June 2026 to 31 August 2026. Rain enhancement activities were suspended as necessary (see Table 3).

During the 2025-26 winter, North Dakota experienced mainly average precipitation. Due to a relatively wet summer and October, little to no drought was present. At the beginning of December, the entire state was drought-free, with only 1.78% (far eastern North Dakota) being under abnormally dry conditions. The near-normal winter kept this status unchanged through the end of March. A wet April over eastern North Dakota eroded the abnormally dry conditions. However, a very dry spring over western North Dakota contributed to drought development there. By the end of May, 15.13% of the state was under abnormally dry conditions, 3.56% in a moderate drought, and 0.34% (southwestern McKenzie County) in a severe drought. As for District I, the western half of Bowman County was experiencing abnormally dry conditions.

June saw a split in precipitation occurrence between the northern and southern halves of the state. While northern North Dakota experienced a seasonally active pattern, most of southern North Dakota was drier than average. This allowed for drought expansion over southwestern portions of the state. By the end of the month, moderate drought conditions extended over 8.79% of North Dakota, including
nearly all of District I. July was extremely dry across nearly all of North Dakota, with only a couple of southeastern counties receiving above-average water. As a result, the drought was amplified statewide. By the end of the month, 78.07% of the state was under at least abnormally dry conditions, and 28.38% dealing with a moderate drought. Severe drought had developed over 8.52% of the area- including most of District I. This level of drought crept into far eastern North Dakota as well, which experienced the least amount of rainfall. Drought-free areas included portions of southeastern and northern North Dakota.



Fig. 1. N121WA captures a birds-eye view of a developing rain shower northeast of Bowman during a rain-enhancement mission on June 11, 2026. Photo by Peyton Underwood.

In August there was more variability in precipitation amounts. Portions of southwestern and north-northwestern North Dakota received above-average rainfall. This helped to remedy the drought slightly in Hettinger County. However, much of the state remained dry- especially the southeastern and far western portions. This included the western half of District I. By the end of the month, a net increase in the drought had occurred. Nearly all of the state (96.61%) was under abnormally dry conditions, 85.67% in a moderate drought, 43.70% dealing with a severe drought, and 6.27% suffering from an extreme drought. The project area was in a moderate to extreme drought. Due to a dry summer in southwestern North Dakota, there was no harvest delay. So, District I did not elect to extend hail suppression operations into early September as they had done in 2025. The last day of the project was August 31st.

The 2026 season concluded with a total of 119.04 flight hours. This is higher than District I's five-year average of 91.52 hours and ten-year average of 97.89 hours. Notably, this was only the second year since 2001 that the project operated without the King Air C90, which previously flew for both District I and District II. Furthermore, there was no project extension unlike the previous four seasons. With all of this considered, it is very impressive that the project obtained as many operation hours as it did.

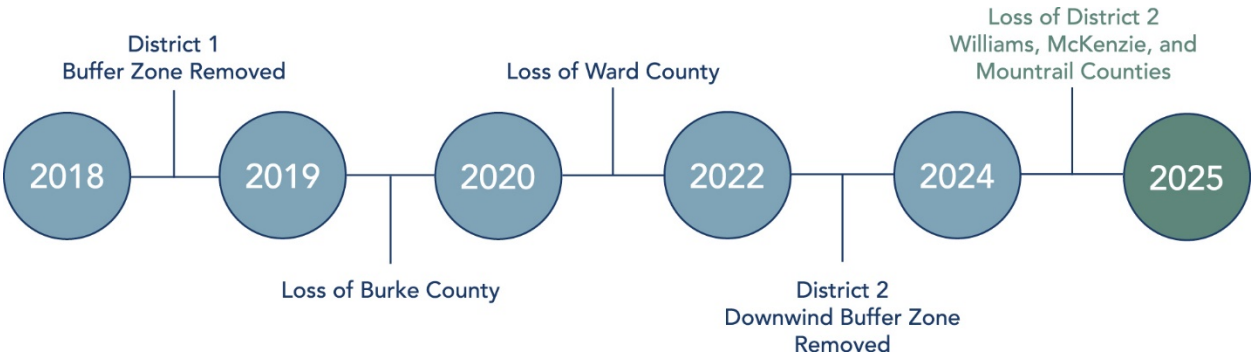


Fig. 2. NDCMP changes from 2018-2025 that have impacted the number of flight hours yearly.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3
TABLE OF CONTENTS 6
LIST OF FIGURES 8
1 INTRODUCTION 10
2 NORTH DAKOTA ECONOMIC IMPACT 12
3 2026 AIRCRAFT CONTRACTOR 14
4 PROJECT DESIGN 15
5 OPERATIONAL AREAS 16
5.1 WMI Aircraft Base Locations 16
5.2 DWR Weather Radar Site 17
6 DAILY OPERATIONS 18
7 AIRCRAFT 19
7.1 Aircraft Maintenance 20
7.2 WMI Aircraft Telemetry System and Communications - AirLink 23
8 CLOUD SEEDING EQUIPMENT 24
8.1 Seeding Equipment Performance 25
9 WEATHER RADAR SYSTEMS 26
10 METEOROLOGICAL SUMMARY 29
10.1 NDCMP Cloud Seeding Criteria 29
10.2 NDCMP Suspension Criteria 29
10.3 Climatological Project Overview 31
10.3.1 JUNE 31
10.3.2 JULY 32
10.3.3 AUGUST 33
11 PROJECT RECORD KEEPING 34
12 WMI AND DWR PROJECT PERSONNEL 35
12.1 Ground School 35
12.2 WMI Pilots 36

12.3 Co-Pilot Internship 36
12.4 DWR Staff 37
12.5 DWR Administration 37
12.6 Weather Modification International Administration 38
12.7 NDCMP Project Personnel Pictures 39
13 PUBLIC RELATIONS 40
14 PROGRAM AWARDS 41
15 CONTRACTOR'S SUMMARY 42
APPENDIX ITEMS 43

LIST OF FIGURES

Fig. 1. N121WA captures a birds-eye view of a developing rain shower northeast of Bowman during a rain-enhancement mission on June 11, 2026. Photo by Peyton Underwood. 4

Fig. 2. NDCMP changes from 2018-2025 that have impacted the number of flight hours yearly... 5

Fig. 3. WMI aircraft on the ramp in Bowman, ND await the 1984 season. Photo by Hans Ahlness. 10

Fig. 4. N121WA watches from the Bowman Airport as a mature thunderstorm fades off to the east. Photo by Daniel Moraes. 12

Fig. 5. Weather Modification Int'l and Fargo Jet Center LLC headquarters at Hector International Airport, Fargo, ND. 14

Fig. 6. A view of N9798C's left wing-tip generator operational during a seeding mission with a well-defined thunderstorm base in the background Photo by Noah Harbarth..... 15

Fig. 7. A representation of the seeding target area, aircraft bases, and radar range capabilities for the 2026 NDCMP. Graphic courtesy of the North Dakota Department of Water Resources..... 16

Fig. 8. The new WRS300 dual-pol radar (left) stands next to its old counterpart (right) while keeping a vigilant eye on a distant thunderstorm. Photo by Elan Azriel. 17

Fig. 9. WMI intern co-pilot Kaitlin Miller (left) and Captain Peyton Underwood (right) ferry N121WA to Bowman for project start on June 1, 2026. Photo by Kaitlin Miller. 18

Fig. 10. The District I crew proudly stands in front of the three WMI Seneca aircraft at the Bowman Regional airport, ready for action. Photo by Jacob Azriel. 19

Fig. 11. A thunderstorm west of the Bowman airport provides a nice backdrop for N121WA. Photo taken by Collin Kennedy..... 21

Fig. 12. WMI seeding Piper Seneca II aircraft. Photos by Ryan Starkey (2021 Intern Pilot; 2022 & 2023 Captain), Keisuke Yoshimura (2013 ARB Intern Pilot), and Taylor Exizidis-Meier (2020, 2021 WMI Captain). 24

Fig. 13. NDCMP 10-Year Generator Failure Rate chart. 25

Fig. 14. Photo by Jacob Azriel shows the TITAN display used by Meteorologists. TITAN is the primary radar tool Meteorologists see and use to manage missions and keep aircraft safe..... 26

Fig. 15. The Bowman radar conducts a full diagnosis on an approaching thunderstorm. Photo by Collin Kennedy. 27

Fig. 16. Percent of Normal Rainfall map for the month of June. Graphic produced by the DWR through their Cooperative Observer network. 31

Fig. 17. Percent of Normal Rainfall map for the month of July. Graphic produced by the DWR through their Cooperative Observer network. 32

Fig. 18. Percent of Normal Rainfall map for the month of August. Graphic produced by the DWR through their Cooperative Observer network. 33

Fig. 19. DWR Meteorologist Dan Brothers gives an overview of TITAN to the NDCMP staff during ground school. Photo by Erin Fischer. 35

Fig. 20. DWR Administration Team located in Bismarck, ND. 37

Fig. 21. WMI – NDCMP Administration Team located in Fargo, ND. 38

Fig. 22. 2026 District I flight crew and meteorology team. Photos by Dan Brothers, DWR. 39

Fig. 23. N121WA and N9798C watch a passing light rain shower from the ramp in Bowman, ND. Photo by Peyton Underwood. 42

1 INTRODUCTION

North Dakota farmers have historically faced above-average crop losses due to hail and drought; these challenges have contributed to reduced crop yields and farm incomes. This led to the search for ways to manage these conditions, which could consequently improve the average North Dakotan's quality of life. One promising new technology was the emerging science of weather modification. The first cloud seeding activities of record in North Dakota occurred in 1951, performed by farmers using ground-based generators.

In 1961, the founders of Weather Modification International began using aircraft for a program to suppress hail in an initial target area of 540 square miles, in the central area of what is now District I. This area has had an active program in some form each year since, with the exception of 1990 when District I did not participate in cloud seeding operations due to budget constraints.

Operations to the north (currently referred to as District II) started one year later and remained active in various counties through 2024. A third district, including Benson, Nelson, and Griggs Counties, operated from 1974 through the 1981 season. In the mid 1970's, there were as many as 17 counties in North Dakota participating in the cloud seeding program. The number has decreased due to various factors over the years, but currently there are 2 active counties in target areas that cover 1,419 square miles (or, almost 1 million acres) – about 2% of the state's area.

In 1965 and 1969, legislation was passed in North Dakota enabling counties and townships to levy two mills for funding of cloud seeding projects. The source of funds was this 2-mill levy, by township elections under NDCC Chapter 58-03-07, or by voluntary funding. The Program was primarily implemented by emphasizing hail reduction. Rain enhancement operations provided added economic benefits to those counties which had an Authority. Counties or associations of counties pooled resources to finance their local programs.

In 1975, North Dakota Legislature established the North Dakota Weather Modification Board (NDWMB). The NDWMB was later renamed the Atmospheric Resource Board (ARB) before duties were transferred to the Department of Water Resources in 2025. In 1975, the State Legislature further provided an appropriation for the remainder of the biennium to implement the 1976 operational program on a cost-sharing basis.



Fig. 3. WMI aircraft on the ramp in Bowman, ND await the 1984 season. Photo by Hans Ahlness.

The cloud seeding projects before the creation of the NDWMB had been paid for by voluntary contributions and county appropriations. The 1976 operational program included 50% state matching funds equaling the county appropriations in support of the project in their area. These matched county funds were used specifically for field operational costs. As state matching fund levels dropped through the mid-1980's, many counties dropped out of the program. State funds were also used for research and evaluation, although some federal funds supported UND-trained co-pilots and evaluation data underwritten by the Bureau of Reclamation.

The recently concluded 2026 program was the 52nd consecutive season under the DWR's direction.

2026 NDCMP COUNTY AUTHORITY MEMBERS - DI

DISTRICT I:	
BOWMAN COUNTY	**SEVERE WEATHER MANAGEMENT ASSOC.**
Wayne Mrnak, Bowman (Chair)	Robb Narum, Bowman (Chair)
Wes Andrews, Bowman	Dan Powell, Bowman
Ryan Brewer, Bowman	
Chad Miller, Bowman	
Wes Miller, Rhame	

Table 1. 2026 NDCMP County Authority Members – District I.

2 NORTH DAKOTA ECONOMIC IMPACT

A study in 2019 from the NDSU Department of Agribusiness and Applied Economics investigated the impact that the NDCMP has on the state's economy. An update of a 2009 analysis, the study considered the value of hail suppression and enhanced rainfall during the growing season. Using the harvested acreage of the top eight crops plus alfalfa, the study combined crop insurance data, production statistics, and NDCMP results to estimate the added value of the project for both the actual target areas and the benefits if the project was statewide. Rain enhancement was figured at two levels, a 5% and a 10% increase (covering the range of results from long-term evaluations of the NDCMP) and combined with a 45% hail reduction estimates to derive the results.

In the NDCMP seeded counties, the direct economic value of cloud seeding specifically to enhance rainfall was estimated to range from $9.19 to $18.15 per planted acre, or $21.2-41.9 million in direct benefits to agriculture production. The hail suppression addition adds another $3.0 per planted acre, or $6.9 million annually. Compared to the cost of the project, those figures would give a benefit-to-cost ratio of 31-to-1 up to 53-to-1, an excellent return on investment. This shows the huge benefit that the NDCMP can provide.



Fig. 4. N121WA watches from the Bowman Airport as a mature thunderstorm fades off to the east. Photo by Daniel Moraes.

Enhanced agricultural production can affect other areas of North Dakota's economy. Increased crop yields can potentially increase tax revenue between $576,000 – $999,000 annually. Most significantly, this study does not include the considerable benefits that a reduction in hail damage has to property, especially in more populated areas.

A study published in October 2021 written by Michigan State University, used historical cloud seeding participation over a 30-year period to estimate the effect on wheat and barley yields. They found that the average annual wheat yields in the seeding counties was 13% higher than unseeded counties for the 1989-2018 timeframe. The benefit to cost ratio was shown to be 36 to 1. The authors concluded "In this study we present new evidence that cloud seeding improves wheat yield in participating North Dakota counties as evidenced by the statistically significant effect on wheat yields and insurance loss ratios."

These complete reports and other NDCMP program evaluations are available on the North Dakota Department of Water Resources website at: http://www.dwr.nd.gov/arb/ndcmp/. Click on Program Evaluations bullet.

3 2026 AIRCRAFT CONTRACTOR

Weather Modification International is a global atmospheric sciences company committed to continued advances in the field of weather modification. With over 60 years of successful operations, WMI has pioneered safe and effective techniques for cloud seeding. These advances have made it possible to conduct operations 24 hours per day, seven days a week. These techniques – many formulated in North Dakota operations – have allowed WMI to provide aircraft, seeding and research equipment, radars, personnel, and company expertise in the areas of cloud physics research and atmospheric sampling for various governmental agencies and private entities around the world.

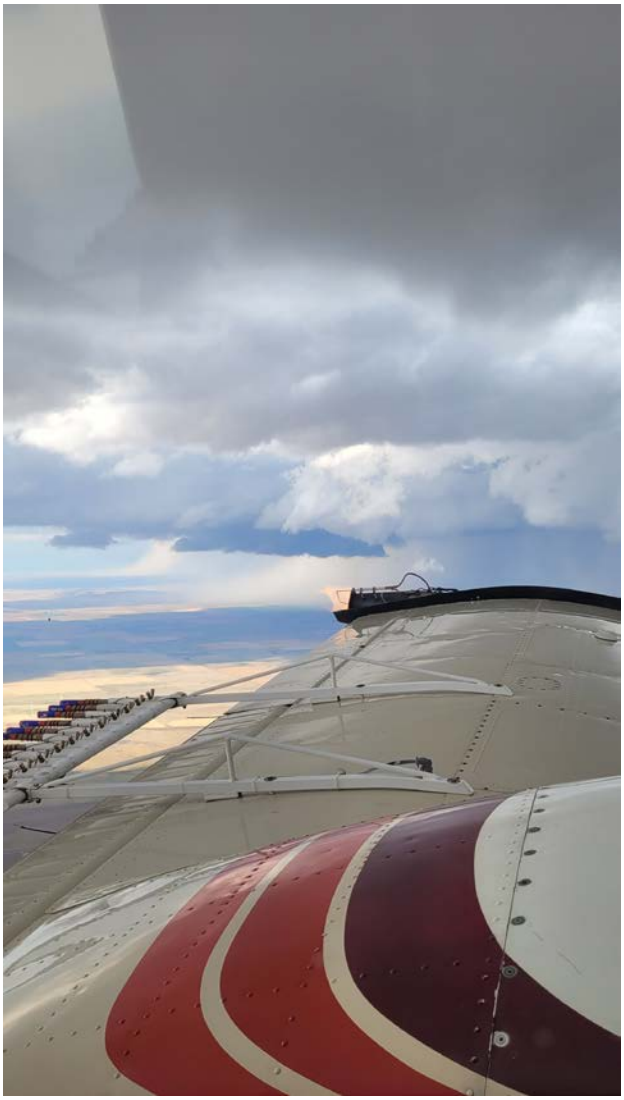
WMI was originally formed in 1961 in Bowman, North Dakota, and the anti-hail program begun at that time was the genesis of the current NDCMP. WMI relocated to Fargo, ND in 1993 and a sibling company, Fargo Jet Center LLC (FJC), was incorporated in 1994. Since then, WMI has grown exponentially. Today, WMI and FJC facilities in Fargo have more than tripled in size and employees and number more than two hundred personnel worldwide. FJC adds a wide range of aviation services including a charter flight department, aircraft refueling services, an FAA approved aircraft maintenance and overhaul facility, avionics shop, aircraft rental, and a flight school. FJC also operates Premier Jet Center, a full-service FBO/repair station, paint and upholstery shop, and Exclusive Aircraft Sales based in Eden Prairie, MN. Further expanding the enterprise, WMI acquired SPEC Incorporated in May 2025. SPEC operates out of Boulder, CO and specializes in instrumentation for atmospheric measurements. The operating companies frequently share resources, skills, talents, and equipment – each contributes to the success of the other. The synergy realized from several multi-faceted operating companies highlights a strong aviation enterprise that continues to grow.



Fig. 5. Weather Modification Int'l and Fargo Jet Center LLC headquarters at Hector International Airport, Fargo, ND.

4 PROJECT DESIGN

The design of the 2026 North Dakota Cloud Modification Project was based on techniques developed and refined over years of operational programs. These techniques, many developed here in North Dakota, were used in conjunction with seeding criteria evolved by compatible research programs and the comprehensive North Dakota Cloud Modification Project Operations Manual, January 2025. A companion manual, the NDCMP Radar Applications Manual (latest revision May 2012) provides guidance for the project meteorology staff.



As set forth by the DWR, the project design is a "non-randomized, development and operational program for the purposes of decreasing hail damage, increasing seasonal rainfall, and achieving certain development objectives for improved operations". In summary, the project design is one in which any cloud that meets the criteria for increasing rainfall or decreasing hail is seeded (within the limits of equipment and personnel) rather than clouds being chosen on a random basis for seeding. In theory, any project member can initiate seeding operations, but in practice the DWR radar meteorologists usually direct when and where the WMI pilots operate.

Fig. 6. A view of N9798C's left wing-tip generator operational during a seeding mission with a well-defined thunderstorm base in the background Photo by Noah Harbarth.

5 OPERATIONAL AREA

North Dakota weather modification activities were conducted in one operational target area, or District. District I included Bowman County, as well as Hume, Carroll, Cash, Connor, Sheets, Mineral Springs, and Cedar Creek Townships in Slope County. District I has operated without a buffer zone since 2018.

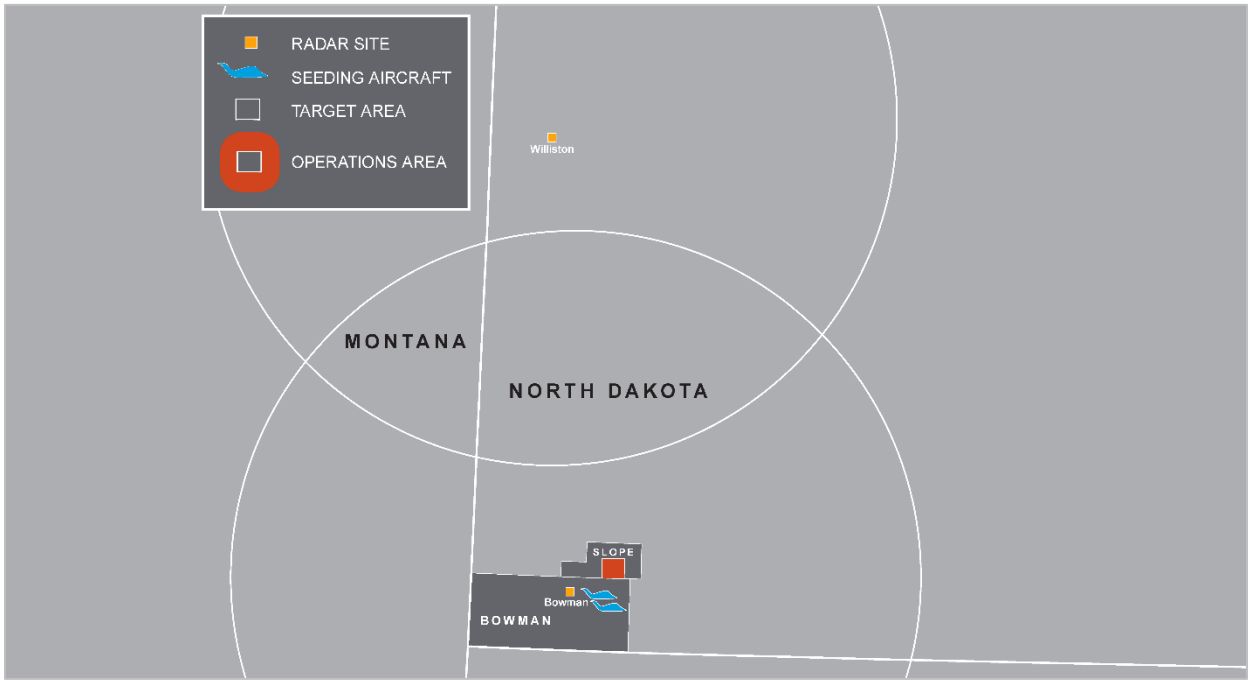


Fig. 7. A representation of the seeding target area, aircraft bases, and radar range capabilities for the 2026 NDCMP. Graphic courtesy of the North Dakota Department of Water Resources.

5.1 WMI Aircraft Base Locations

Aircraft bases for the project are determined by the DWR in cooperation with WMI and the county weather modification authorities. Airport selection criteria prioritize location, runway length, fuel availability, and suitable facilities, with comfortable crew housing also being a significant factor. This season's operations in District I were consistent with prior years. The dedicated Piper Seneca aircraft were based at the Bowman Regional Airport in Bowman, North Dakota. The planes typically arrive at their assigned location and operate continuously from there for the duration of the project, save for minimal days needed for maintenance or airport closures; happily, there were no such interruptions in Bowman this year. The two contracted aircraft arrived at their base in Bowman, ND on 1 June 2026 and a third for reserve arrived on 1 July 2026.

5.2 DWR Weather Radar Site

One Vaisala WRS300 dual-polarization C-band weather radar, owned by the DWR, was employed on the project. Located at the Bowman Airport, this state-of-the-art technology replaced the old WSR-74C 5-cm radar in July 2025. The 2026 season was the first that utilized this upgrade from start to finish. This new radar specializes in high-resolution storm identification and precipitation differentiation, which is very useful for dual-purpose cloud seeding operations.



Fig. 8. The new WRS300 dual-pol radar (left) stands next to its old counterpart (right) while keeping a vigilant eye on a distant thunderstorm. Photo by Elan Azriel.

6 DAILY OPERATIONS

The 2026 season of the North Dakota Cloud Modification Project became active at noon CDT (11:00 am MDT) on 1 June 2026 for District I. The project ended at 11:59pm MDT on 31 August 2026.

Project forecasts were prepared each morning by the DWR Intern Meteorologist and Radar Meteorologist at the Bowman Regional Airport. They were based on National Weather Service data, NEXLAB numerical forecast models, regional synoptic observations, and satellite information. Project staff received the daily forecast either online or by joining, if available, a video conference at approximately 12:00 noon, CDT. Forecast support was additionally provided by DWR staff as needed. In the event of significant changes, updates were furnished to the radar meteorologist by phone and on the website.

The radar meteorologist and pilots all kept an eye out for significant weather activity. Sometimes with input from the aircraft crews, the DWR radar meteorologist launched aircraft for seeding missions. Cloud candidates for seeding were usually chosen by the radar meteorologist, with the pilots making the final determinations based upon storm inflow, cloud structures, flight safety, and other factors.



Fig. 9. WMI intern co-pilot Kaitlin Miller (left) and Captain Peyton Underwood (right) ferry N121WA to Bowman for project start on June 1, 2026. Photo by Kaitlin Miller.

7 AIRCRAFT

WMI uses twin-engine piston aircraft for all flight operations. In addition to their high-performance characteristics, in comparison to smaller, single-engine aircraft, twin-engine aircraft provide an extra measure of safety in bad weather, in-cloud, and nighttime operations. All the seeding aircraft are owned and modified by WMI.



Fig. 10. The District I crew proudly stands in front of the three WMI Seneca aircraft at the Bowman Regional airport, ready for action. Photo by Jacob Azriel.

WMI operated three Piper Seneca II (PA34-200T) aircraft for cloud base seeding in District I. WMI's Piper PA34-200T Seneca II aircraft are turbocharged, twin 200-horsepower engine light aircraft.

Aircraft must be flown and maintained in accordance with US Federal Aviation Administration (FAA) rules and regulations. WMI's specially modified cloud seeding aircraft, when fitted with seeding equipment, must be operated in RESTRICTED category – meaning that their operations are limited to the special purpose operations for which the equipment installations are certified by the FAA and are bound by extra rules that prohibit these aircraft from carrying passengers who are not part of the project, among other things.

All aircraft must also be inspected and maintained according to approved schedules; the Senecas used on this project must all have a yearly "annual" inspection and certain required maintenance checks at each 50 and 100 hours of operation. WMI seeding aircraft are equipped with anti-icing pneumatic boots on the leading edges of the control surfaces and heated boots on the propellers with anti-pneumatic boots but not equipped with windshield heat therefore they don't fly into known icing environments. In addition to normal aircraft and seeding systems, aircraft furnished for the project were equipped and certified for instrument flight rules (IFR) with GPS navigation equipment.

Prior to the 2026 season, all WMI project aircraft underwent renewed annual inspections (as required by the FAA) and had the appropriate WMI seeding equipment mounted to conform to the project contract requirements. Project pilots assisted WMI and FJC mechanics in Fargo to prepare the aircraft. This provides the pilots with valuable training and hands-on experience with seeding equipment and their aircraft. All seeding generators were flight tested with acetone before delivery to ensure proper operation.

The project aircraft were ferried in two stages. The primary two aircraft to be used for the duration of the season both ferried to Bowman on the morning of 1 June 2026 (N121WA and N13AG). WMI provided a third aircraft, not required by contract, as a spare in case of unforeseen maintenance or equipment issues. N9798C was picked up in Fargo by project pilots and brought to Bowman on 1 July 2026. This backup proved to be very useful this season, as N9798C became the primary operations aircraft for seed 2 by mid-summer.

Crews ensured all aircraft in the project area were loaded with burn-in-place (BIP) flares and silver iodide solution prior to the start of project at noon local time on 1 June 2026. Crews conducted "District Tour" flights at the start of the 2026 NDCMP to familiarize themselves with their area of operations, function of the acetone burners, and reliability of the voice and data links with the radar site.

7.1 Aircraft Maintenance

All pre-season, major aircraft, and seeding equipment maintenance was performed by and/or at the direction of Weather Modification International/Fargo Jet Center in Fargo, ND. Jody Fischer, Vice President of Operations; Kirk Hamilton, Director of Flight Operations; and Captain Austin Krause tracked and supervised the required maintenance and support for the aircraft during the summer. Other Pilot-In-Commands (PIC) of each aircraft were instructed to contact Krause, Fischer, or Hamilton immediately if any unscheduled maintenance was required.



Fig. 11. A thunderstorm west of the Bowman airport provides a nice backdrop for N121WA. Photo taken by Collin Kennedy.

With the 24/7 nature of WMI's commitments for the DWR, when an aircraft has a maintenance problem it needs to be repaired quickly. WMI has developed a working relationship with the maintenance shop in Bowman, Bottom Line Aviation LLC. This relationship allows WMI to have inspections and limited maintenance performed on-site, which reduces the down time of the aircraft by eliminating travel time to and from Fargo. WMI provided these locations with parts, documentation, and support services. If local shops are unable to perform any maintenance tasks, WMI can fly a mechanic and/or parts to the broken project aircraft or ferry it to Fargo for more extensive work. WMI has always attempted to have smaller items taken care of by local maintenance shops in western ND when possible.

If any of the two primary project aircraft needed maintenance that would have it removed from service for an extended period, WMI provided a spare Piper Seneca II seeding aircraft on standby onsite to ensure uninterrupted service. While a spare aircraft is not required by contract, WMI has the resources to provide this service in case of an emergency.

Additional aircraft maintenance outside of routine and/or scheduled inspections that occurred during the season are provided in Table 2.

2026 NDCMP AIRCRAFT MAINTENANCE

DATE	AIRCRAFT #	MX SUMMARY
6/26/2026	N121WA	N121WA returned immediately after takeoff to remove cowl plugs, airplane cooled and was ready for ops 10min later. Mets did not re-launch.
6/29/2026	N13AG	N13AG Avionics master failed during mission, aircraft RTB early. N9798C was flown to Bowman soon after to replace N13AG. N13AG returned to Bowman on July 1st.
7/2/2026	N13AG	N13AG flat spotted tire, pilot operated N9798C until the tire was replaced.
7/6/2026	N13AG	N13AG tire was replaced with no operations missed.
7/17/2026	N9798C	Oil change and 50 hour gear air worthiness directive performed in Bowman. No operations were missed.

Table 2. Summary of WMI aircraft maintenance performed during the 2026 NDCMP season.

7.2 WMI Aircraft Telemetry System and Communications - AirLink

The DWR contracted with WMI to provide the project radar with equipment to track each seeding aircraft's position, altitude and seeding events. Each aircraft was equipped with a WMI "datalogger" system composed of a purpose-built computer running WMI's ADAS (Aircraft Data Acquisition System) software. The computer receives inputs from the aircraft's GPS receiver, ice nuclei generators, and the firing systems from the burn-in-place flare racks. All project aircraft were equipped with a datalogger as part of the telemetry systems that provided position and altitude information as well as seeding events. The datalogger systems were designed and are specially built by WMI in Fargo.

The WMI EDAS system logs position from the aircraft GPS (latitude, longitude, altitude, and groundspeed) during the entire flight at a data rate of once per second. The computer also records the time and location of seeding events. A telemetry radio in each aircraft transmits the EDAS information to the WMI *AirLink* computer in the radar. This information is then sent to the radar's TITAN computer to generate the aircraft tracks on the TITAN display. Files are created on the aircraft computer's USB flash drive for later analysis. The DWR was provided with the AirLink computer software to replay the flight track data for post-flight analysis. The data was downloaded from each aircraft on a regular basis, checked by WMI, and sent to the DWR at the end of the season.

AirLink can provide, in real-time, a display of the seeding aircraft flight paths generated from aircraft GPS data. *AirLink* displays position information, seeding status, and atmospheric microphysical information (if the aircraft is equipped with probes), all transmitted via radio modem from each seeding aircraft to a receiver in the radar. The event tracking capability allows the radar meteorologists to determine which thunderstorm complexes were seeded and the number of flares used. If chosen by the radar operator, files can also be created on the ground computers in the radars to enable playback of flight tracks for post-mission analysis.

WMI supplied a multi-channel VHF (Very High Frequency) aviation-band communications base station radio that was used at the radar field office for communications in association with *AirLink* with the seeding aircraft. WMI also supplied antenna and low-loss cabling at the site for good reception, and power supplies for the radio that ensured adequate transmitting power. The DWR maintains the appropriate FCC radio station licenses for the radar site.

8 CLOUD SEEDING EQUIPMENT

WMI designs, manufactures, and operates a wide variety of cloud seeding equipment. Each PIC received pre-season operation and maintenance training on the seeding equipment. WMI maintains an extensive inventory of seeding equipment spares that were restocked as needed during the project. WMI also keeps an inventory of spares for the airplanes used on the project to avoid downtime waiting for parts.

Each WMI Seneca II aircraft was outfitted with the following equipment:

- 2 WMI-Lohse ram-air pressurized liquid-fueled AgI generators, with a 7-gallon usable capacity, calibrated to a flow rate of 3.0 gallons per hour at 120 mph airspeed.
- 2 Wing-mounted flare racks, each capable of carrying 12-16 burn-in-place flares.

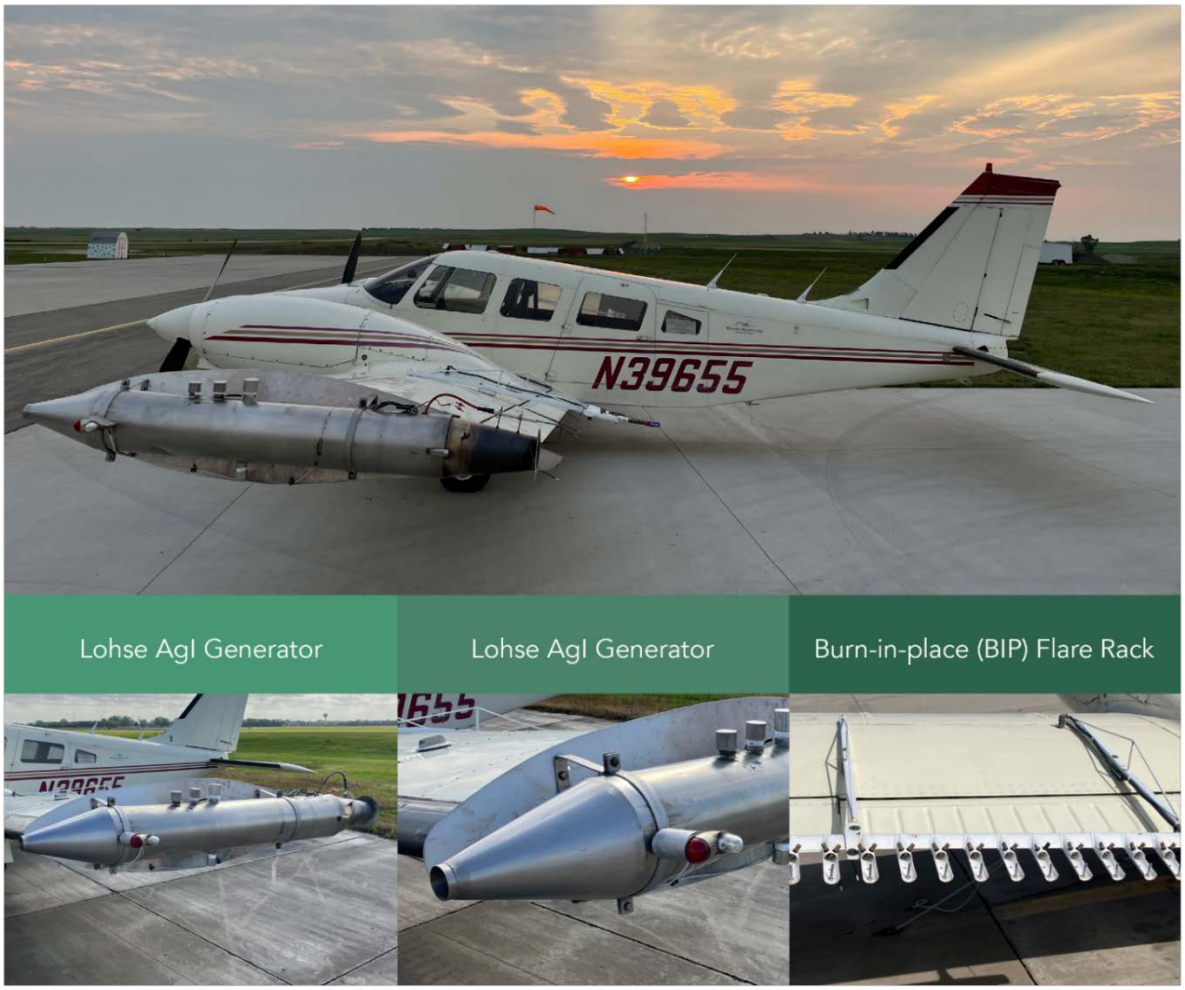


Fig. 12. WMI seeding Piper Seneca II aircraft. Photos by Ryan Starkey (2021 Intern Pilot; 2022 & 2023 Captain), Keisuke Yoshimura (2013 ARB Intern Pilot), and Taylor Exizidis-Meier (2020, 2021 WMI Captain).

Seeding Equipment Performance

The generator performance is a measure of the total time that one seeding generator was inoperative during hail missions, when two were required. The following graph depicts an accurate illustration of the percentage that the project aircraft were operating at less than desired capability. This year the burner-failure rate was recorded at 8.4%, which was unfortunately highest than the past 10 seasons with the 10 year average now at 3.03%. The main culprit for burner failure this season was ignition problems with the burners.

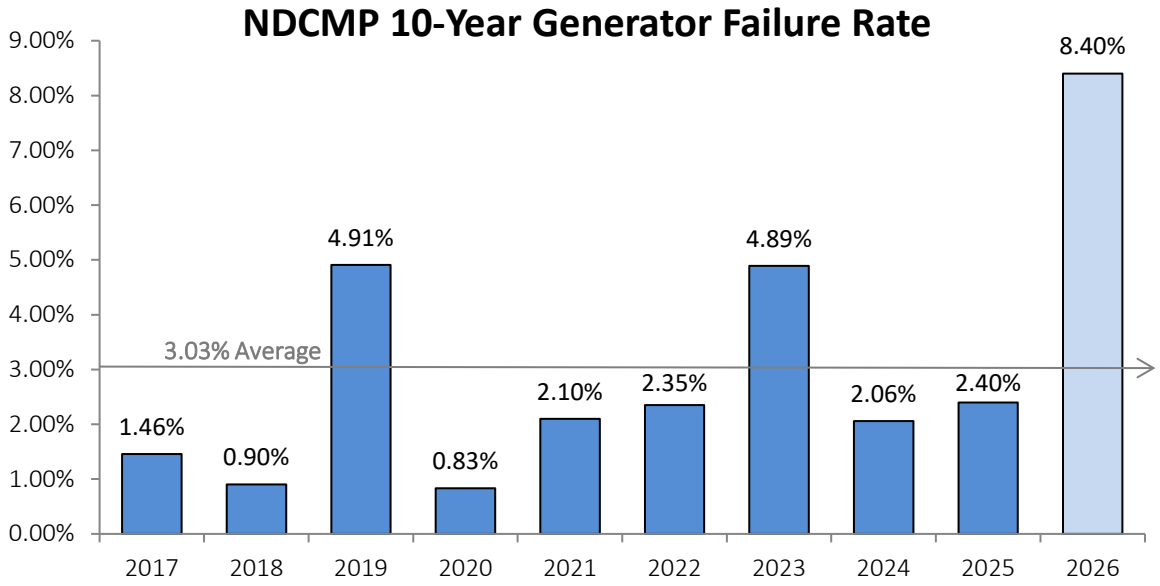


Fig. 13. NDCMP 10-Year Generator Failure Rate chart.

All the seeding materials used during the project were supplied by the DWR. These included 75-gram burn-in-place (ICE-EB®) flares) and a silver iodide solution. This solution mixture contains silver iodide, ammonium iodide, paradichloro-benzene, and sodium perchlorate, all dissolved in acetone.

Seeding formulations have evolved with research and experience and now incorporate ingredients that make the formulas faster acting – better for hail suppression operations, where the crews are often working with rapid-growing storms. The seeding solution was mixed at each site by the field crews. The DWR provided secure storage for the seeding materials at the Bowman airport.

9 WEATHER RADAR SYSTEMS

The DWR operates a five-centimeter dual-pol Vaisala WRS300 radar, located at the Bowman Regional Airport. This is a state-of-the-art upgrade that began in July 2025, with 2026 being the first full season to utilize its benefits. The Doppler capabilities provide meteorologists in the field with velocity data to forecast rapid storm development from outflow boundaries and to help avoid directing aircraft into areas of turbulence from microbursts. Furthermore, it also improves the sensitivity of the radar, allowing them to detect early echoes, which aids in the response time for rain enhancement missions. Another upgrade that is useful for the radar site is the remote access capability, which allows the radar technician or anyone at the DWR to monitor the radar remotely and fix any software problems.

The radar set has an antenna pedestal and a dish. The antenna pedestal is the elevation-over-azimuth type. The dish is parabolic, constructed of aluminum and installed within a 22 ft. (6.7 m) diameter fiberglass radome, which protects the radar from wind, precipitation, and hail damage and allows it to operate continuously. The antenna assembly is positioned on a steel tower at the Bowman airport, at an adequate height to provide the best possible radar coverage for the target area.

The data collected by the radar is analyzed through an IRIS/TITAN system. The Interactive Radar Information System (IRIS, a Sigmet/Vaisala product) and the Thunderstorm Identification, Tracking, Analysis, and Nowcasting (TITAN) system developed by scientists from the National Center for Atmospheric Research (NCAR) are software/hardware systems provided to the radar site by DWR. A clone of the software setup is also kept in Bismarck for remote data analysis.

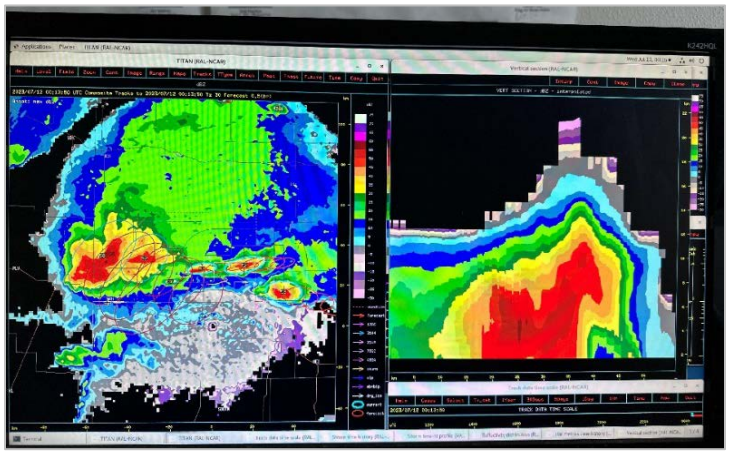


Fig. 14. Photo by Jacob Azriel shows the TITAN display used by Meteorologists. TITAN is the primary radar tool Meteorologists see and use to manage missions and keep aircraft safe.

IRIS is very useful for meteorologists in that it provides the real-time display of the radar data. Along with displaying the reflectivity detected at each elevation angle in real-time, IRIS also has tools available to do cross sections on the most recently completed scan data (cannot do cross sections on real-time display data). IRIS is not as useful when directing aircraft, since it does not display aircraft and their position. IRIS is a great tool to use to determine if a storm is increasing or decreasing in intensity, and it is a good backup tool for cross sections if the TITAN machine is inoperable.

While IRIS is valuable, the TITAN system is the main software used when running operations. The TITAN system provides 16 levels of contoured color radar reflectivity data, zooming capabilities, custom target overlays, instant playback, and real-time aircraft flight track/seeding event superimposition. TITAN software runs on a LINUX operating system, and the TITAN system displays constant altitude plan position indicator (CAPPI), vertical storm cross section, storm history, storm time-height profile and reflectivity distribution. The history of storm motions (yellow circles) and forecast storm motions (red circles) are also displayed.

CAPPI display can be selected for various altitudes starting at 2 kilometers above the surface and stepping up in 1 kilometer increments. It is also possible to create a "composite PPI" display, which plots the strongest radar reflectivity at any altitude in a PPI (radar display) format. A zoom function allows the radar operator to zoom-in on interesting features, such as hail cores, on the display. The vertical cross section capability enables a radar operator to produce a two-dimensional slice through a thunderstorm. Unlike conventional radar Range Height Indicators (RHI), the vertical cross section option permits cross sections to be made along any two points on a PPI display and not just along the azimuth from the radar.



Fig. 15. The Bowman radar conducts a full diagnosis on an approaching thunderstorm. Photo by Collin Kennedy.

Aircraft flight tracks can be superimposed upon the TITAN display, and the field office and project aircraft have the equipment to do so (see the previous section describing the WMI datalogger system). Superimposed flight tracks aid the meteorologists in directing the cloud seeding aircraft to the most suitable seeding candidates. An electronic overlay generated by a computer file displays the project target area as well as county boundaries and prominent cities and geographical features.

Radar maps and flight track data are saved automatically in approximately 5-minute increments. The time required to complete a volume scan varies dependent upon the RPM setting of the radar. The large volume of graphical data being recorded and stored is the reason for the necessity of upgrading to a specialized computer. The weather radar data is recorded onto hard-drive disks for storage and playback later, and the storms can be replayed for future analysis.

The composite PPI radar maps are automatically sent to the DWR website when a scan has been completed providing access to recently recorded data. The links (accessible from the ND Department of Water Resources, Data and Atmospheric Resources Division website, http://www.dwr.nd.gov/arb) can be viewed using any device with an internet connection and show current radar maps displaying reflectivity data and aircraft flight tracks. Additionally, Level II radar data can be accessed with the following URL: https://level2.swc.nd.gov/dualpol/. Using additional funding from surrounding counties in the offseason, the Bowman radar operates year-round. Airplane tracks were depicted when airplanes were flying. GPS tracks showed individual colors when airplanes were flying but not seeding, and turned gold when aircraft were seeding. GPS flight tracking of airplanes on the North Dakota Cloud Modification Project has been provided on project radar images since 2004.

10 METEOROLOGICAL SUMMARY

10.1 NDCMP Cloud Seeding Criteria

The meteorologists employ a set of guidelines to determine the most promising storms for seeding. These guidelines, established by the DWR, include but are not limited to:

Rain Enhancement:

- Cloud bases lower than 10,000ft MSL
- Radar reflectivities at or higher than 35dbz at a 5km vertical height
- Obvious convective storm behavior
- Pilot reported rain shafts reaching the surface
- Pilot reported inflow between 100-500fpm

Hail Suppression: All the same criteria for rain enhancement **plus:**

- Radar reflectivities of 45dbz or greater, 5,000ft above the freezing level
- Pilot reported inflow between 500-800fpm and/or
- Hail reports from the public/law enforcement

10.2 NDCMP Suspension Criteria

According to the project design and standard operating procedures, seeding operations are suspended for specific cells and/or project regions under certain circumstances. Suspension criteria include:

- Tornado Warnings or Funnel-Bearing Clouds
- Flash Flood Potential/Warnings/Flood Warnings/Areal Flood Advisories
- County Determinations (at the discretion of local weather modification authority)

Tornado Warnings issued by the National Weather Service (NWS) or funnel clouds/tornadoes observed by project personnel trigger the halting of seeding activities for a storm. In the case of NWS Tornado Warnings, nearby pilots may perform reconnaissance of the cell to confirm the presence of a funnel. If pilots are unable to confirm a funnel, seeding operations may immediately resume. However, if a tornado or funnel is confirmed by project personnel, there is an immediate 30-minute suspension of seeding for the funnel-bearing cell. Seeding may only resume 30-minutes after the funnel has dissipated. According to the DWR operations manual, studies have not demonstrated that cloud seeding causes or intensifies tornadoes.

Flood Potential may also trigger the suspension of seeding activities under several scenarios. A partial summary of the official DWR Flood Suspension Criteria follows: If the National Weather Service issues a Flood Warning/Flash Flood Warning in a specific area, seeding is suspended. This usually means that an area has already experienced sufficient rainfall accumulation and additional heavy rain is expected. If that is the case, seeding is generally suspended for a region of the district and cannot be resumed within the warning area until the flood threat subsides.

A second scenario is if a storm exhibits flash flooding potential as determined by the project meteorologists. This can be determined by investigating the rainfall rate (derived from the radar reflectivity values) and the storm motion. If the storm is stationary, a reflectivity value greater than 54.5 dBZ (indicating a rainfall rate greater than 2 inches per hour) would meet the criteria for seeding suspension. If the storm is in motion, the meteorologist must determine the flood potential based on cell speed, intensity, and expected rainfall rate. Seeding in this case may only be resumed when the storm system is no longer a flood threat.

Seeding operations may be suspended at any time at the request of the local weather modification authorities for the entire district or on a county-by-county basis. Rain-enhancement activities are frequently suspended late in the season as crops reach maturity. However, due to a dry summer, 2026 suspensions were not activated for this reason. There was a particularly high number of hailstorms coupled with a limited number of allotted flight hours. So, all rain-enhancement suspensions were implemented to focus resources on hail suppression and mitigate crop losses.

2026 NDCMP RAIN ENHANCEMENT SUSPENSIONS

Date	Bowman	SWMA
6/1/2026	enhance	enhance
6/8/2026	enhance	enhance
6/15/2026	enhance	enhance
6/22/2026	enhance	enhance
6/29/2026	enhance	enhance
7/6/2026	suspend	suspend
7/13/2026	suspend	suspend
7/20/2026	suspend	suspend
7/27/2026	suspend	suspend
8/3/2026	suspend	suspend
8/10/2026	suspend	suspend
8/17/2026	suspend	suspend
8/24/2026	suspend	suspend
8/31/2026	suspend	suspend

Table 3. Rain enhancement suspension dates by county.

10.3 Climatological Project Overview

10.3.1 JUNE

June is typically the most active month for strong-to-severe convective activity in western North Dakota. The 2026 season was no exception as operations got off to a fast start. During the first week of the project, seven dual-purpose (rain-enhancement and hail suppression) flights and one rain-enhancement flight occurred. After a brief lull in operations during the second week of the month; several dual-purpose missions were carried out in mid to late June. Despite a strong operational start to the season, southern North Dakota experienced below average rainfall. This included the project area; which recorded 47-76% of average precipitation. Meanwhile, much of northern North Dakota received near to above average amounts. This is due to the frequency of upper-level lows that traversed the southern Canadian Prairies- often providing better moisture to the north. Meanwhile, most of the rainfall received in District I came from hail-capable storms triggered by passing shortwaves. The project area experienced average to below average temperatures for June. At the beginning of the month, the western half of District 1 was under abnormally dry conditions, while the eastern half was drought-free. By the end of June, moderate drought had developed over nearly the entire area.

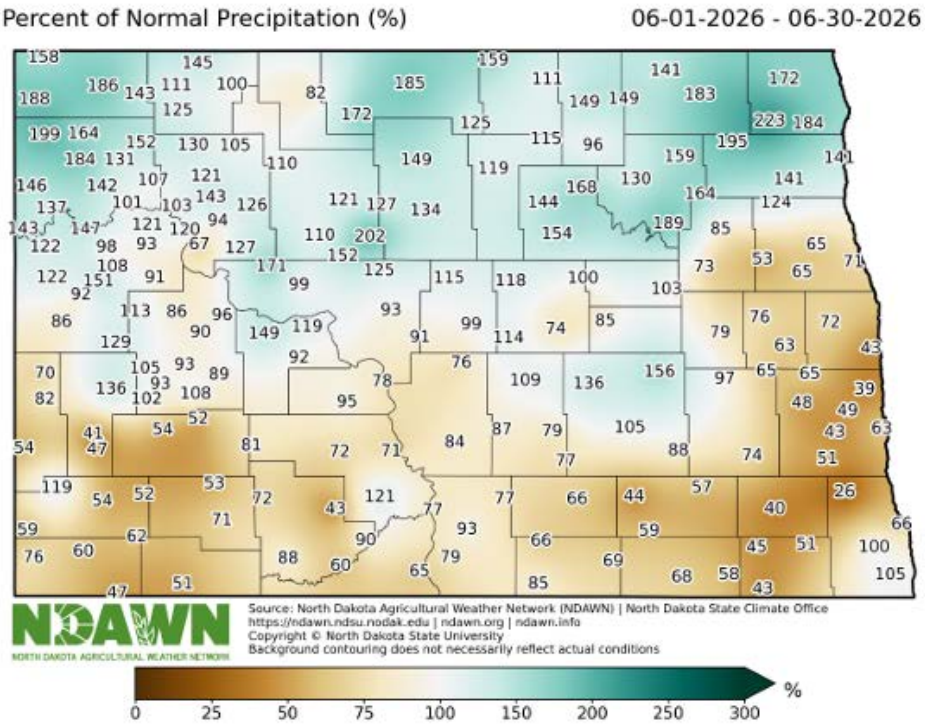


Fig. 16. Percent of Normal Rainfall map for the month of June. Graphic produced by the DWR through their Cooperative Observer network.

10.3.2 JULY

July is normally the hottest month of the year in North Dakota; with slightly less precipitation than in June. This climatological norm was augmented in 2026 with near-record heat and dryness. The first week of the month was quite active across southwestern North Dakota, as strong southwesterly flow aloft brought thunderstorms with any passing shortwave. Several dual-purpose cloud seeding missions were conducted. However, an amplified ridge developed during the middle of the month which created a very quiet and hot weather pattern. Nearly the entire state experienced below-average precipitation, with some areas receiving less than 10% of their normal monthly rainfall. District I values ranged from 60-85%, remedied some by the fast start to July. Southwestern North Dakota also saw the warmest temperatures. In parts of District I, daily high temperatures exceeded 90°F nineteen times, and 100°F eleven times. A high statewide temperature of 110°F was achieved in Bowman County on July 12. The upper-level high pressure began to break down towards the end of the month- which provided a few operational opportunities. However, a quiet July augmented drought conditions across North Dakota. By the month's conclusion, a severe drought had developed across the southwest, including much of District I.

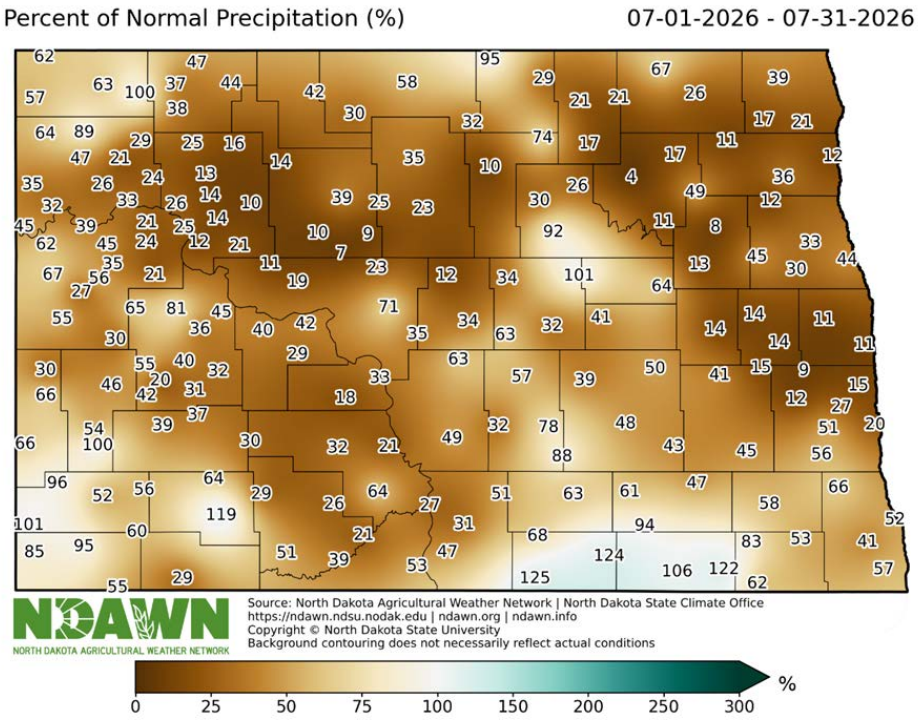


Fig. 17. Percent of Normal Rainfall map for the month of July. Graphic produced by the DWR through their Cooperative Observer network.

10.3.3 AUGUST

As common in August, North Dakota experienced varying amounts of precipitation. Southwestern and northwestern portions of the state received above-average rainfall- including over 400% of normal in Burke County. Meanwhile, west central and eastern North Dakota remained dry. Thunderstorm occurrence was seasonably spotty, which contributed to the stark contrast in precipitation amounts. This disparity was reflected in District I as well. The western side of the project area received as little as 60% of the August normal, while the eastern received nearly double. Operations were infrequent, partially due to the rain enhancement suspension in place. Also, a weak synoptic pattern prevented widespread activity. A slight uptick in hail suppression missions occurred during the last two weeks of the month, when a couple robust shortwaves and a longwave trough passed overhead. As for temperatures- many areas of North Dakota were relieved from the July heat. Lower than normal temperatures occurred in much of the northwest, central, and eastern portions of the state. Southwest North Dakota, including most of District I, remained slightly warmer than average. Drought conditions improved slightly over the extreme eastern project area where there was above average rainfall. However, by the end of the month, an extreme drought had developed over eastern and far western North Dakota. This included western Bowman County. The overall dry summer contributed to an early harvest. So, the counties of District I did not elect to extend hail suppression operations. The project concluded at the end of the month.

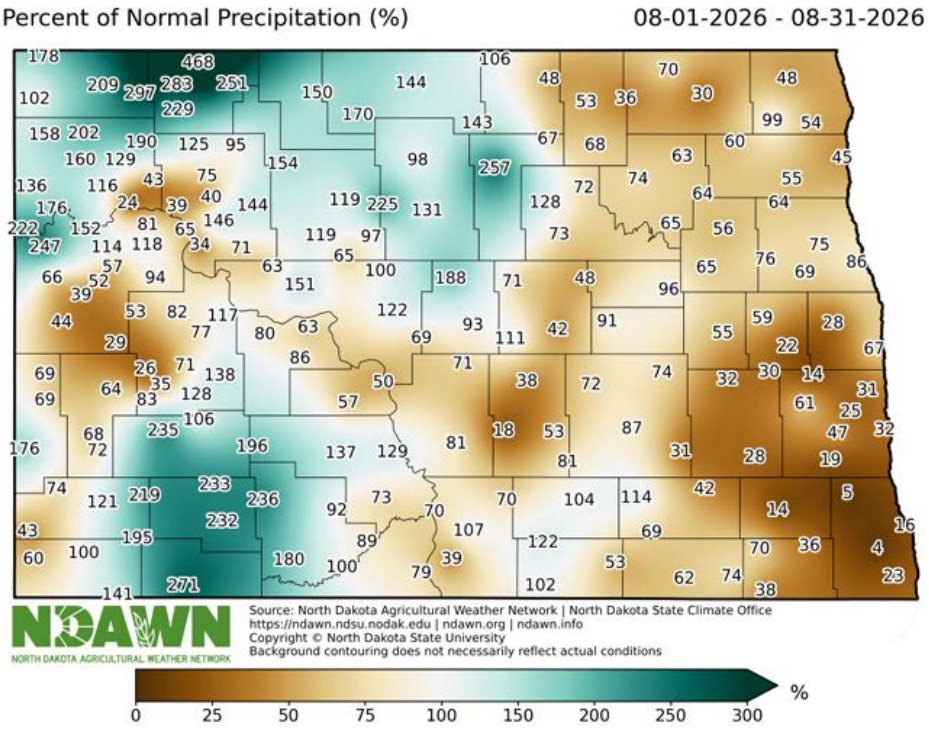


Fig. 18. Percent of Normal Rainfall map for the month of August. Graphic produced by the DWR through their Cooperative Observer network.

11 PROJECT RECORD KEEPING

NDCMP record keeping is completed on the Apple iPad. The iPad is widely used by many aviation companies, including WMI who have used it to replace the need for bulky paper charts. The iPad features the DWR's "PARS" (Pilot Aircraft Recordkeeping System) software and can track position and altitude data. The iPad receives this data from its built-in GPS. This data is used to create the flight form as well as accurate maps, with seeding areas depicted as entered by the flight crew. Two additional programs, *ARBSync* and *ChemInv*, are included on the iPad to execute data uploads to the DWR database, and to monitor seeding chemicals and flares at the NDCMP field site. The iPad allows for speedy uploads of data to DWR's database via Wi-Fi.

All aircraft were equipped with an ADS-B receiver (Automatic Dependent Surveillance - Broadcast) to access the FAA weather information provided by this network. The weather information can be displayed on *ForeFlight* using either the DWR or the pilots' personal iPad. While the radar depictions available from ADS-B are delayed, they are still an excellent tool for the flight crews to aid in situational awareness and communications with the radar.

12 WMI AND DWR PROJECT PERSONNEL

12.1 Ground School

The 2026 North Dakota Cloud Modification Project Ground School was conducted 26-28 May 2026 at the Weather Modification International headquarters in Fargo, ND. All aspects of the program were discussed, including responsibilities of personnel, cloud physics, opportunity recognition, use of seeding chemicals, project documentation, safety procedures, PARS iPad training, and selected examples from prior projects that helped illustrate efficient cloud seeding procedures.

Numerous questions typically surface during the project as problems arise, and remedies are explored. It is invaluable to have experienced personnel in the field during the season to resolve these problems. DWR Data and Atmospheric Resources Division Director Paul Moen and Chief Meteorologist Mark Schneider were always available for advice and answers whenever their meteorologists needed guidance; all project personnel were provided with a link to online copies of the NDCMP Operations Manual and Radar Applications Manual prior to the season start.

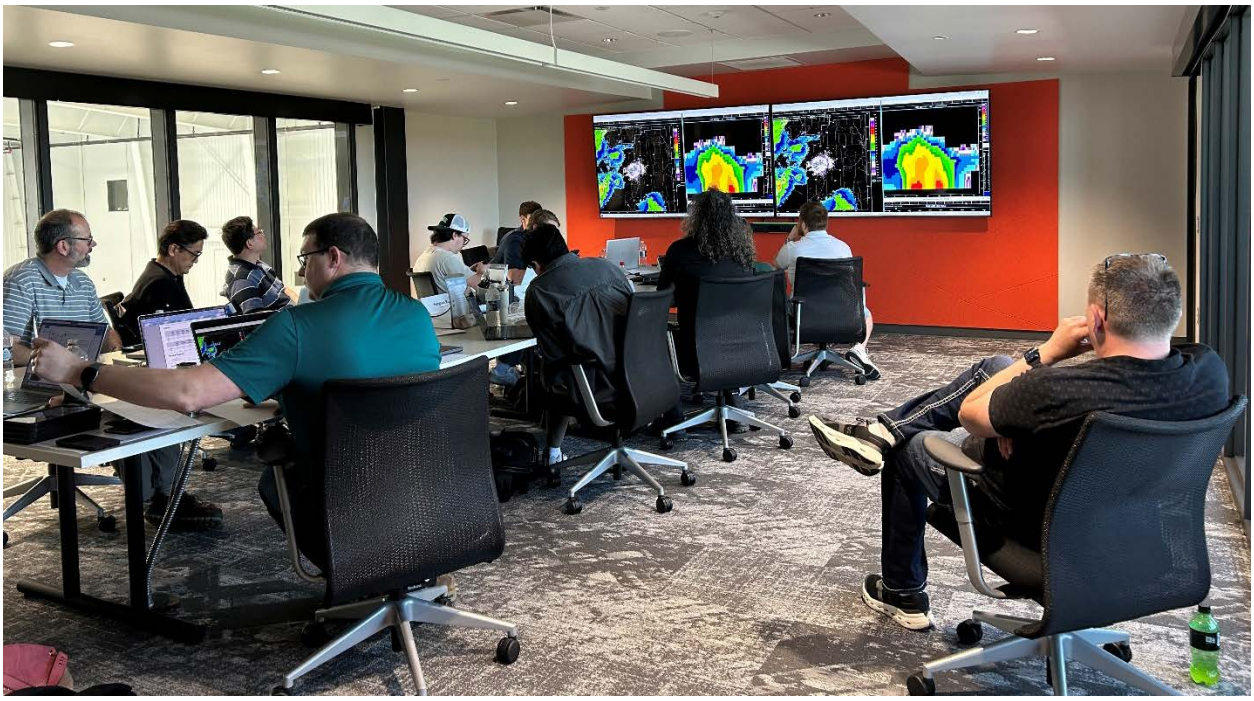


Fig. 19. DWR Meteorologist Dan Brothers gives an overview of TITAN to the NDCMP staff during ground school. Photo by Erin Fischer.

Jody Fischer (WMI Vice President of Operations) and Kirk Hamilton (WMI Director of Flight Operations) provided support for WMI pilot personnel during the season. Fischer started on the NDCMP project as an intern in 1999 and has been involved with the project since. Hamilton started on the NDCMP project as a PIC in 2016.

12.2 WMI Pilots

Both WMI captains were new in the captain's seat for this year's season. Noah Harbarth returned this year after flying as a co-pilot in 2025, and Peyton Underwood's returned after flying as a co-pilot in 2024. Instructors Austin Krause and Jake Floyd delivered training covering safe operational protocols, emergency response procedures, and comprehensive aircraft proficiency.

During training, all pilots got to fly with at least one of the two instructors to ensure that they were familiar with the airplane systems and the operation of the seeding equipment. The pilots were instructed on airspeeds and power settings used during seeding missions, as well as safe operating procedures. These flights provided quality assurance to standardize the WMI procedures for each pilot. All the pilots were involved in the pre-season maintenance and flight-testing of the aircraft and seeding equipment.

The absence of a dedicated vacation rover intern pilot role allowed Pilots in Command (PICs) and interns greater flexibility in selecting vacation times. WMI maintained service continuity by supplying relief pilots to fill temporary vacancies resulting from scheduled leave.

2026 NDCMP RELIEF PILOT ASSIGNMENTS

START DATE	END DATE	WMI RELIEF PILOT	SEED	CAPTAIN or INTERN REPLACED
7/21/2026	7/26/2026	Austin Krause	S2	Noah Harbarth

Table 4. Pilot vacation dates and relief pilot assignments for the 2026 NDCMP.

12.3 Co-Pilot Internship

The Bureau of Reclamation first launched the Pilot Internship Program in 1974. Since 1975, the program has been governed by a Memorandum of Understanding (MOU) between the DWR and the University of North Dakota. Mr. Brothers oversaw the program for the DWR. The intern pilots were paid an hourly wage and were required to maintain a timesheet of their project activities. As of the completion of the 2026 program, the program has provided training and experience for 416 pilots. Both co-pilot interns returned to school before the end of August. Information about the NDCMP Pilot and Meteorologist Internship Programs can be found at https://www.dwr.nd.gov/arb/ndcmp/internprog.html.

WMI provides, for a nominal charge, each season's co-pilot interns with flight instruction and endorsements for High Altitude and/or High-Performance training to give them the proper US Federal Aviation Administration certifications to act as pilots in the WMI aircraft used on the NDCMP. This allows the interns to log flight time in the aircraft, giving them hands-on experience that is far more beneficial for them. These certifications are not normally earned during flight training at UND. The flights involve several takeoffs and landings as well as flight operations at 25,000 feet.

Kirk Hamilton, WMI Director of Flight Operations, conducted flight training with the DWR Intern Co-Pilots prior to the start of project. Training included aircraft operations, airport operations, and project specific procedures.

12.4 DWR Staff

All radar and intern meteorologists were DWR personnel. The Bowman operations base was staffed by one radar meteorologist and one intern meteorologist. Elan Azriel was selected to run the primary operations. Collin Kennedy served as the intern meteorologist. Both meteorologists shared duties and assisted the other when needed. In certain cases, forecasting duties could be fulfilled by DWR staff in Bismarck – typically when extended operations stretched through the night or when operations were ongoing during normal forecast preparation. The NDCMP Meteorology Internship Program began in 1996 and to date has provided hands-on radar, operations and forecasting experience for 77 meteorology undergraduates.

12.5 DWR Administration

Division Director Mr. Paul Moen oversees the NDCMP operations for the DWR. Chief Meteorologist Mr. Mark Schneider manages the radar and intern meteorologists. Program Manager, Ms. Kelli Schroeder handles the program funding and contracts. Mr. Daniel Brothers, Meteorologist, trains and oversees the forecasting duties, as well as performing office duties including record keeping, iPads, the DWR rain gauge network, and record quality control. He also manages the Pilot Internship Program. Mr. Schneider is a Weather Modification Association (WMA) Certified Weather Modification Manager, and Mr. Brothers is a WMA Certified Operator.



Fig. 20. DWR Administration Team located in Bismarck, ND.

12.6 Weather Modification International Administration

Kirk Hamilton, Director of Flight Operations, was the primary ND Project Manager for the 2026 season. Mr. Hamilton has been involved with the project as a pilot from 2016-2019, and he has supervised operations in his current role since 2021. Hamilton has also been a PIC for WMI on winter projects in Wyoming and California, as well as a PIC on a rainfall enhancement project in India and The Kingdom of Saudi Arabia.

He was assisted by the Vice President of Operations, Jody Fischer who has been involved with the project since 1999 when he interned as a pilot. He returned the following two years as a Seneca captain, then as C340A captain and continued that role for the next 4 seasons until he was assigned to other WMI international programs and duties. Mr. Fischer is a WMA Certified Operator.

Hamilton and Fischer were responsible for hiring and training the project pilots, overseeing aircraft operations, aircraft and equipment maintenance, and providing relief pilot duties.



Fig. 21. WMI – NDCMP Administration Team located in Fargo, ND.

Adam Brainard, WMI's Chief Meteorologist, served as Co-Project Manager in case Mr. Hamilton needed to travel outside the state. Mr. Brainard is a WMA Certified Operator and has worked with WMI since 2014.

Two of WMI's field meteorologists, Ben Schaefer and Marisa Perez, helped provide pilots weather forecasts from WMI's new ops center in Fargo during training. Schaefer also assisted Jake Van Ornum with paperwork and data entry.

Dennis Afseth, WMI Director of Electronics, oversaw the installation and maintenance of the datalogger computers and electronics in the aircraft, including *AirLink*.

12.7 NDCMP Project Personnel Pictures

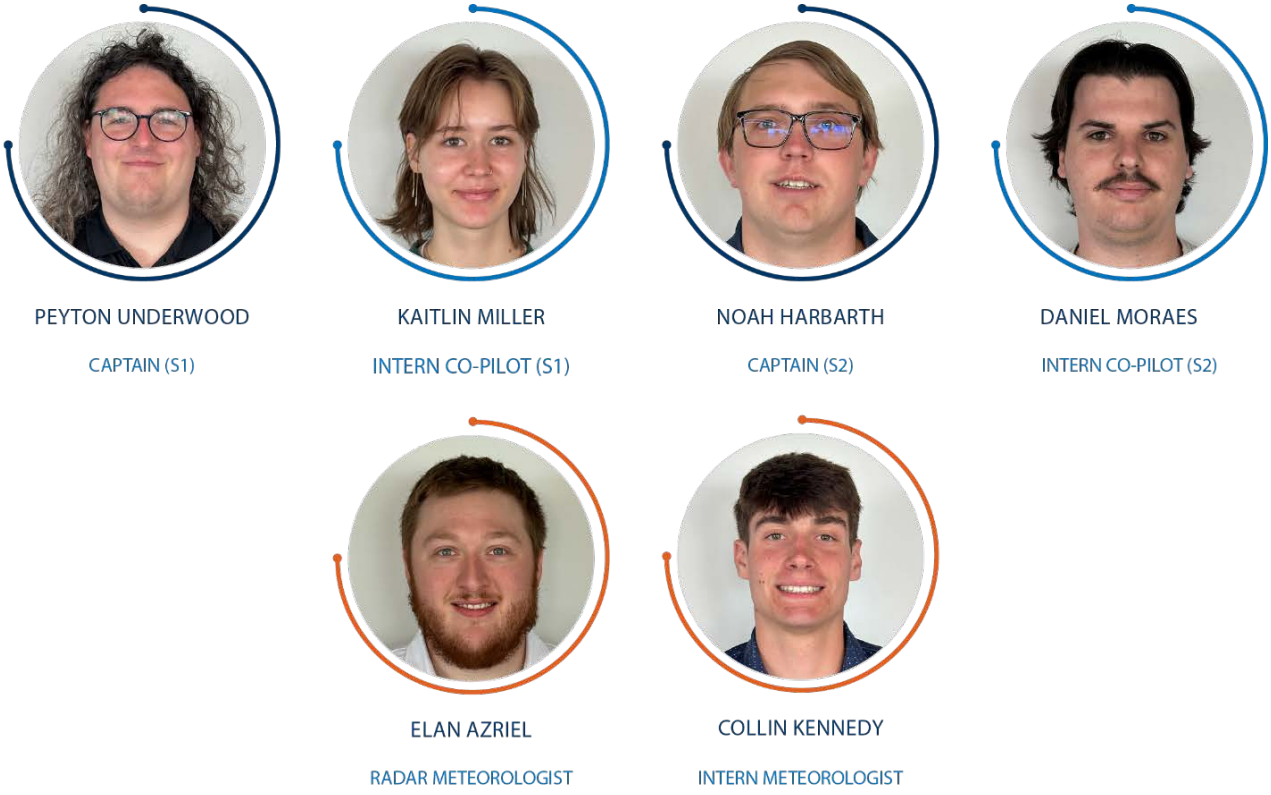


Fig. 22. 2026 District I flight crew and meteorology team. Photos by Dan Brothers, DWR.

13 PUBLIC RELATIONS

The North Dakota Cloud Modification Project has a rich history of community event participation, education, and public outreach. This season presented numerous opportunities for community engagement with the on-site personnel. Highlights included hosting representatives from the South Korean Weather Modification Delegation, the Bowman County fair, held 6-9 August; and a fly-in poker run coordinated with other local airports on 20 June. All these, among many other unscheduled occasions, gave ample time for the crew, and some members from the Department of Water Resources, to make an impact on the local community. Aircraft were available on static display whenever possible for questions and explanations of the program's seeding methodology.

Pilots and meteorologists alike contributed not only to the local non-aviation community, but directly with the airport. Throughout the summer, the crew shared responsibility for keeping the Bowman airport mowed and presentable. They could also be found helping in the maintenance shop, fueling aircraft, and providing hospitality to visitors to the airport and radar. The professionalism, willingness to pitch in, and positivity typically given by this crew should be an example for future projects to strive for.

14 PROGRAM AWARDS

DWR recognizes field personnel professionalism and dedication to the project with the presentation of the following project awards. Nominations are taken from project personnel, WMI administration, and DWR staff in the last week of the project and are carefully considered. This season, two awards were presented – the Wilbur E. Brewer Professional Award and the Hans P. Ahlness Outstanding Intern Award.

Wilbur E. Brewer Professionalism Award

Named in honor of one of the founders of WMI and a longtime NDCMP advocate, this award was presented to Seneca Captain Noah Harbarth. Noah displayed his dedication to the program by doing an excellent job and demonstrating his strong work ethic daily. He worked hard beyond his flying duties. He mentored project staff, helped around the airport and assisted with public relations, making work for all project staff easier. Noah was an excellent role model and consistently demonstrated the level of professionalism everyone should strive for on the NDCMP.

Hans P. Ahlness Outstanding Intern Award

A desire to learn and further their career attracts interns to the NDCMP. This award is presented to the intern who had the greatest positive impact on the project and its daily operations. Kaitlin Miller's efforts as an Intern Co-Pilot on the NDCMP were described by her peers as "stellar." She developed a habit of making sure everything at the airport was ready to go, often on her own initiative. She was also a strong representative of the project when interacting with the public. Kaitlin's work ethic across multiple aspects of the NDCMP made her a "star" of the NDCMP.

15 CONTRACTOR'S SUMMARY

This summer was Weather Modification International's 66th season providing operational cloud seeding services for the North Dakota Cloud Modification Project.

WMI would like to recognize DWR staff members – Paul Moen, Mark Schneider, Kelli Schroeder, and Dan Brothers for their consistent management and program direction. Personnel must be hired and trained, equipment maintained and improved, seeding chemicals and flares obtained, and procedures put in place to allow for smooth project operations. The DWR staff members have several years of experience and WMI appreciates working with such professionals.

In closing, WMI invites comments from the DWR regarding this summer's project and improvements for continued operations. Thank you for another great season!



Fig. 23. N121WA and N9798C watch a passing light rain shower from the ramp in Bowman, ND. Photo by Peyton Underwood.

APPENDIX ITEMS

Appendix A: Aircraft Activity Table
Appendix B: Piper Seneca II Specifications
Appendix C: NOAA Final Operations Reporting

Appendix A

District I – Cloud Base Aircraft, Seneca II

2026 DISTRICT I FLIGHT SUMMARY
CLOUD - BASE (Seneca)

DATE	DUAL HOURS	HAIL HOURS	RAIN HOURS	RECON HOURS	OTHER HOURS	DAILY TOTAL	RUNNING TOTAL	MAINTENANCE (Contractor Expense)	HOURS BURNED 1 GENERATOR	HOURS BURNED 2 GENERATORS	GRAMS BURNED 1 GENERATOR	GRAMS BURNED 2 GENERATORS	FLARES GRAMS
06/01/26						0.00	0.00	8.95					
06/02/26	3.43		0.80		1.29	5.52	5.52		0.24	1.95	48	784	150
06/03/26	2.22				0.59	2.81	8.33		1.20		241		
06/04/26	4.62					4.62	12.95			3.10		1,246	1125
06/05/26					1.40	1.40	14.35						
06/07/26	6.41					6.41	20.76			3.70		1,487	375
06/08/26					2.61	2.61	23.37						
06/11/26			3.48			3.48	26.85		1.74		350		
06/17/26	1.73			1.13		2.86	29.71			0.75		302	225
06/18/26	4.75					4.75	34.46		0.67	1.76	135	708	600
06/19/26					1.40	1.40	35.86						
06/23/26	4.44					4.44	40.30	0.32	0.68	0.70	137	281	
06/27/26	8.65					8.65	48.95	0.52	2.19	2.62	440	1,053	675
06/28/26					2.51	2.51	51.46						
06/29/26	1.62		0.81			2.43	53.89	0.38	0.67	0.43	135	173	
06/30/26	1.44					1.44	55.33	1.84		0.40		161	225
07/01/26						0.00	55.33	2.92					
07/02/26	3.43				1.33	4.76	60.09	0.34		1.93		776	750
07/03/26	3.36			1.28	1.36	6.00	66.09			1.46		587	300
07/04/26				0.70		0.70	66.79						
07/05/26	4.05					4.05	70.84			2.17		872	375
07/06/26					0.55	0.55	71.39						
07/07/26	4.73				1.28	6.01	77.40			3.05		1,226	900
07/12/26						0.00	77.40	2.30					
07/17/26						0.00	77.40	1.82					
07/18/26						0.00	77.40	1.03					
07/20/26						0.00	77.40	0.32					
07/21/26						0.00	77.40	1.18					
07/23/26						0.00	77.40	0.98					
07/25/26						0.00	77.40	2.16					
07/27/26		3.24				3.24	80.64	0.41		1.47		591	
07/28/26		1.31			1.32	2.63	83.27			0.20		80	
07/29/26		5.55			1.09	6.64	89.91			3.40		1,367	
07/30/26				0.68		0.68	90.59	0.84					
08/03/26						0.00	90.59	0.47					
08/04/26						0.00	90.59	2.14					
08/07/26						0.00	90.59	1.74					
08/09/26						0.00	90.59	0.89					
08/10/26		3.00				3.00	93.59			1.75		704	975
08/11/26		6.16				6.16	99.75		0.82	4.02	165	1,616	1275
08/12/26				0.51		0.51	100.26						
08/13/26						0.00	100.26	0.43					
08/15/26						0.00	100.26	1.10					
08/16/26				0.87		0.87	101.13						
08/17/26		3.06		0.98		4.04	105.17	1.38		1.82		732	825
08/18/26		1.19				1.19	106.36			0.73		293	300
08/19/26						0.00	106.36	0.52					
08/22/26						0.00	106.36	2.25					
08/23/26		5.29				5.29	111.65			2.97		1,194	1650
08/24/26					1.36	1.36	107.72						
08/25/26						0.00	107.72	0.96					
08/27/26						0.00	107.72	0.98					
08/28/26		1.74		1.33		3.07	110.79	1.14		0.86			75
08/30/26		2.00				2.00	112.79			0.33			
08/31/26					0.96	0.96	108.88						
TOTALS	**54.88**	**32.54**	**5.09**	**7.48**	**19.05**	**119.04**	**119.04**	**40.31**	**8.21**	**41.57**	**1,650**	**16,233**	**10,800**

End of table

TOTAL AgI RELEASED BY BASE AIRCRAFT: 28,683 grams

Appendix B

Piper Seneca II

PIPER SENECA II SPECIFICATIONS
4,570 lbs maximum gross weight
3,200 lbs typical empty weight
1,370 lbs typical useful load
Turbocharged, 200HP engines
Portable supplemental oxygen system
200 hp per engine at sea level
215 hp at 12,000 ft
225 mph max cruise speed
185 mph recommended cruise speed
70 mph stall in landing configuration
93-123 gallons usable fuel capacity
25,000 feet all engine service ceiling
14,000 feet single engine service ceiling
1,200 feet per minute all engine rate of climb
190 feet per minute single engine rate of climb
1,030 feet for takeoff over 50-ft obstruction
750 feet for takeoff ground roll
950 feet landing ground roll
28 ft. 07 in. length
9 ft. 11 in. height
38 ft. 11 in. wingspan

Appendix C

NOAA FORM 17-4A (4-81) — U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Form Approved OMB No. 0648-0025
Expires 12/31//2007

INTERIM ACTIVITY REPORTS AND FINAL REPORT

This report is required by Public Law 92-205; 85 Stat. 735; 145 U.S.C. 330b. Knowing and willful violation of any rule adopted under the authority of Section 2 of Public Law 92-205 shall subject the person violating such rule to a fine of not more than $10,000, upon conviction thereof.

NOAA FILE NUMBER: unknown

[ ] INTERIM REPORT [x] FINAL REPORT

Complete in accordance with instructions on reverse and forward one copy to:
National Oceanic and Atmospheric Administration
Office of Oceanic and Atmospheric Research
1315 East-West Highway SSMC-3 Room 11216
Silver Spring, MD 20910

REPORTING PERIOD: FROM 06/01/2026 TO 08/31/2026

MONTH	(a) NUMBER OF MODIFICATION DAYS	(b) NUMBER OF MODIFICATION DAYS PER MAJOR PURPOSE				(c) HOURS OF APPARATUS OPERATION BY TYPE		(d) TYPE AND AMOUNT OF AGENT USED				
		INCREASE PRECIPITATION	ALLEVIATE		OTHER	AIRBORNE	GROUND	SILVER IODIDE	CARBON DIOXIDE	UREA	SODIUM CHLORIDE	OTHER
			HAIL	FOG								
JANUARY												
FEBRUARY												
MARCH												
APRIL												
MAY												
JUNE	11	11	10			38		8,040				
JULY	7	4	7			27		5,747				
AUGUST	7	0	7			26		5,247				
SEPTEMBER												
OCTOBER												
NOVEMBER												
DECEMBER												
TOTAL	25	15	24	0	0	91	0	19,033	0	0	0	0
TOTALS FOR FINAL REPORT	25	15	24	0	0	91	0	19,033	0	0	0	0

DATE ON WHICH FINAL WEATHER MODIFICATION ACTIVITY OCCURRED *(For Final Report only.)* 08/30/2026

CERTIFICATION: I certify that all statements in this report on this weather modification project are complete and correct to the best of my knowledge and are made in good faith.

NAME OF REPORTING PERSON: Kelli Schroeder

AFFILIATION: ND Department of Water Resources

SIGNATURE: Kelli Schroeder — Digitally signed by Kelli Schroeder Date: 2026.09.17 09:49:27 -05'00'

STREET ADDRESS: 1200 Memorial Hwy

OFFICIAL TITLE: Program Manager

CITY: Bismarck | STATE: ND | ZIP CODE: 58504

DATE: 09/17/2026