Estimate of adjoining geographic area possibly affected: Areas downwind (east) of highway no. 2 to highway no. 21 may also benefit from the seeded storms.

Approximate total cost: approx. $2 million per year.

Funds to be expended in Canada: est. $500,000 per year.

General period of operation: June 1st - Sept. 15th annually.

PART 7. GENERAL INFORMATION CONCERNING OPERATIONS AND TECHNIQUES

A. GENERAL: The following text describes the methods to be used, general principles of techniques, description of specific techniques, and a brief description of typical operations:

OVERVIEW OF METHOD

For hail suppression, aircraft patrolling based upon forecasts and hourly weather reports will be used to initiate seeding as soon as appropriate conditions develop. Storms will be seeded if they have radar reflectivities of approximately 35 dBZ at heights above the -5 C temperature level, and are considered to be a potential hail threat to an urban or populated area. When large hail is forecast, seeding will commence when radar reflectivities reach approximately 20 dBZ in order to start the microphysical suppression process as early as possible within the potential hailstorms. Storms will be seeded by aircraft using either droppable AgI pyrotechnics and/or wing mounted AgI pyrotechnics or AgI-solution burners.

The amount of seeding material used will depend upon the lifetime and size of the cloud or storm and other meteorological conditions. The seeding rates are about double those used during the 1970's and 1980's in Alberta. Seeding will be focused on the feeder clouds of the storm's new growth zone and will be conducted at cloud top and cloud base. Further details of the seeding method are discussed below.

HAIL SUPPRESSION HYPOTHESIS

The cloud seeding hypothesis is based on the cloud microphysics concept of "beneficial competition". Beneficial competition assumes a lack of natural ice nuclei in the environment effective at temperatures warmer than -20 ^{o}C and that the injection of AgI will result in the production of a significant number of "artificial" ice nuclei. The natural and artificial ice crystals "compete" for the available supercooled liquid cloud water within the storm. Hence, the hailstones that are formed within the seeded cloud volumes will be smaller and produce less damage if they should survive the fall to the surface. If enough nuclei are introduced into the new growth region of the storm, then it is possible that the hailstones will be small enough to melt completely before reaching the ground.

Cloud seeding operations are intended to alter the cloud microphysics of the treated clouds, assuming that the present precipitation process is inefficient due to a lack of natural ice nuclei. The seeding is based on a conceptual model of Alberta hailstorms that evolved from the studies of Chisholm (1970), Chisholm and Renick (1972), Barge and Bergwall (1976), Krauss and Marwitz (1984), English and Krauss (1986) and English (1986).

It is assumed that hail embryos grow within the time evolving "main" updraft of single cell storms and within the updrafts of developing "feeder clouds" or cumulus towers that flank mature "multi-cell" and "super-cell" storms (see e.g. Foote, 1984). The growth to large hail is hypothesized to occur along the edges of the main storm updraft where the merging feeder clouds interact with the main storm updraft.

For hail suppression, seeding with a large amount of silver-iodide will dramatically increase the ice crystal concentration in thunderstorm clouds and compete for the available supercooled cloud water to prevent the growth of large, damaging, ice particles. Based on WMI's experience, the cloud seeding will be targeted on the feeder cloud updraft regions associated with the production of hail and will leave unseeded those regions of the storm associated with the production of rain only. This will make efficient use of the seeding material (AgI) and will reduce the possible risk of overseeding rain clouds.

CLOUD SEEDING METHODOLOGY - SEEDING TECHNIQUES

Convective cells (defined by radar) with maximum reflectivity approximately >35 dBZ within the cloud layer above the -5 C level, located within the project areas or within a 20 min travel time "buffer zone" upwind of the project area, will be seeded if they pose a potential threat of damaging hail for an urban or populated area. Radar observers/controllers will be responsible for making the "seed" decision and directing the cloud seeding missions.

Patrol flights will be launched before clouds within the target area meet the radar reflectivity seeding criteria. These patrol flights are meant to provide immediate response to developing cells. In general, a patrol is launched in the event of visual reports of vigorous towering cumulus clouds near Calgary or Red Deer, or when radar cells exceed 25 kft height over the higher terrain along the western border and begin moving towards the urban areas.

Launches of more than one aircraft are determined by the number of storms in each area, the lead time required for a seeder aircraft to reach the proper location and altitude, and projected overlap of coverage and on-station time for multiple aircraft missions. In general, only one aircraft can work safely at cloud top and one aircraft at cloud base for a single storm. The operation of three aircraft is recommended to provide uninterrupted seeding coverage at either cloud-base or cloud-top and to seed three storms simultaneously if required.

The program is designed to seed convective clouds, before they achieve radar reflectivities associated with hail, and deliver seeding material to regions of updraft and supercooled liquid water i.e. the primary conditions responsible for the growth of hailstones.

Factors that determine cloud top or cloud base seeding are: storm structure, visibility, cloud base height, or time available to reach seeding altitude. Cloud base seeding is conducted by flying at cloud base within the main inflow of single cell storms, or the inflow associated with the new growth zone (shelf cloud) located on the upshear side of multi-cell storms.

Cloud top seeding is conducted between typically between -5 C and -10 C. The pencil flares fall approximately 1.5 km (approximately 10 C) during their 35-40 s burn time. The seeding aircraft will penetrate the edges of single convective cells meeting the seed criteria. For multi-cell storms, or storms with feeder clouds, the seeding aircraft will penetrate the tops of the developing cumulus towers on the upshear sides of convective cells, as they grow up through the aircraft's altitude.

Occasionally, with embedded cells or convective complexes, there are no clearly defined feeder turrets visible to the flight crews or on radar. In these instances, at an altitude between -5 C and - 10 C, a seeding aircraft will penetrate the storm edge (region of tight radar reflectivity gradient) on the upshear side and burn a burn-in-place flare and inject droppable pencil flares when updrafts are encountered.

Seeding is effective only within cloud updrafts and in the presence of supercooled cloud water, i.e. the developing, and mature stages in the evolution of the classic thunderstorm conceptual model. The dissipative stages of a storm would be seeded only if the maximum reflectivity is particularly severe and there is evidence (visual cloud growth, or tight reflectivity gradients) indicating the possible presence of embedded updrafts.

SEEDING RATE

A seeding rate of one 20 g flare every 5 s is typically used during cloud penetration. A slightly higher rate is used (e.g. 1 flare every 2 s) if updrafts are very strong (e.g. > 2000 ft/min) and the storm is particularly intense. Calculations show that this seeding rate will produce >1300 ice crystals per litre which is more than sufficient to deplete the liquid water content produced by updrafts of 10 m/s (2000 ft/min), thereby preventing the growth of hailstones within the seeded cloud volumes.

A cloud seeding pass is repeated immediately if there are visual signs of new cloud growth or radar reflectivity gradients remain tight (indicative of persistent updrafts). A 5 to 10 min waiting period may be used, to allow for the seeding material to take effect and the storm to dissipate, if visual signs of glaciation appear or radar reflectivity values decrease and gradients weaken. This waiting period precludes the waste of seeding material and ensures its optimum usage.

For cloud base seeding, a typical seeding rate of 1 burn-in-place flare (150 g each) is used. Cloud seeding runs are repeated until no further inflow is found. Acetone burners will also be used to provide continuous silver iodide seeding if extensive regions of weak updraft are observed at cloud base and the shelf cloud region. Base seeding is not conducted if only downdrafts are encountered at cloud base, since this would waste seeding material.

The cloud seeding flares are silver-iodide pyrotechnics with an ice nuclei effectiveness of approximately 10^{14} nuclei per gm of pyrotechnic, active at -10 C, as determined by independent cloud chamber tests at Colorado State University.

Sufficient dispersion of the particles is required for AgI plume overlap from consecutive flares by the time the cloud particles reach hail size for effective hail suppression. The work by Grandia et al. (1979) based on turbulence measurements within Alberta feeder clouds indicated that the time for the diameter of the diffusing line of AgI to reach the integral length scale (200 m) in the inertial subrange size scales of mixing, was 140 seconds. This is insufficient time for ice particles to grow to hail size. Therefore, dropping flares at 5 sec intervals should effectively deplete the supercooled liquid water and prevent the growth of hail particles. The use of the 20 gm flares and a frequent drop rate provides better seeding coverage than using larger flares with greater time/distance spacing between flare drops. In fact, the above calculations are conservative when one considers that the center of the ice crystal plume center will have a higher concentration of crystals.

B. EQUIPMENT

Type:

- One WMI-C band weather radar, 250 kw peak power, with 1.65 deg. beam width, located at the Olds-Didsbury airport, 50ft tower mounted including radome.
- Two Beechcraft C90 King-Air prop-jet aircraft (one in Calgary and one in Red Deer).
- Two Cessna 340 aircraft (one in Calgary and one in Red Deer).

C. MATERIALS TO BE EMITTED:

- Cloud top (ejectable) pyrotechnic flares are 20g AgI formulation manufactured by Ice Crystal Engineering (ICE) of Kindred, North Dakota, USA (www.iceflares.com)
- Cloud base (burn-in-place) flares are 150g AgI formulation manufactured by Ice Crystal Engineering (ICE) of Kindred, North Dakota, USA (www.iceflares.com)
- A solution of acetone, silver iodide, sodium perchlorate, paradichlorobenzene, and ammonium iodide will also be burned for continuous seeding at cloud base.

Activation tests performed at Colorado State University indicate greater than10^{14} ice crystals per gram of seeding agent burned, active at -10 $^{\circ}$C.

Total flight hours and quantities to be dispersed: We estimate the project may use 5000 twenty-gram flares and 500 one hundred-fifty gram flares, plus approximately 150 gallons of acetone (2% AgI solution) will be burned. The number of operational days, flights, and amount of seeding material dispensed over the past fifteen years is summarized in the attached table. No harmful effects from these materials is expected. This is based on years of studies (both in the USA and Canada) to detect silver in precipitation (above background levels) following cloud seeding. The amount of silver distributed by the cloud seeding is small compared to the output from industry. Silver amounts from cloud seeding are far, far less than the USA EPA guidelines.

PART 8. GENERAL INFORMATION CONCERNING USE OF AIRCRAFT.

- Two C90 King Air prop-jet aircraft, one in Calgary (N904DK) and one based in Red Deer (N522JP).
- Two Cessna 340 aircraft, one in Calgary (N457DM) and one in Red Deer (N123KK).

PART 9. GENERAL INFORMATION CONCERNING USE OF GROUND VEHICLES.

No special project ground vehicles will be used on the project. (Only private vehicles for personal transportation will be used.)

PART 10. GENERAL INFORMATION CONCERNING ANY MEASUREMENTS OR OBSERVATION INSTRUMENTATION.

No special surface observations are planned for this project. The primary instrumentation is the weather radar and special aircraft instrumentation. Daily weather charts will be recorded for documentation and reporting purposes.

AIRCRAFT TRACKING GLOBAL POSITIONING SYSTEM (GPS): The WMI weather radar control and communications center will be equipped to receive and record data from the GPS aircraft tracking system. The GPS system displays the exact position of aircraft superimposed on the radar display to enable the controller to accurately direct the seeding aircraft to optimum seeding locations within the storm system. The color-coded aircraft position on the PPI will be marked with a small symbol. Electronic coding will enable radar controllers to discriminate between all project aircraft.

TEMPERATURE INSTRUMENTATION: Each of the cloud seeding aircraft will have a temperature sensor to ensure that the cloud penetration seeding runs are conducted at the proper temperature levels.

WEATHER RADAR: The C-band radar will be equipped with a computerized radar recording and display system. The radar recording system will be capable of providing numerous cell statistics and colour products including plots of radar PPI displays and maximum reflectivity maps. The sophisticated radar tracking software called TITAN (Thunderstorm Identification, Tracking, Analysis, and Nowcasting) has been used since 1997 and has proved to be very useful. TITAN is licensed from NCAR.

PART 11. CERTIFICATION BY ORGANIZATION FOR WHOM ACTIVITY IS TO BE CONDUCTED:

State type of working agreement entered into with the weather modifier: Contract.

I HEREBY CERTIFY THAT ALL STATEMENTS MADE IN THIS NOTIFICATION OF INTENT TO ENGAGE IN WEATHER MODIFICATION ACTIVITIES ARE TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE, AND REPRESENT IN SUBSTANCE AN ACCURATE DESCRIPTION OF A PROPOSAL TO UNDERTAKE WEATHER MODIFICATION ACTIVITIES ON BEHALF OF THE ORGANIZATION NAMED HEREIN.

Name of organization: Alberta Severe Weather Management Society

Full name of certifying officer and title:

Todd Klapak
President, Alberta Severe Weather Management Society
(403) 231-1357, Todd.Klapak@intact.net

Signature: 

Date: May 3, 2012

PART 12. CERTIFICATION BY PERSON PROPOSING TO CONDUCT ACTIVITY.

I HEREBY CERTIFY THAT INFORMATION PROVIDED IN THIS NOTIFICATION OF INTENT TO ENGAGE IN WEATHER MODIFICATION ACTIVITIES IS A TRUE AND COMPLETE DESCRIPTION OF MY PROPOSED PLANS TO ENGAGE IN THE SPECIFIC WEATHER MODIFICATION ACTIVITIES HEREIN DESCRIBED.

Name of organization: Weather Modification, Inc.

Full name of certifying officer:
Bruce A. Boe
Director of Meteorology
(701) 235-5500

19(1)

Signature: Bruce A. Boe **Date: May 3, 2012**

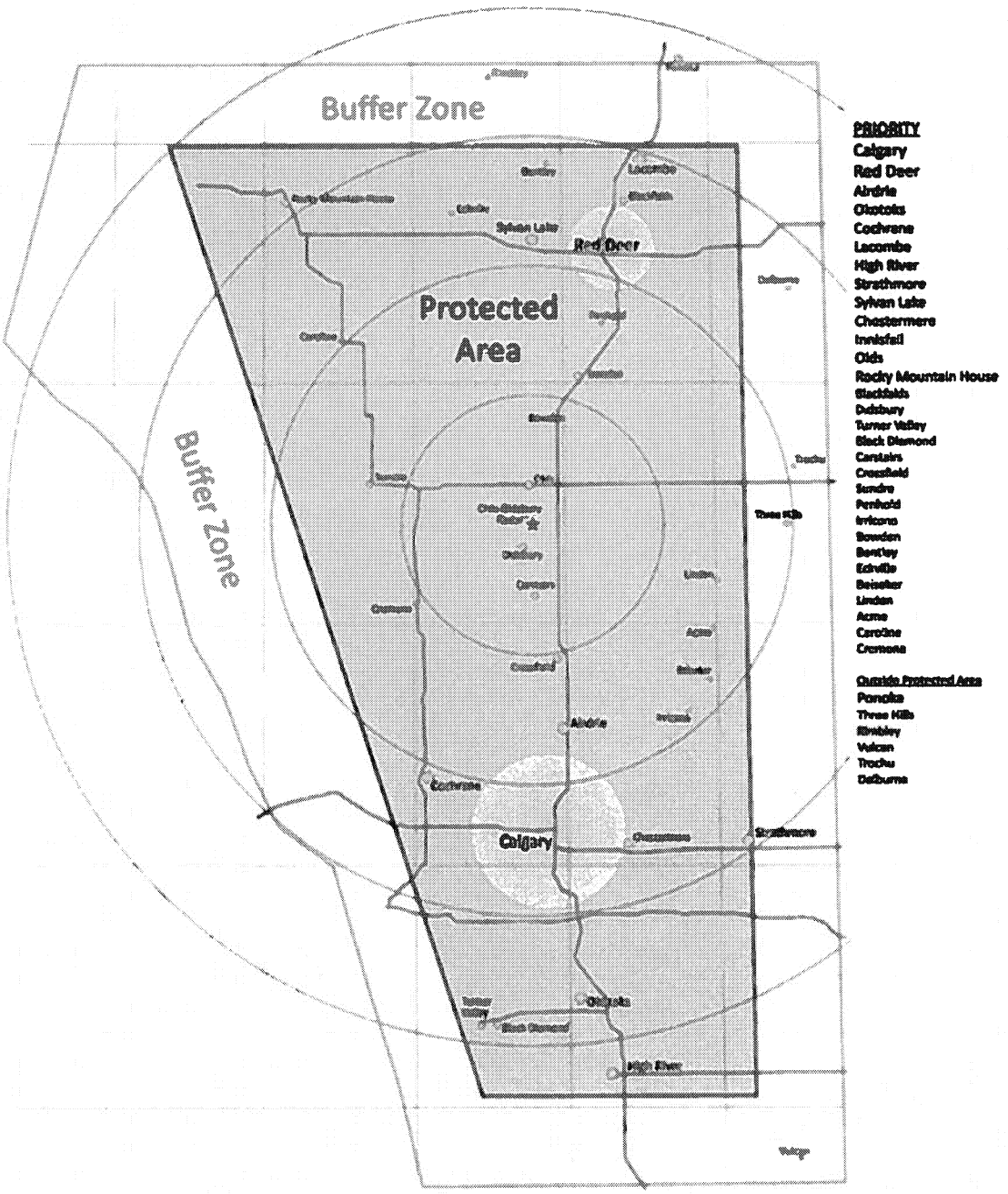
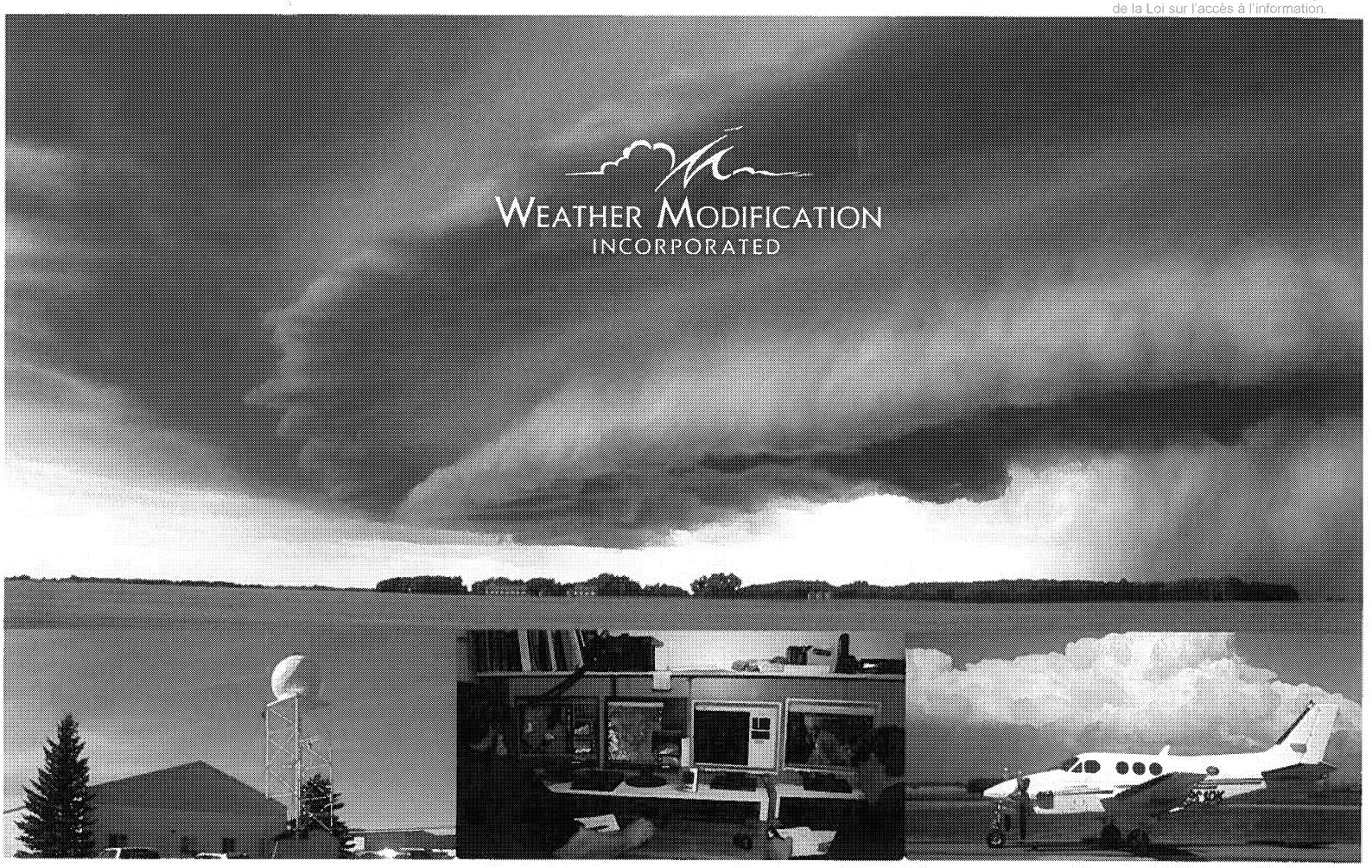


Figure 1: Map of southern Alberta showing the project area, outlined in green, covered by the Hail Suppression activities.

Table 1: Operational Statistics for 1996 to 2011.

Alberta	Mean	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Storm Days with Seeding	31.1	29	38	31	39	33	36	27	26	29	27	28	19	26	20	42	48
Aircraft Missions	95.4	71	92	96	118	130	109	92	92	105	80	92	76	112	37	91	134
Total Flight Time (hours)	202.0	159.1	188.1	189.9	251.3	265.2	208.3	157.4	163.6	227.5	157.9	190.2	115.3	194.7	109.3	271.8	383.0
Number of Storms Seeded	91.8	75	108	153	162	136	98	54	79	90	70	65	41	56	30	118	134
Total Seeding Agent (kg)	188.3	163.3	110.8	111.1	212.7	343.8	195.0	124.2	173.4	270.9	159.1	214.0	99.7	122.9	48.4	263.8	400.1
Seeding Agent per Day (kg)	5.9	5.6	2.9	3.6	5.5	10.4	5.4	4.6	6.7	9.3	5.9	7.6	5.2	4.7	2.4	6.3	8.3
Seeding Agent per Hour (kg)	0.96	1.00	0.60	0.60	0.80	1.30	0.90	0.80	1.10	1.20	1.00	1.10	0.90	1.00	0.84	1.10	1.13
Seeding Agent per Storm (kg)	2.1	2.2	1.0	0.7	1.3	2.5	2.0	2.3	2.2	3.0	2.3	3.3	2.4	2.2	1.6	2.2	3.0
Ejectable Flares	4415.9	3817	2376	2023	4439	9653	5225	3108	4485	6513	3770	4929	1622	1848	451	5837	10779
BIP Flares	601.0	542	356	496	690	940	533	377	518	677	515	703	413	548	237	851	1020
Seeding Solution (gal)	148.0	80.5	144.3	193.6	297.5	141.3	140.8	80.3	92.6	132.7	94.2	145.4	77.0	113.5	56.5	227.5	350.2



Alberta Hail Suppression Project

Alberta Severe Weather Management Society

Final Operations Report 2012

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ALBERTA HAIL SUPPRESSION PROJECT (AHSP)
FINAL OPERATIONS REPORT 2012

A Program Designed for
Seeding Convective Clouds
With Glaciogenic Nuclei to
Mitigate Urban Hail Damage in the
Province of Alberta, Canada

by

Weather Modification, Inc.
3802 - 20th Street North
Fargo, North Dakota
U.S.A. 58102
www.weathermodification.com

for the

Alberta Severe Weather Management Society
Calgary, Alberta
Canada

December 2012

EXECUTIVE SUMMARY

This report summarizes the activities during the 2012 field operations of the Alberta Hail Suppression Project. This was the seventeenth year of operations by Weather Modification, Inc. (WMI) of Fargo, North Dakota under contract with the Alberta Severe Weather Management Society (ASWMS) of Calgary, Alberta. This season was the second year of the current 5-year contract cycle for this on-going program; WMI has been the contractor since operations began in 1996. The program was again directed for the ASWMS by Dr. Terry Krauss. The program continues to be funded entirely by private insurance companies in Alberta with the sole intent to mitigate the damage to urban property caused by hail.

The cloud-seeding contract with WMI was renewed in 2001, 2006, and again in 2011. Calgary, Red Deer and many of the surrounding communities have seen significant growth in population—and area—since 1996. Calgary's population exceeded 1 million in 2006, and property values have more than doubled since the program's inception. In 2008 it was estimated that a hail storm similar to that which caused $400 million damage in Calgary in 1991 would now cause more than $1 billion damage. New record Alberta hailstorms have recently occurred in 2009 and 2010, and the severe storm that struck Calgary on August 12, 2012 caused hundreds of millions of dollars damage, clearly indicating that a billion dollar storm within Calgary is now possible.

The project design has remained the same throughout the period, but a fourth seeding aircraft was added to the project in the summer of 2008 to improve seeding coverage on active storm days. The new project radar (2011) is more sensitive and has Doppler capability which provides additional information about internal storm circulations that would not otherwise be available.

The program was operational from June 1st to September 15th, 2012. Only storms that posed a hail threat to an urban area as identified by the project's weather radar situated at the Olds-Didsbury Airport were seeded. The project target area covers the region from High River in the south to Lacombe in the north, with priority given to the two largest cities of Calgary and Red Deer. The project area is shown in Figure 3.

The summer of 2012 experienced above average severe thunderstorms both inside and outside the project area. Hail was reported within the project area (protected area and buffer area) on 56 days this past summer.

Larger than golf ball size hail was reported on July 28th east southeast of Airdrie and south of Irricana. The 12th of August also saw a report of larger than golf ball size hail in the northwestern part of Calgary.

Golf ball size hail was reported or observed by radar signature on June 13th east of the town of Linden; July 1st southwest of High River, north of Three Hills, and near Linden; the 5th of July in northwestern Calgary; on the 12th of July northwest of Rocky Mountain House, southwest of High River, and southwest of Calgary; then on the 13th of July southwest of Calgary; and the 17th of July northwest of Rocky Mountain House. Hail up to golf ball size was also reported on the 18th of July near Rimbey, southwest of Ponoka, and east of Lacombe; the 23rd of July north of Rocky Mountain House and northwest of Caroline; on the 25th of July southwest of Three Hills; on the 27th of July south and southeast of High River and near Irricana; on the 30th of July north of Sundre; and the 31st of July southwestern Calgary, near the town of Three Hills, and east southeast of Strathmore. The month of August saw up to golf ball size hail on the 4th, north of Lacombe; on the 5th south and southeast of Rocky Mountain House; on the 6th west of Sylvan Lake; the 7th in eastern Calgary and near Irricana; on the 8th west of Rocky Mountain House, west of Sundre, south of Red Deer, and east of the town of Acme; the 10th northwest of Lacombe and northwest of Rocky Mountain House; on the 14th near Turner Valley and west of High River; on the 20th southwest of Cremona; on the 21st north and south of Rocky Mountain House; and on the 23rd northwest of Caroline and east southeast of Red Deer.

Walnut size hail was reported or observed by radar signature on June 2nd near Strathmore; June 6th southeast of Strathmore; on June 9th northeast of Innisfail; on the 17th of June in Rocky Mountain House; June 24th south of Sundre and east southeast of Airdrie; July 3rd north northeast of Sundre and near Three Hills, on the 8th of June west southwest of Cremona, July 10th north of Rocky Mountain House, on the 20th of July south of Strathmore, the 22nd of July west of Strathmore, July 26th east northeast of Airdrie, and west of the town of Caroline on the 10th of September.

The weather pattern was less active in June than 2011, but even so 70.1 hours were flown for seeding and patrol. July was the busiest month; the four project aircraft flew a total of 181.6 hours during seeding and patrol flights. A "patrol" flight is a flight flown to check cloud intensity or in anticipation of clouds becoming intense enough to warrant seeding, but during which no seeding was actually conducted. A total of 74.4 hours were flown in August, and only 4.5 hours in September.

There were thunderstorms reported within the project area on 70 days this summer, compared with 73 days in 2011. However, 22 of the 70 days produced storms having hail or radar vertically-integrated liquid (VIL) values commensurate with the Convective Day Category of +4, indicating an unusual number of very strong storms. The weather became much less active by mid-August, and only two seeding missions were flown after August 14th.

During this season, there were 300.1 hours flown on 43 days with seeding and/or patrol operations. A total of 116 storms were seeded during 115 seeding flights (271.1 flight hours) on the 37 seeding days. There were 28 patrol flights (30 hours), and 24 short "public relations" flights on which one aircraft was flown to the Olds-Didsbury Airport to be available for viewing by insurance company employees attending tours of the operations centre and radar.

The amount of silver-iodide nucleating agent dispensed during the 2012 field season totaled 314.6 kg. This was dispensed in the form of 7,717 ejectable (cloud-top) flares (154.34 kg seeding agent), 914 burn-in-place (cloud-base) flares (137.1 kg seeding agent), and 260.3 gallons of silver iodide seeding solution (23.12 kg seeding agent).

Four specially equipped cloud seeding aircraft were dedicated to the project. One Beech C90A King Air and a Cessna 340A were based in Calgary (Springbank after June 25), and a C90A and another C340A were based in Red Deer. The procedures used in 2012 remained the same as the previous years. The Calgary office and aircraft were initially stationed at the Landmark Aviation hangar at the Calgary International Airport, but because of new arrival scheduling procedures at the airport, operations were for the first time shifted to the Springbank Airport west of Calgary. This change was implemented on June 25th, without interruption of service. A WMI Red Deer office was again set up in the Air Spray hangar at the Red Deer Regional Airport, as had been done in 2010 and 2011.

The aircraft and crews provided a 24-hour service, seven days a week throughout the period. Eight full-time pilots and three meteorologists were assigned to the project this season. In addition, WMI's Chief Pilot, Mr. Jody Fischer, served as overall program manager. The 2012 crew was well experienced. The Red Deer aircraft team was led by Mr. Roger Tilbury, who has been flying cloud research and cloud seeding missions since the 1970s, and Mr. Joel Zimmer who has been with the Alberta Program for ten years. In addition to Mr. Fischer, the Calgary (Springbank) team was anchored by Mr. Brook Mueller and Mr. Mark Friel, both of whom also had considerable experience. The radar crew was led by Mr. Daniel Gilbert, now with three seasons' experience in Alberta, in addition to seven seasons' work in a similar capacity on a hail suppression program in North Dakota.

Overall, the personnel, aircraft, and radar performed exceptionally well and there were no interruptions or missed opportunities. A gear failure in the radar antenna drive placed the radar temporarily out of service at 6:01 pm on June 17th, while operations were being conducted near Rocky Mountain House. Radar guidance for the operations immediately began using imagery from the Environment Canada radar near Strathmore, though real-time aircraft flight tracks were still being received at the WMI radar on AirLink. Once the problem was isolated, a replacement drive gear was found in the on-site spare parts and repairs began. Flight operations were completed without difficulty. The repairs were completed by 4:53 pm the following day. A second, similar failure occurred on August 6th at about 5:00 pm but repairs were quickly made and the radar was back in operation by 8:45 that same evening, without any interruption in operations.

High speed Internet service was once again obtained at the Calgary (Springbank) and Red Deer offices for the pilots so that they could closely monitor the storm evolution and storm motion using the radar images on the web prior to take-off.

All of the project's radar data, meteorological data, and reports have been recorded onto a portable hard drive as a permanent archive for the Alberta Severe Weather Management Society. These data include the daily reports, radar maps, aircraft flight tracks, as well as meteorological charts for each day. The data can be made available for outside research purposes through a special request to the Alberta Severe Weather Management Society. In addition, ASWMS Program Director Dr. Terry Krauss was provided the entire season's TITAN (radar) data, as he has that software running on a computer in his office. This will enable mutual (WMI and ASWMS) examination of the data set in the off season, prior to the 2013 program.

ACKNOWLEDGEMENTS

WMI acknowledges the continuing, kind support of Todd Klapak, Catherine Janssen, Dr. Terry Krauss, and the entire Board of Directors of the Alberta Severe Weather Management Society (ASWMS). Their understanding, support, and cooperation of the ASWMS are greatly appreciated.

A number of organizations and people deserve recognition and thanks. The cooperation of these persons and agencies is very important in making the project successful, in positive working environments.

- Edmonton Area Control Center and Calgary Terminal Air Operations. The excellent cooperation by the ATC once again played a very important role in allowing the project pilots to treat the threatening storms in an efficient and timely manner as required, often directly over the city of Calgary.
- Saroj Aryal and Kathleen Cleveland of Alberta Financial Services Corp. (AFSC) in Lacombe are thanked for providing the crop insurance information.
- For the seventeenth year, special thanks go to Bob Jackson for sharing his office and hangar at the Olds-Didsbury airport, used for the radar and communications control center.
- Lynne Fawcett of Intact Insurance is thanked for organizing the 14 informational seminars that were conducted at the Olds radar this summer as part of the Alberta Insurance Council accreditation program.
- Perry Dancause, Ross Katterhagen and the staff of Air Spray Ltd are sincerely thanked for providing offices, ramp space, and timely reliable aircraft maintenance this season at the Red Deer Airport.
- Tony Hickey, Wade Dornstauder and the staff of Landmark Aviation are thanked for providing office space and other operational support to the project at Calgary International Airport.
- Kevin Gies and the staff of Springbank Aero are thanked for providing office space, ramp space, and other operational support to the project at the Springbank Airport.

WMI wishes to acknowledge the contributions of the staff who served on the project during the summer of 2012: project manager Jody Fischer, meteorologists (Dan Gilbert, Brad Waller, and Joe Pehoski), electronics-radar technicians (Dave Civil, and Todd Schulz), pilots in command (Roger Tilbury, Brook Mueller, Mark Friel, and Jenny Thorpe); the co-pilots (Joel Zimmer, Jenelle Newman, Hing Kwok, and Matthias Morel). The staff performed very well as a team. The support of the WMI corporate head office in Fargo ND is also acknowledged, specifically, the efforts of Erin Fischer, Cindy Dobbs, Patrick Sweeney, James Sweeney, Randy Jenson, Hans Ahlness, Jody Fischer, Bruce Boe, Dennis Afseth, Mike Clancy and Mark Grove are greatly appreciated.

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Operating in tandem with TITAN is the *Configurable Interactive Data Display* (CIDD) radar processing system. The CIDD is similar to TITAN in function. There are advantages to both systems, so WMI uses both. The CIDD is typically set up to run a continuous animated 1-hour movie loop.

Both TITAN and CIDD are available in the operations room on dedicated displays, that is, flat-panel monitors dedicated full-time to those purposes. In addition, a supplemental TITAN RVIEW window is not used interactively, but used to port (send) TITAN data to the web upon the completion of each complete volume scan made by the radar. This is done so that the web image always has the same information and appearance for all scans.

GROUND SCHOOL

A ground school was conducted prior to the commencement of the project field operations on May 28th and 29th, 2012 for all available project personnel at the Intact Insurance training room downtown Calgary. Operational procedures about who does what, where, when and why, as well as general conduct and reporting requirements were presented and reviewed at the ground school. Two representatives of NAV Canada in Calgary and Edmonton participated in the ground school. A copy of the ground school program and samples of the flight log and radar log forms, are included in the appendices.

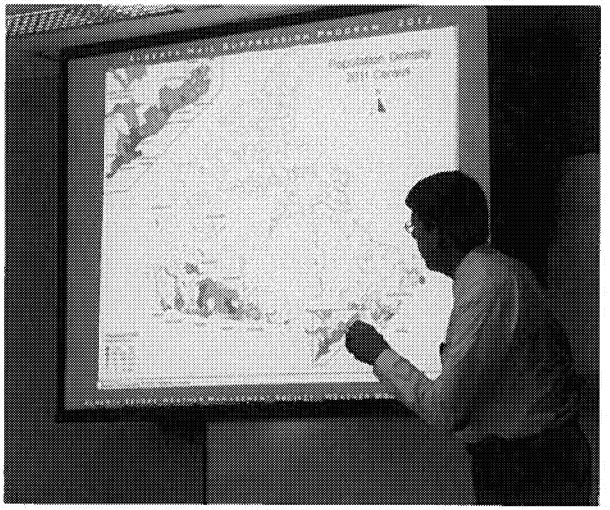


Figure 15 (right). Bruce Boe, WMI Director of Meteorology presents on the 2011 Canada Population Density during the 2012 AHSP ground school on May 29, 2012. (WMI photograph by Cindy Dobbs)

The pre-project ground school training topics included:

i. program overview and design, project area, target areas, and priorities
ii. overview of operations and procedures
iii. cloud seeding hypotheses for hail suppression
iv. cloud seeding theory and techniques
v. aviation weather problems and special procedures
vi. aircraft controlling techniques and procedures
vii. seeding aircraft equipment and characteristics
viii. weather radar equipment and basic principles
ix. basic meteorological concepts and severe weather forecasting
x. weather phenomena, fronts, and storms
xi. daily routines and procedures
xii. communications procedures
xiii. computers, documentation, and reporting procedures
xiv. safety, security precautions and procedures

PUBLIC RELATIONS

A total of fourteen groups toured the project Operations Centre at the Olds-Didsbury airport as part of the Alberta Insurance Council accreditation program.

The tours, organized and led by Ms. Lynne Fawcett of Intact Insurance, each included a presentation by ASWMS Program Director Dr. Terry Krauss, a tour of the room and equipment used to direct the cloud seeding operations, and a chance to see one of the project seeding aircraft and its associated equipment (Figure 16). Recent storms were also replayed on the radar. In total 195 persons took part in this program, which helps those working in the industry understand the program.

In addition to the equipment used in the project, attendees learn about Alberta's long history in hail suppression research and operations, the scientific basis for the program, and how the seeding agent (silver iodide) functions to reduce hail.

Figure 16. WMI Co-pilot Janelle Newman explains the Cessna 340 aircraft (Hailstop 2) to a group of insurance industry employees during a tour of the Olds-Didsbury Airport on August 24, 2012. (WMI photograph by Jody Fischer)

8.0 Flight Operations

Four specially equipped cloud seeding aircraft were dedicated to the project. One Beech C90A King Air and a Cessna 340A were based in Calgary (Springbank after June 25), and a C90A and another C340A were based in Red Deer. The procedures used in 2012 remained the same as the previous years. The Calgary office and aircraft were initially stationed at the Landmark Aviation hangar at the Calgary International Airport, but because of new arrival scheduling procedures at the airport operations were for the first time shifted to the Springbank Airport west of Calgary. This change was implemented on June 25th, without interruption of service. A WMI Red Deer office was again set up in the Air Spray hangar at the Red Deer Regional Airport, as had been done in 2010 and 2011.

When convective clouds were detected by radar or visually observed to be developing, the seeding aircraft were placed on standby status, and the crew of at least one sent to their airport. Aircraft on standby status are able to launch and reach a target cloud within about 30 min after the request to launch has been made by the controlling meteorologist. When seedable clouds are imminent, the seeding aircraft are dispatched to investigate. Aircraft were available and prepared to commence a seeding mission at any time and the seeding of storms often continued after dark with due regard to safety (see again Figure 9).

AIR TRAFFIC CONTROL

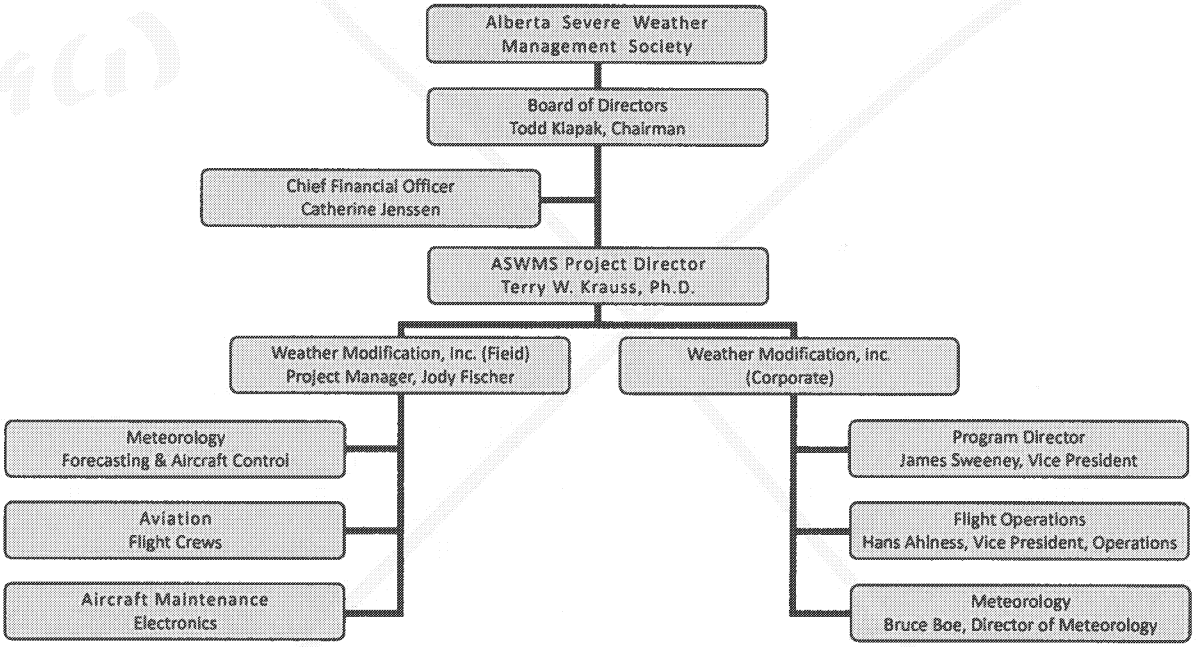
Prior to the start of field operations, arrangements were made with NAV Canada managers of Air Traffic Services in Calgary and Edmonton to coordinate the cloud seeding aircraft operations. Permission was granted to file pre-defined flight plans for the project aircraft, with special designations and fixed transponder codes. The designated aircraft were as follows: Hailstop 1 for the King Air C90 airplane (N904DK) based in Calgary/Springbank, Hailstop 2 for the C340 aircraft (N457DM) based in Calgary/Springbank, Hailstop 3 for the King Air C90 aircraft (N522JP) stationed in Red Deer, and Hailstop 4 for the C340 aircraft (N123KK) based in Red Deer. For mechanical reasons, the C340 serving as Hailstop 4 was swapped for another (N234PS) on 12 July.

Figure 17 (right). WMI Captain Jenny Thorpe and Co-pilot Janelle Newman (HS2), conduct a Patrol flight on August 23, 2012. (WMI photograph by Jody Fischer)

Direct-line telephone numbers were used to notify air traffic controllers of cloud seeding launches. Aircraft were launched to specific locations defined by VOR and DME coordinates. Distinct air traffic clearance was given to project aircraft within a 10 nautical mile radius of the specified storm location. Cloud top aircraft were given a 2,000 ft block with 6,000 ft clearance below bottom of their block. Cloud base aircraft were given a ± 1,000 ft altitude clearance (see again Figure 8). This procedure works very well in general. On a few occasions, seeding aircraft are asked to briefly climb to higher altitudes over the city of Calgary, or to suspend seeding for a few minutes to allow other commercial aircraft to pass below them, but such interruptions are infrequent.

APPENDICES

Appendix A - Organization Chart



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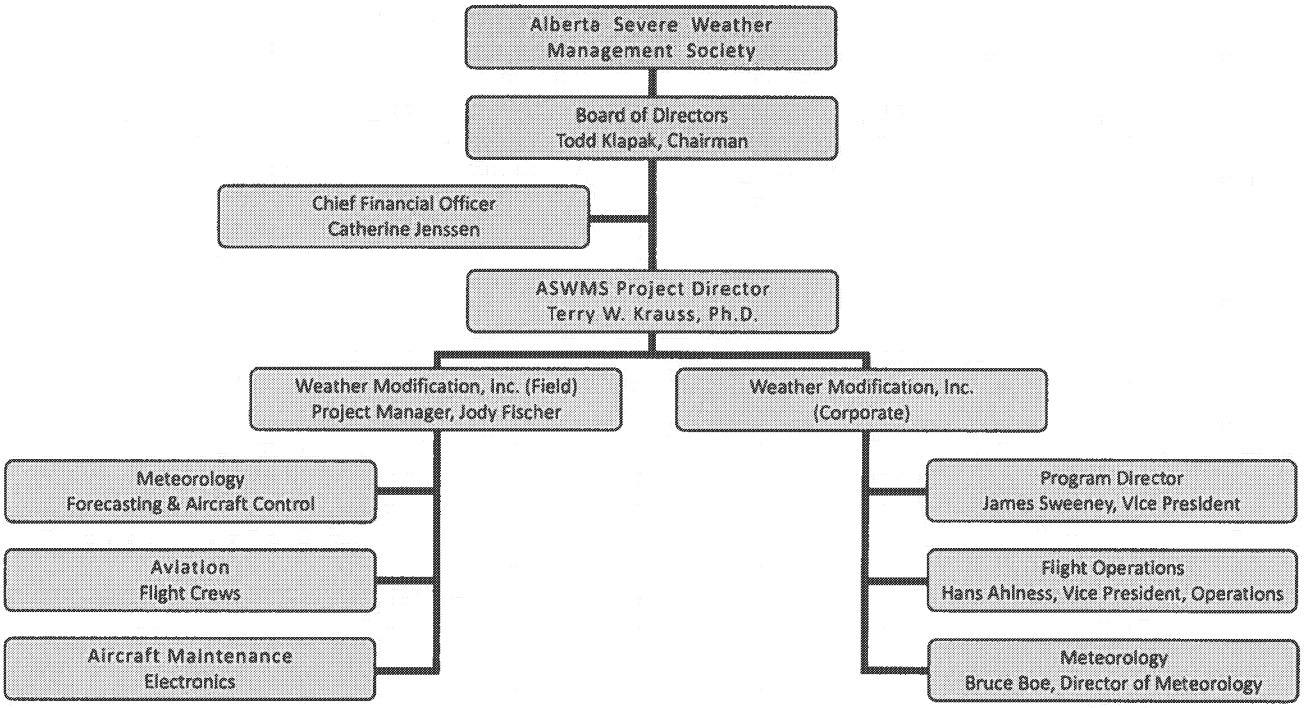
Appendix A - Organization Chart



Appendix B – Daily Weather and Activities Summary Table

ALBERTA HAIL SUPPRESSION PROJECT 2013
DAILY SUMMARY REPORTS

Date	Weather	Activities Summary
June 1, Saturday	Upper level jet energy was well to the south and southwest of AB. A broad closed low over BC was expected to strengthen as it slowly crept eastward. Low level moisture was also expected to start pushing into the region from the SW. Surface pressure was steadily falling. Area soundings suggested that any thunderstorms would be weak and short lived. Thunderstorms formed southeast and east of Red Deer during the early evening hours. These storms were weak and short-lived. They tracked northward along the eastern boundary of the project area. There were no significant hail threats. Max cell top: 6.9km, 59.0 max dBz, 21.6 max VIL Tmax YC = 17.0C and a trace of rain. Tmax QF = 18.5C and no rain. Tmax Radar = 17.0C and no rain.	HS2 performed a currency flight. They took off at 1844Z and landed at 1937Z. No seeding occurred. Flight Summary HS2: 1828Z-1940Z; no seeding; currency flight
June 2, Sunday	A large midlevel trough was located over Alberta and British Columbia. It was expected to strengthen slightly through the forecast period. Skies were overcast over the region with ample moisture through the entire troposphere. Despite cool temperatures, the atmosphere was unstable during the afternoon. Weak short-lived thunderstorms were expected. Stratiform rain showers were expected as well. Showers were expected to continue through the night. The best chance for significant convection was around midnight when the strongest vorticity was expected to move into the project area from the southwest. The day began with mostly cloudy skies and light rain. A few thunderstorms were observed SW of the project area. Rain and overcast skies persisted throughout the day. The high temperature for the day was set in the morning. The cold surface conditions prevented deep convection. Rain continued through the overnight period. Max cell top: 6.9km, 62.5 max dBz, 29.0 max VIL Tmax YC = 12.7C and 25.4mm rain. Tmax QF = 13.7C and 10.0mm rain. Tmax Radar = 12.3C and 7.9mm rain.	No aircraft operations.
June 3, Monday	A weak surface trough was creating dense cloud cover and light rain during the morning. As a low pressure system in Montana moved east during the late	No aircraft operations.

	morning, dry midlevel easterly flow was expected to occur. Dry midlevel conditions at peak heating made thunderstorm development unlikely, with skies clearing and some fair weather cumulus anticipated during the afternoon. Overnight, a ridge was expected to begin building. No significant storms were expected. Rain tapered off from NE to SW during the late morning as dry air moved in. In the southern part of the project area, virga and convective rain showers were observed during the late afternoon. A single flash of lightning was detected east of Calgary. Skies cleared completely during the evening and overnight hours. Max cell top: 6.1km, 53.5 max dBz, 9.8 max VIL Tmax YC = 14.0C and 16.4mm rain. Tmax QF = 18.2C and 8.4mm rain. Tmax Radar = 14.6C and 14.2mm rain.	
June 4, Tuesday	Dry midlevel air was expected to persist throughout the day. Gusty winds would create a well-mixed boundary layer. Low surface dew points were expected. A ridge would build during the afternoon with fair weather cumulus prevalent. While rain was expected over the foothills, no precipitation was forecast for the project area. Overnight clearing was expected. Scattered weak rain showers formed in the foothills during the afternoon, some moving into the project area. Skies cleared during the evening and remained clear overnight. No TITAN cells, 46.0 max dBz, 2.7 max VIL Tmax YC = 19.1C and no rain. Tmax QF = 20.5C and no rain. Tmax Radar = 18C and no rain.	No aircraft operations.
June 5, Wednesday	A low over the Northwest Territories was expected to form a cold front that would move into the project area from the NW. Midlevel troughing was also expected over the project area, producing adequate lift across the project area. Dry midlevel air was expected. Only a few short lived storms were forecast during the early evening, concentrated in the N half of the project area. Most precipitation was expected to remain N of the buffer. Overnight, no significant rain was expected due to a strong cap. As the trough moved through the northern half of the project area during the afternoon, some convective rain occurred, but there was no threat of hail. Rain showers and virga continued into the overnight period. Max cell top: 7.6km, 54.5 max dBz, 13.5 max VIL	No aircraft operations.

	Tmax YC = 23.0C and no rain. Tmax QF = 24.5C and a trace of rain. Tmax Radar = 23C and no rain.	
June 6, Thursday	With the cold front having passed through early in the morning, the atmosphere was stable. No significant weather was expected. Pressure was expected to rise as a weak ridge moved into the region. Southerly flow was expected to moisten the atmosphere. Some showers were possible overnight as a weak shortwave moved through the project area. Clouds formed during the afternoon and evening. Overnight, some virga and light rain showers were observed on radar. No TITAN cells. 36 max dBz, 2.0 max VIL Tmax YC = 22C and a trace of rain. Tmax QF = 22C and no rain. Tmax Radar = 20C and no rain.	No aircraft operations.
June 7, Friday	A jet streak was expected to begin moving into the project area during the late morning producing rain showers and beginning cyclogenesis in central Alberta. Wind shear was modest during the afternoon, and instability was moderate, indicating potential for strong embedded storms. Showers were expected beginning around noon, with stronger storms possible later as the trough and front moved through the area. Storms were expected to be out of the area by the overnight period, with a few rain showers lingering through morning. Showers began during the morning, and then thunderstorms formed along the foothills during the early afternoon as the trough moved into the project area. By the early evening, storms had diminished and moved into the E half of the project area. A few showers occurred overnight, and then skies cleared by morning. Max cell top: 10.6km, 65.5 max dBz, 78.9 max VIL Tmax YC = 23.1C and .6mm rain. Tmax QF = 20.2C and 9.8mm rain. Tmax Radar = 20.9C and 1.0mm rain. Nickel size hail NW of Sundre was reported by the public. Marble size hail was reported in Northern Airdrie by the media.	HS3 performed a PR flight to the radar for a CBC documentary film crew. They were airborne from YQF at 1652Z and landed in Olds-Didsbury at 1713Z. HS4 was launched at 2013Z for a cell W of Caroline. They were airborne at 2030Z and climbed to cloud base. Finding only rain, they were redirected to patrol Sundre at 2119Z. They found no inflow for some time, and had trouble approaching the storm due to heavy rain. They commenced seeding storm #2 at 2131Z as they began experiencing inflow, beginning BIPs at 2135Z. They stopped BIPs at 2146Z, but proceeded with generators as the storm moved away from Sundre and began to weaken. At 2151Z, they stopped seeding and began patrol NW of Didsbury. When the storm intensified, they resumed seeding with generators at 2203Z. As the storm approached Didsbury, it weakened, and at 2237Z HS4 stopped seeding and moved to patrol Red Deer. At 2302Z, they were told to RTB, moving NW around the cell and landing at 2315Z. HS3 was launched from Olds-Didsbury at 2053Z. They were airborne at 2108Z and began climbing to cloud top. At 2119Z they commenced seeding storm #1 northwest of Airdrie. At cloud top, they experienced 500fpm updrafts with moderate liquid water, and commenced seeding with EJs at 2123Z. HS3 repositioned to a growing cell over downtown Calgary at 2207Z, arriving and commencing seeding on storm #3 at 2212Z. At 2226Z, they descended to the southeast to shed ice. They

		resumed seeding on storm #3, now moving towards Strathmore, at 2238Z. At 2244Z, as the storm began to weaken, they stopped seeding and began patrol near Strathmore. They RTB in Red Deer at 2302Z landing at 2330Z. HS2 was launched at 2204Z. They were airborne at 2218Z and climbed to cloud base, commencing seeding with wing-tip generators at 2223Z. They used one BIP at 2231Z as they found a pocket of good inflow. At 2257Z, as the storm moved off to the east, they RTB, landing at 2306Z. Flight Summary HS3: 1645Z-1726Z; no seeding; PR flight; takeoff YQF, land Olds-Didsbury. HS4: 2021Z-2321Z; 2 BIP, 108 minutes wing-tip generators; patrol Caroline, #2 Sundre, patrol Red Deer. HS3: 2102Z-2336Z; 9 BIP, 180 EJ; #1 Carstairs and Airdrie, #3 Calgary to Strathmore. HS2: 2211-2308; 1 BIP, 44 minutes wing-tip generators; #1 Airdrie to Irricana.
June 8, Saturday	With an upper level jet streak positioned directly over the project area, dry, cool, midlevel air was moving into the project area. Ascent due to the jet was occurring well north of the project area, but the main focus for storm development was a weak area of vorticity moving into the project area during the afternoon. A weak warm front moving in from the south, combined with the lift from this vorticity, created the potential for storms over the southern project border. While the lowest levels of the atmosphere were unstable, stable air at midlevels suggested that any convection would not be deep. A few short lived storms were forecast for the late afternoon, with showers overnight. The day began with clear conditions. Cloud cover increased during the afternoon. A few rain showers became visible on radar, but they did not grow into thunderstorms. As night fell, showers gradually diminished, and skies began to clear. Max cell top: 6.9km, 61.0 max dBz, 17.6 max VIL Tmax YC = 18.8C and 1.2mm rain. Tmax QF = 18.9C and 1.4mm rain. Tmax Radar = 17.9C and 6.6mm rain.	No aircraft operations.
June 9, Sunday	An upper level jet streak was centered over the far southern part of AB. A mid and upper level low was beginning to deepen over central SK. Several lobes of vorticity were expected to move into the southern half of the project area from BC. Temperatures aloft were cooling by around 2C which acted to destabilize the	No aircraft operations.

	atmosphere. The thermodynamic profile indicated that long lived, weak thunderstorms were possible. A line of convection formed along the foothills west of Calgary during the late morning which slowly moved eastward over the project area during the afternoon. The strongest storm of the day occurred east of High River and tracked southeastward toward Vulcan. Max cell top: 8.4km, 61.0 max dBz, 39.5 max VIL Tmax YC = 14.8C and 0.6mm of rain. Tmax QF = 16.6C and 2.0mm of rain. Tmax Radar = 14.1C and a trace of rain.	
June 10, Monday	The jet stream was expected to move northward over central AB during the forecast period. The closed low over SK weakened as another closed low deepened over Vancouver. Moderate midlevel vorticity advection was likely. No major surface features were present over AB, but dewpoints were gradually rising. Convective rain showers occurred over the southern half of the region during the late afternoon and evening. The heaviest rain showers were observed along the western boundary of the project area, SW of Cochrane. The Calgary metropolitan area saw lighter rain showers. Max cell top: 5.4km, 52.0 max dBz, 6.4 max VIL Tmax YC = 16.8C and 0.6mm of rain. Tmax QF = 15.2C and no rain. Tmax Radar = 16.1C and no rain.	No aircraft operations.
June 11, Tuesday	Jet energy at the upper levels was SW and E of the area. A mid and upper level low continued to be centered over Vancouver Island. Lobes of vorticity rotated counter-clockwise around low. An occluded front was expected push into the region during the late overnight hours. Model soundings indicated that the atmosphere had a strong cap at the mid-levels. Convection was mainly concentrated over the foothills and mountains during the daytime hours. Overnight, scattered convective rain showers were observed over parts of the region. Max cell top: 6.1km, 51.0 max dBz, 6.5 max VIL Tmax YC = 14.0C and 0.6mm of rain. Tmax QF = 14.5C and no rain. Tmax Radar = 12.6C and no rain.	HS2 flew a currency flight near CYBW. The aircraft was airborne at 1909Z and then landed at 1934Z. HS1 flew a currency flight near CYBW. The aircraft was airborne at 1919Z and then landed at 1931Z. HS5 flew a currency flight near CYBW. The aircraft was airborne at 2006Z and then landed at 2036Z. <u>Flight Summary</u> HS2: 1857Z-1937Z; no seeding; currency flight. HS1: 1900Z-1933Z; no seeding; currency flight. HS5: 1945Z-2038Z; no seeding; currency flight.
June 12, Wednesday	An upper level jet streak nosed its way into the project area from the SW. The left-exit region of the jet was expected to enhance lifting motions. The midlevel low	HS4 was launched at 2336Z to a northeastward tracking storm west of Olds. The aircraft was airborne at 2352Z and was directed to fly to the

	over Vancouver Island started to slowly move northeastward. Vorticity advection from the low was the main trigger for thunderstorms. At the surface, lee cyclogenesis was likely over central AB. The 00Z CYQF sounding showed an unstable atmosphere with moderate speed shear. Weak thunderstorms formed over the region during the late morning and early afternoon. A longer lived cluster of thunderstorms then developed south of Sundre during the late afternoon which tracked northeastward towards Innisfail. In the evening, taller cells formed over the foothills. A few of these storms moved northeastward into the northern part of the project area. Max cell top: 9.9km, 66.0 max dBz, 56.6 max VIL Tmax YC = 19.9C and no rain. Tmax QF = 19.8C and 2.8mm of rain. Tmax Radar = 19.7C and 3.8mm of rain.	southeastern side of the storm near Olds. The crew then started patrolling W of Didsbury starting at 0011Z (06/13). They continued patrolling until the storm dissipated. The flight was then redirected to the Sundre area at 0054Z (06/13). They started patrolling near Sundre at 0102Z (06/13). They RTB 0113Z (06/13), landing at 0134Z (06/13). HS3 was launched at 0146Z (06/13) to a cluster of cells SW of Rocky MH. The aircraft was airborne at 0207Z (06/13) and was redirected to a new cell W of Sylvan Lake. They started top seeding this storm (#1) at 0214Z (06/13). The flight was then redirected to growth south of Rocky MH at 0220Z (06/13). At 0231Z (06/13) HS3 started seeding storm #2 SW of Caroline. The crew stopped seeding at 0238Z (06/13) and flew to Innisfail for patrol. After patrolling the Innisfail area briefly, a new cluster of cells started growing near Calgary, so the aircraft repositioned to this area. At 0315Z (06/13) the crew began patrolling the Airdrie area. The development dissipated and the aircraft RTB at 0324Z (06/13). They landed at 0334Z (06/13). <u>Flight Summary</u> HS4: 2344Z (06/12)-0138Z (06/13); no seeding; patrol Didsbury, patrol Sundre. HS3: 0201Z (06/13)-0340Z (06/13); 30 EJ, 3 BIP; #1 Sylvan Lake, #2 Caroline, patrol Innisfail, patrol Airdrie.
June 13, Thursday	An upper level jet streak nosed its way into southern AB from the south. The midlevel closed low over BC and the state of Washington slowly moved eastward. This low was expected to start moving into AB during the overnight hours. The main trigger mechanism for thunderstorms was vorticity advection moving counter-clockwise around the low. A weak surface low was progged to form east of the project area during the overnight hours. Area soundings suggested that most of the storm activity would be over the northern part of the project area. The region mainly saw convective rain showers during the daytime hours. A few stronger thunderstorms formed near Innisfail and Red Deer in the early evening. Radar data suggested that grape size hail occurred SW of Innisfail. Pea size hail was reported in Red Deer. Max cell top: 8.4km, 62.5 max dBz, 32.0 max VIL Tmax YC = 16.9C and 2.8mm of rain. Tmax QF = 19.3C and 8.4mm of rain. Tmax Radar = 16.1C and 1.5mm of rain.	No aircraft operations.

June 14, Friday	Upper level jet energy was south and southeast of the area. The closed low at the mid-levels was centered along the AB/SK border. The low provided cool NW flow to the area. A wave of moderately strong vorticity was expected to move southeastward through the project area during the afternoon hours. The surface low was collocated with the midlevel low. The area saw convective rain showers in the late morning. Then in the afternoon, numerous cells formed over the project area. A line of convection formed south of Sundre which tracked southeastward through Airdrie, Chestermere, and Strathmore. The strongest cell of the day formed SW of Calgary and tracked towards Okotoks. Radar data indicated grape size hail may have occurred W of Okotoks. Max cell top: 9.9km, 63.0 max dBz, 56.5 max VIL Tmax YC = 16.3C and 7.8mm of rain. Tmax QF = 15.5C and 1.2mm of rain. Tmax Radar = 15.3C and 5.1mm of rain.	HS5 was launched at 1955Z to a cell north of Calgary. The flight became airborne at 2017Z and flew to the east end of the line of convection. HS5 started top seeding storm #1 west of Airdrie at 2031Z. The crew was able to find the best growth along the south side of the storm while over Chestermere. The flight stopped seeding at 2045Z after finding no new growth. Then at 2051Z, the aircraft started seeding the same storm again as it intensified. They continued seeding as the line of convection moved towards Strathmore. HS5 stopped seeding at 2121Z and RTB. The aircraft landed at 2140Z. <u>Flight Summary</u> HS5: 2003Z-2145Z; 44 EJ, 7 BIP; #1 Airdrie to Strathmore.
June 15, Saturday	The upper level jet continued to stay south of the region. The midlevel low was now over the SK/MB border and weakening. A few lobes of moderately strong vorticity moved southeastward through the project area during the afternoon and early evening hours. Surface pressure values were expected to start rising during the evening hours. The atmosphere was unstable with weak speed shear. A cluster of cells formed over the foothills NW of Cochrane which tracked southeastward through Calgary during the early afternoon. Radar data suggested that grape size hail fell NW of Cochrane. Thunderstorms also formed SW of Calgary and moved through Okotoks. In the late afternoon, a cell developed along the mountains W of Cochrane. This storm moved southeastward along the foothills before dissipating close to the Turner Valley and Black Diamond area. Max cell top: 9.1km, 60.5 max dBz, 36.8 max VIL Tmax YC = 19.1C and 4.6mm of rain. Tmax QF = 18.6C and 0.2mm of rain. Tmax Radar = 17.8C and 0.8mm of rain.	HS2 was launched at 1853Z to a cluster of TITAN cells N of Cochrane. They became airborne at 1909Z and climbed to the base seeding altitude. The aircraft started seeding storm #1 north of Calgary at 1913Z. The crew continued seeding as the storm system moved southeastward over Calgary and towards Okotoks. Then at 2023Z, HS2 was finding only weak inflow near over Okotoks, so they stopped seeding and started patrolling. HS2 RTB 2030Z, landing at 2050Z. HS1 was launched at 1855Z to new growth between Airdrie and Calgary. The aircraft became airborne at 1914Z and started climbing to cloud top. At 1927Z HS1 started top seeding storm #1 which was near northern Calgary. Then at 2001Z, HS1 also started seeding Storm #2 NW of Okotoks. At 2013Z, the crew stopped seeding and RTB. They landed at 2025Z. HS2 was launched at 2345Z to a long-lived cell moving towards Turner Valley and Black Diamond. The aircraft became airborne at 2357Z and flew to the SE side of the cell. At 0007Z (06/16) HS2 started base seeding storm #3 NW of Turner Valley and Black Diamond. The crew then stopped seeding at 0019Z (06/16) and started patrolling for a short time before RTB 0025Z (06/16). The aircraft landed at 0037Z (06/16). <u>Flight Summary</u>

		HS2: 1902Z-2052Z; 8 BIP, 140 minutes wing-tip generators; #1 Calgary to Okotoks, patrol High River. HS1: 1906Z-2028Z; 78 EJ, 3 BIP; #1 Calgary, #2 Okotoks. HS2: 2350Z (06/15)-0040Z (06/16); no seeding; #3 Turner Valley and Black Diamond .
June 16, Sunday	A closed low was moving out of the area, and pressure was rising. There was still some modest instability in the atmosphere, but very little wind shear. A few weak thunderstorms were possible later in the afternoon as a weak shortwave moved into the area. Overnight, no precipitation was expected. Light convective rain showers formed during the afternoon with no lightning or TITAN cells. During the evening, skies cleared and winds shifted to the SE. No TITAN cells, 48.5 max dBz, 2.4 max VIL Tmax YC = 18.8C and no rain. Tmax QF = 16.5C and a trace of rain. Tmax Radar = 17.3C and no rain.	No aircraft operations.
June 17, Monday	At the surface, southeast flow was advecting very warm moist air into the project area. With the atmosphere capped during the morning and early afternoon, high temperatures and dewpoints were expected to produce a very unstable air mass. Instability combined with good speed shear and upper jet support meant severe storms were likely. Storms were expected to form in the mid-afternoon along a weak vorticity maximum and also form along the foothills, where they would easily move into the project area. As a vorticity maximum into the Rockies around noon, some weak thunderstorms began to form over the foothills. Showers and then storms were limited to the foothills until the mid afternoon when they began to move into the project area. After storms cleared the E border of the project area, a more intense complex moved in from the S, but hail threats were mainly limited to the E buffer area. A few showers persisted overnight. Max cell top: 12.1km, 68.5 max dBz, 142.9 max VIL Tmax YC = 21.6C and 2.0mm rain. Tmax QF = 21.9C and no rain. Tmax Radar = 21.7C and 0.5mm rain.	HS2 was launched at 1820Z for a cell developing in the foothills W of Calgary. They were airborne at 1828Z and climbed to cloud base. They began patrol, finding only weak inflow. At 1910Z they observed the bases beginning to dissipate, and continued patrol. As they began to encounter inflow, they began seeding storm #2 with wing-tip generators at 1957Z. Moderate inflow persisted, and as the storm strengthened on radar and the bases lowered, they started BIPs at 2026Z. They continued seeding as the storm passed through all target areas, and RTB at 2154Z, landing at 2221Z. HS5 was launched at 1823Z for development W of Sundre. They were airborne at 1848Z and climbed to cloud top. They patrolled until 1944Z, when a cell became threatening, and began seeding storm #1 at 1952Z. They encountered embedded conditions, and at 2021Z, reported mainly ice crystals. At 2024Z, they repositioned farther down the line of storms to W of Cochrane, seeding with a BIP as they repositioned. They began seeding storm #3 for Cochrane at 2029z. As they began to get closed off by the storm, they moved to the S, seeding storm #2 with EJs at 2045Z. When they ran out of EJs at 2142, they descended to base and began seeding with BIPs until. They RTB at 2149Z, landing at 2208Z.

		HS4 was launched at 1952Z for a cell SW of Rocky MH. They were airborne at 2016Z and climbed to cloud base. As they approached the storm, they observed a dark rain shaft, and began seeding with burners and continuous BIPs upon arrival at storm #4 at 2037Z. As the storm weakened, they stopped BIPs at 2107Z. They stopped burners and began to patrol Rocky MH at 2124Z. They RTB 2130Z, landing at 2150Z. HS1 was launched at 2038Z for storm #2. They were airborne at 2050Z and climbed to cloud top on a S heading. They held S of storm #2 until 2134Z, when they moved in to replace HS5. They began seeding storm #2 at 2145Z. They encountered embedded conditions, mainly using BIPs. As the storm weakened and moved away from the calgary area, they RTB 2205Z, landing at 2218Z. Flight Summary HS2: 1828Z-2225Z; 15 BIP, 234 minutes wing-tip generators; patrol W. Calgary, #2 Calgary. HS5: 1836Z-2212Z; 304 EJ, 9 BIP; Patrol Sundre, #1 Sundre, #3 Cochrane, #2 Calgary. HS4: 2000Z-2155Z; 4 BIP, 94 minutes wing-tip generators; #4 Rocky MH, patrol Rocky MH. HS1: 2045Z-2220Z; 1 EJ, 4 BIP; #2 Calgary.
June 18, Tuesday	The main weather influence for the day was an upper level low moving into the Pacific Northwest, which was expected to send a series of strong shortwaves through the project area. The atmosphere was unstable, and shear profiles favored supercells. Surface winds were from the southeast. Upper level jet support and midlevel forcing were also present. Severe hail was expected. Cloud cover and morning rain made the high temperature somewhat uncertain. Overnight, upper levels remained unstable. A very strong shortwave was expected to trigger widespread elevated thunderstorms. A shortwave moved through the project area at the beginning of the forecast period producing thunderstorms and a few marginal hail threats moving northward. Skies remained overcast or broken all day, and temperatures remained below convective temperature. During the evening, a few showers occurred with heavier showers overnight. There was no threat of hail during the evening or overnight. A radar tour was held at the Olds-Didsbury airport during the afternoon. There were 17 people in attendance. Max cell top: 11.4km, 63.5 max dBz, 38.9 max VIL	HS1 was launched at 1453Z for development S of Chestermere. They were airborne at 1510Z and climbed to cloud top. They encountered embedded conditions with some pockets of water, and began top seeding storm #1 at 1523Z. At 1600Z, the aircraft was struck by lightning in the right propeller, igniting several BIP flares. They continued seeding for a short time, but then decided to RTB when they smelled smoke in the cabin and noticed some minor electrical issues. They RTB at 1609Z landing at 1623Z. There was no major damage to the aircraft. HS5 was launched at 1623Z for a patrol flight over Calgary. They were airborne at 1710Z. All hail threats had dissipated when they became airborne, so they RTB immediately, landing at 1719Z. HS1 performed a PR flight to reposition to Olds-Didsbury for the radar tour. They took off from Spring Bank at 1952Z and landed in Olds-Didsbury at 2015Z. HS1 performed a PR flight to return to Spring Bank after the radar tour. They took off from Olds-Didsbury at 2304Z and landed in Spring

	Tmax YC = 19.3C and 6.4mm rain. Tmax QF = 19.4C and 0.6mm rain. Tmax Radar = 18.3C and 3.8mm rain.	Bank at 2321Z. Flight Summary HS1: 1500Z-1627Z; 5 EJ, 12 BIP; #1 Chestermere. HS5: 1650Z-1724Z; no seeding; patrol Calgary. HS1: 1947Z-2017Z; PR flight; YBW to EA3. HS1: 2259Z-2323Z; PR flight; EA3 to YBW.
June 19, Wednesday	As the closed low in the PACNW moved into Montana, southeast flow was present at all levels in the project area. Moisture was very good, but with cool temperatures and weak shear, stratiform rain and only a few weak thunderstorms were expected. Early evening was the focus for thunderstorm development, as a moderate shortwave moved through the project area. Overnight, the atmosphere was capped, but heavy rain showers were expected due to a strong shortwave moving through the area. Rain showers occurred during the afternoon. When a strong band of vorticity pushed through during the evening, a few weak thunderstorms were triggered in the S half of the PA. The rest of the night saw heavy rain through most of the PA, particularly in the foothills. Max cell top: 9.9km, 64.0 max dBz, 45.7 max VIL Tmax YC = 17.7C and 7.8mm rain. Tmax QF = 19.3C and 0.4mm rain. Tmax Radar = 17.4C and 3.6mm rain.	No aircraft operations.
June 20, Thursday	A low pressure system was expected to slowly move N into the project area, producing abundant vertical motion. Ample moisture was being drawn around the north side of the low into the project region. The day began with heavy rain, and rain was expected to continue throughout the period, particularly in the foothills due to strong orographic flow. Some clearing was expected in S sections of the project area during the afternoon. With some cooling aloft, moderate instability was expected. With the jet streak over the project area, good speed shear was present. The severity of storms was highly dependent on high temperatures, but the forecast high was conducive for only weak to moderate storms, with possible small hail. Hail storms were most probable in the S half of the project area during the early evening, coinciding with both strong vorticity advection and the warm temperatures. Overnight, vorticity advection continued, but the atmosphere was stable. Heavy rain was expected overnight. Stratus and convective rain showers occurred all day with east flow. During the later afternoon, a few short lived thunderstorms formed in clear areas. Extreme rainfall amounts over the western project area and the foothills caused river flooding. Many major cities in the	No aircraft operations. All seeding operations were suspended due to flooding concerns and State of Emergency in several municipalities.

	project area had evacuations and/or declared states of emergency. These cities included Calgary, Red Deer, High River, Okotoks, Cochrane, Sundre, Black Diamond, Turner Valley, Bragg Creek, and Canmore. Max cell top: 6.9km, 63.5 max dBz, 34.9 max VIL Tmax YC = 17.1C and 45.0mm rain. Tmax QF = 16.0C and 5.8mm rain. Tmax Radar = 16.3C and 37.6mm rain.	
June 21, Friday	A closed low was located over the project area, and not expected to move significantly during the forecast period. Stratus rainfall was expected to continue with the chance for a thunderstorm or two in the later afternoon as the temperature surpassed convective temperature. Overnight, some dry air was expected to begin advecting in from the N, reducing rainfall rates. Evacuations and flooding were still ongoing. Showers prevailed throughout the day with stronger convective showers during the later afternoon. There were a few brief thunderstorms, mainly in the northern half of the project area. Skies cleared overnight. Pea size hail was reported in Eckville. Max cell top: 9.1km, 66.5 max dBz, 58.9 max VIL. Tmax YC = 15.3C and 23.0mm rain. Tmax QF = 17.7C and 16.4mm rain. Tmax Radar = 15.1C and 29.0mm rain.	No aircraft operations. Seeding suspension continued due to flooding and State of Emergency in several municipalities.
June 22, Saturday	The closed low was centered on the Alberta Saskatchewan border with dryer air advecting into the PA from the north. Showers were likely all day, forming in the project area's moist, warm air mass, and also over the foothills. Instability was present, but there was weak wind shear favoring short lived thunderstorms. Storms were most likely during the early evening as a band of vorticity moved around the closed low. Overnight, showers were possible, but storms were unlikely due to a strong cap. Showers and weak thunderstorms prevailed throughout the day. Skies cleared during the evening and overnight with some virga and light rain showers on radar. Max cell top: 8.4km, 60.5 max dBz, 42.5 max VIL. Tmax YC = 18.9C and 0.6mm of rain. Tmax QF = 19.0C and no rain. Tmax Radar = 18.8C and no rain.	No aircraft operations. Seeding suspension continued due to flooding and State of Emergency in several municipalities.
June 23, Sunday	Upper level jet energy was just south of the region. The broad midlevel low over AB, SK, and MB was	All seeding operations were suspended due to flooding concerns and State of Emergency in

	continuing to weaken. Vorticity advection from the low was expected to be the main trigger for thunderstorms during the day and night. Model soundings suggested that the atmosphere was moderately unstable with weak speed shear. Thunderstorms would likely be of the pulse variety. Moderately strong thunderstorms were observed during the afternoon and early evening hours. These storms formed mainly over the northern part of the project area. Radar data suggested that grape size hail was possible NE of Lacombe. Pea size hail was reported in Red Deer. Max cell top: 9.9km, 62.5 max dBz, 65.6 max VIL Tmax YC = 20.6C and 1.2mm of rain. Tmax QF = 19.4C and 0.6mm of rain. Tmax Radar = 18.8C and 1.8mm of rain.	several municipalities.
June 24, Monday	Jet energy at the upper levels was south of the area. The mid-levels were experiencing southwest flow. Weak lobes of vorticity were expected to move through during the afternoon hours. A shortwave trough was expected to push into the area during the late evening. Temperatures aloft were warming by around 3C during the daytime which acted to inhibit deep convection. A lee surface trough was in place from central AB down through Montana. Weak thunderstorms were first seen along the foothills during the early afternoon. This wave of convection eventually tracked north-northeastward across the entire project area. Radar data indicated that pea size hail may have occurred W of Bowden and E of Innisfail. Max cell top: 6.9km, 64.0 max dBz, 26.1 max VIL Tmax YC = 20.2C and no rain. Tmax QF = 21.8C and 4.0mm of rain. Tmax Radar = 19.6C and no rain.	Seeding suspension was lifted for areas north of the Trans-Canada Highway 1 as flood waters receded. Suspension continued in the southern project region due to flood concerns and State of Emergency in multiple municipalities. HS2 flew a currency flight. The aircraft was airborne at 2228Z and landed at 2317Z. Flight Summary HS2: 2200Z-2320Z; no seeding; currency flight.
June 25, Tuesday	The upper level jet continued to stay south of the area. Midlevel flow was out of the SW. A shortwave trough was over the Red Deer area during the morning hours but moving northeastward out of the area. A wave of moderately strong vorticity was expected to pass over during the peak heating hours. A surface low was in place over the region and was progged to move northeastward during the day. The Red Deer soundings suggested that strong pulse thunderstorms were possible during the afternoon and evening hours. A line of weak thunderstorms formed just to the SW of Sundre and slowly moved northeastward across the region. During the late afternoon, these storms became stronger near Innisfail and Red Deer before	Seeding suspension continued for the towns of Turner Valley, Black Diamond, and High River which remained under a State of Emergency with continued flood concerns. Normal seeding operations resumed for the rest of the project area. HS3 was launched at 2150Z to the west of Red Deer. The aircraft became airborne at 2204Z and climbed to top seeding altitude. They started seeding storm #1 southwest of Red Deer at 2214Z with BIPs. At 2217Z HS3 started seeding with EJs as well. After the line of thunderstorms started diminishing, they stopped seeding at 2241Z and started

	tracking east of the area. Radar data showed that walnut size hail may have fallen just to the NW of Rimbey. A cluster of cells also formed over western Calgary and tracked east-northeastward through Calgary during the early evening hours. Pea size hail was reported in Calgary. Max cell top: 10.6km, 66.5 max dBz, 81.3 max VIL Tmax YC = 21.5C and 1.2mm of rain. Tmax QF = 19.0C and 3.0mm of rain. Tmax Radar = 19.4C and 2.0mm of rain.	patrolling the Sylvan Lake area. Then at 2250Z, HS3 stopped patrolling and RTB. They landed at 2259Z. Flight Summary HS3: 2158Z-2305Z; 68 EJ, 4 BIP; #1 Red Deer, patrol Sylvan Lake.
June 26, Wednesday	The jet stream at the upper levels shifted northward and was over the region in the evening. The midlevel flow continued to be out of the SW. A wave of vorticity moved through the area in the late afternoon. Differential surface heating was also expected to act as a trigger mechanism for thunderstorms along the foothills. Thunderstorms formed in the northern buffer zone and near Rocky MH during the evening. The strongest of these thunderstorms formed N of Eckville and moved towards Lacombe. Another line of storms formed W of this storm (#1), but was not a threat to any cities. According to radar data, grape size hail may have occurred W of Lacombe. Max cell top: 9.1km, 61.5 max dBz, 53.1 max VIL Tmax YC = 22.9C and no rain. Tmax QF = 23.5C and no rain. Tmax Radar = 22.8C and no rain.	Seeding suspension continued for the towns of Turner Valley, Black Diamond, and High River which remained under a State of Emergency with continued flood concerns. Normal seeding operations continued for the rest of the project area. A radar tour was conducted with 17 insurance people in attendance. HS2 flew a PR flight from YBW to EA3. The flight became airborne at 1607Z and landed at 1627Z. HS2 then flew a PR flight from EA3 to YBW. The aircraft was airborne at 2212Z and landed at 2234Z. HS3 was launched at 0230Z (06/27) to a rapidly growing storm W of Lacombe. The flight was airborne at 0244Z (06/27) and climbed to top seeding altitude. Upon arriving at the storm (#1), they quickly found decent growth and started seeding at 0252Z (06/27). The flight found plenty of seeding targets starting at 0303Z (06/27). At 0411Z (06/27), the crew had expended all of their EJs and the storm was now reaching Lacombe, so they stopped seeding and RTB. HS3 landed at 0416Z (06/27). Flight Summary HS2: 1554Z-1630Z; PR flight; YBW to EA3. HS2: 2203Z-2236Z; PR flight; EA3 to YBW. HS3: 0238Z (06/27)-0418Z (06/27); 294 EJ, 2 BIP; #1 Lacombe.
June 27, Thursday	The jet stream was centered directly over the region. A mid and upper level ridge built over southern AB from the south. The ridge caused temperatures aloft to warm by around 2C during the daytime hours. Vorticity advection was expected to by weak. At the surface, a high pressure system was in place over southern BC. Model soundings indicated that the atmosphere was slightly unstable.	All seeding suspensions were lifted as flood waters had receded across the region. Normal seeding operations resumed project-wide. HS2 flew a currency flight. The flight became airborne at 1533Z and landed at 1703Z. HS4 flew a currency flight. The aircraft was

	The region saw cumulus, altocumulus, and cirrus clouds during the day. Virga was also observed near the town of Caroline. No significant weather occurred overnight. 36.0 max dBz Tmax YC = 23.1C and no rain. Tmax QF = 24.2C and no rain. Tmax Radar = 24.4C and no rain.	airborne at 1847Z and landed at 1920Z. HS5 flew a currency flight. The flight became airborne at 2040Z and landed at 2116Z. Flight Summary HS2: 1520Z-1706Z; no seeding; currency flight. HS4: 1836Z-1927Z; no seeding; currency flight. HS5: 2020Z-2120Z; no seeding; currency flight.
June 28, Friday	The upper level jet stream was now positioned over northern AB. A mid and upper level ridge continued to build over southern AB. The ridge axis was expected to shift east of the area overnight. 500mb temperatures warmed by around 3C during the daytime which inhibited deep convection. Surface high pressure was centered over the Banff NP area. The region saw cumulus, altocumulus, cirrocumulus and cirrus clouds during the daytime hours. Radar imagery showed virga near Airdrie and Calgary in the early evening. 30.5 max dBz Tmax YC = 23.7C and no rain. Tmax QF = 25.4C and no rain. Tmax Radar = 24.2C and no rain.	HS2 flew a currency flight. The aircraft was airborne from YBW at 1833Z and landed in YQF at 1909Z. HS3 flew a maintenance flight to test AirLink. The aircraft became airborne at 1958Z and landed at 2011Z. HS2 flew a currency flight. The aircraft was airborne out of YQF at 2129Z and landed in YBW at 2158Z. Flight Summary HS2: 1820Z-1916Z; no seeding; currency flight; YBW to YQF. HS3: 1946Z-2017Z; no seeding; maintenance flight. HS2: 2118Z-2202Z; no seeding; currency flight; YQF to YBW.
June 29, Saturday	The axis of the ridge shifted towards the east and was centered over the AB/SK border in the evening. Temperatures aloft were expected to cool during the day. A shortwave trough was expected to move through the northern part of the region in the evening. An 850mb theta-e ridge stayed over the area throughout the period. A low level jet was also expected to strengthen over eastern AB during the late evening hours. At the surface, a cold front was progged to move through with the trough. Area soundings showed a very unstable atmosphere with weak to moderate speed shear. Directional shear also existed in the low levels of the atmosphere. Thunderstorms began to develop over the northern foothills in the midafternoon. The first major cell of the day moved off the foothills and grew into a moderately tall storm as it tracked towards the town of Rocky MH. In the late afternoon, another cluster of cells developed W of Caroline and merged with the Rocky MH storm. This new larger storm then tracked east-northeastward towards Red Deer. Walnut size hail was reported just W of Caroline. In the evening the cold front pushed eastward across the area and a couple of strong lines of thunderstorms formed. The first line formed west of Sylvan Lake and moved eastward. This line of cells	HS4 was launched to Rocky MH at 2113Z. The aircraft was airborne at 2136Z and flew to a rapidly intensifying cell W of Rocky MH. Upon arriving at the storm (#1), the crew started seeding with one wing-tip generator and BIPs at 2201Z. HS4 was unable to get the left wing-tip generator working throughout the flight. At 2232Z, the cell was diminishing on radar, so they stopped seeding and started patrolling the same area. HS4 then repositioned (2240Z) a few miles to the SW where a new cell was growing on the S side of storm #1. After finding no seedable inflow, the flight stopped patrolling and RTB at 2254Z, landing at 2312Z. HS2 was launched at 2226Z to new growth SW of Sundre. The flight became airborne at 2243Z and flew towards the cell. They were then redirected towards taller convection W of Caroline at 2304Z. The crew then started seeding this storm (#2) at 2312Z. They continued seeding this storm as it became larger and taller. When the storm reached Caroline, HS2 stopped seeding and RTB at 0007Z (06/30). The aircraft landed in EA3 at 0018Z (06/30).

	dissipated before reaching Red Deer. The other line formed west of Sundre and tracked eastward across the area as a bow echo. The radar parameters suggested that golf ball size hail was possible W of Sylvan Lake. Max cell top: 12.9km, 70.5 max dBz, 172.7 max VIL. Tmax YC = 25.6C and no rain. Tmax QF = 26.7C and 5.6mm rain. Tmax Radar = 25.8C and 29.7mm rain.	HS3 was launched at 0205Z (06/30) for a cell SW of Sylvan Lake. They were airborne at 0219Z (06/30) and climbing to cloud top, commencing seeding on storm #3 with BIPs at 0225Z (06/30). They reported very strong updrafts and a deep green tint, and commenced EJs at 0229Z (06/30). They descended to shed ice at 0257Z (06/30), recommencing seeding at 0304Z (06/30). As the storm weakened no targets remained, they stopped seeding at 0315Z (06/30) and repositioned towards Olds. They arrived and commenced seeding storm #5 at 0341Z (06/30). They continued seeding the storm as it combined with a long linear storm, and began seeding in a longer track extending to the south. They descended to shed ice at 0426Z (06/30), recommencing seeding storm #5 at 0438Z (06/30). As the storm continued to weaken and moved past protected cities, HS3 stopped seeding and RTB at 0446Z (06/30), landing at 0502Z (06/30). HS4 was launched at 0210Z (06/30) for a cell SW of Sylvan Lake. They were airborne at 0225Z (06/30) and climbed to cloud base, commencing seeding on storm #3 with BIPs and wing-tip generators at 0231Z (06/30). At 0301Z (06/30), their right wing-tip generator was reported inoperative. At 0309Z (06/30), they RTB as the storm began to weaken, landing at 0317Z (06/30). HS2 was launched at 0210Z (06/30) for a cell W of Sundre. They were airborne at 0224Z and climbed to cloud base, redirecting for storm #3 at 0230Z (06/30). They began seeding storm #3 with wing-tip generators at 0247Z (06/30), beginning BIPs at 0252Z (06/30). They stopped seeding at 0315Z (06/30) and repositioned to Sundre as storm #3 weakened considerably. They began seeding storm #4 with wing-tip generators upon arrival at 0326Z (06/30). They repositioned towards Olds as a new cell began growing, beginning seeding storm #5 with wing-tip generators at 0327Z (06/30). They continued seeding the storm as it combined with a long linear storm. They began seeding in a longer track extending to the south, beginning BIPs at 0357Z (06/30) as they experienced better inflow. When HS5 replaced them at 0426Z (06/30), HS2 stopped seeding and RTB, landing at 0434Z (06/30). HS5 was launched at 0348Z (06/30) to a cell W of Crossfield. They were airborne at 0415Z (06/30) and climbed to cloud base. They

		positioned near of Crossfield and began seeding the linear storm #5 with BIPs at 0426Z (06/30). As the storm weakened and moved past protected cities, HS5 stopped seeding and RTB at 0451Z (06/30), landing at 0505Z (06/30). Flight Summary HS4: 2125Z-2324Z; 4 BIP, 31 minutes wing-tip generators; #1 Rocky MH. Left generator inoperative. HS2: 2234Z (06/29)-0022Z (06/30); 7 BIP, 110 minutes wing-tip generators; #2 Caroline; takeoff YBW, land EA3. HS3: 0215Z (06/30)-0509Z (06/30); 306 EJ, 20 BIP; #3 Sylvan Lake, #5 Olds to Crossfield. HS4: 0217Z (06/30)-0323Z (06/30); 67 minutes wing-tip generators, 5 BIP; #3 Sylvan Lake; Right generator inoperative. HS2: 0219Z (06/30)-0438Z (06/30); 168 minutes wing-tip generators, 8 BIP; #3 Sylvan Lake, #4 Sundre, #5 Olds; takeoff EA3, land YBW. HS5: 0405Z (06/30)-0507Z (06/30); 4 BIP; #5 Crossfield.
June 30, Sunday	A very unstable air mass was in place over the project area with good speed shear. The atmosphere was expected to be capped for most of the day with a strong ridge also in place. As winds shifted to the E around peak heating, some isolated thunderstorms were expected to form over the foothills and move into the project area. If storms formed, they were expected to be severe. Overnight, skies were expected to clear. The cap held, and only fair weather cumulus formed during the afternoon. Skies cleared overnight. No TITAN cells. Tmax YC = 24.6C and no rain. Tmax QF = 25.0C and 1.0mm rain. Tmax Radar = 23.7C and no rain.	HS4 performed a maintenance flight to test their wing-tip generators. They were airborne at 1900Z, and landed at 1907Z. Flight Summary HS4: 1852Z-1913Z; no seeding; maintenance flight.
July 1, Monday	A ridge continued to build with a jet streak located N of the project area. A very unstable air mass was still in place, but convective inhibition precluded any convective initiation. Skies were expected to remain mostly clear through the entire forecast period. The cap held, and skies were mostly clear throughout the period. No TITAN cells. Tmax YC = 26.9C and no rain. Tmax QF = 27.1C and no rain. Tmax Radar = 26.4C and no rain.	No aircraft operations.

July 2, Tuesday	The ridge was moving toward the east. The air mass was exceptionally unstable, but it was expected to remain capped for most of the day. A small jet streak during the afternoon created a possibility for initiation in the S project area, but the main focus was a cold front moving down from the north. Severe storms were expected to form along the cold front during the early evening, continuing as the cold front slowly moved southward through the area. Strong outflow boundaries were expected to trigger additional storms ahead of the cold front. Storms were expected to weaken overnight, but elevated convection was still a possibility. By the next forecast period, most of the project area was expected to be postfrontal and stable, except for the far south. The early afternoon was mostly humid, hazy, and hot. Skies were mostly clear, but some short lived towering cumulus was observed within the project area. No TITAN cells. Tmax YC = 32.8C and no rain. Tmax QF = 31.8C and no rain. Tmax Radar = 32.2C and no rain.	The radar was down for repairs during most of the afternoon and early evening hours. There were no storms in the project area during this time. HS2 performed a maintenance flight. They were airborne from YBW at 1325Z and landed in YQF at 1354Z. HS2 was launched at 2239Z for development north of Rocky MH. They were airborne at 2350Z and climbed to cloud base. The storms remained N of the project area and were not a threat. HS2 RTB 0020Z (07/03), landing in Rocky MH at 0032Z (07/03). HS2 performed a reposition flight to return to Spring Bank. They were airborne from Rocky MH at 0307Z (07/03) and landed in Spring Bank at 0341Z (07/03). <u>Flight Summary</u> HS2: 1315Z-1403Z; no seeding; maintenance flight; takeoff YBW, land YQF. HS2: 2343Z (07/02)-0035Z (07/03); no seeding; patrol Rocky MH; takeoff YQF, land WRM. HS2: 0300Z (07/03)-0343Z (07/03); no seeding; reposition flight; takeoff WRM, land YBW.
July 3, Wednesday	With a dry, cool air mass in place behind the cold front, the atmosphere was stable. A mostly clear day was expected. Slight troughing was expected to begin overnight, with no significant chance for storms until the next forecast period. The day was mostly clear. During the early morning hours of July 4, some popup cells in the project area turned into brief weak thundershowers. Max cell top: 7.6km, 63.5 max dBz, 36.8 max VIL Tmax YC = 25.0C and no rain. Tmax QF = 22.7C and no rain. Tmax Radar = 21.6C and no rain.	HS3 performed a PR flight for the radar tour. They took off from Red Deer at 1720Z and landed in Olds-Didsbury at 1735Z. HS3 performed a PR flight to reposition back to Red Deer after the radar tour. They took off from Olds-Didsbury at 2155Z and landed in Red Deer at 2207Z. <u>Flight Summary</u> HS3: 1714Z-1737Z; no seeding; PR flight; takeoff YQF, land EA3. HS3: 2151Z-2212Z; no seeding; PR flight; takeoff EA3 land YQF.
July 4, Thursday	A cool moist air mass was in place over the project area. Midlevel troughing was still occurring, and with the jet over southern Alberta, speed and directional wind shear were very strong. As a strong shortwave crested the Rockies, a surface trough was expected to form during the afternoon and strengthen through the evening. Thunderstorms were expected to form in the foothills and move into the project area. Storms were expected to be severe with low cloud bases.	HS4 was launched at 1829Z for a storm W of Lacombe. They were airborne at 1857Z and climbed to cloud base. They began seeding storm #1 with wing-tip generators upon arrival at 1904Z. They found very good inflow, and reported a large pedestal, beginning BIPs at 1915Z. At 1947Z, as the storm moved past Lacombe, HS4 stopped seeding and repositioned to Sylvan Lake, leaving wing-tip generators burning in transit. They began to

	The first storms of the day formed around noon in the northern buffer zone along a surface boundary. During the afternoon, storms formed in the foothills with some becoming severe and moving into the project area. After the first wave of storms shifted east of the project area, some popup cells were observed W of Calgary and along the strongest shortwave near Rocky MH. Around midnight, storms formed near High River and then diminished to rain showers through the rest of the forecast period. Max cell top: 15.1km, 67.5 max dBz, 140.3 max VIL The media reported nickel to dime size hail in Airdrie. Tmax YC = 24.0C and 1.8mm rain. Tmax QF = 22.6C and 15.4mm rain. Tmax Radar = 20.6C and 5.8mm rain.	seed storm #2 at 1956Z without BIPs. They repositioned back to storm #1 as it approached Red Deer recommencing seeding with wing-tip generators and BIPs at 2019Z. As bases began falling, they RTB at 2053Z. They were unable to land in Red Deer due to gusty winds, and landed in Olds-Didsbury, landing at 2109Z. HS3 was launched at 1837Z for a storm W of Lacombe. They were airborne at 1854Z and began climbing to cloud top. They began seeding storm #1 with BIPs and EJs at 1903Z as they continued to climb. They found good liquid water, and continued seeding as the storm approached Lacombe. At 1946Z, HS3 descended to shed ice, stopped seeding, and repositioned to storm #2 W of Sylvan Lake. They began seeding storm #2 at 1957Z with EJs and BIPs as they climbed back to top. At 2014Z, HS3 repositioned to seed storm #1, now over Blackfalds. They continued seeding until the storm was no longer a threat to any target cities, and RTB at 2052Z. They landed at 2100Z. HS5 was launched at 1933Z for growth W of Sundre. They were airborne at 2001Z and climbed to cloud top. They began seeding storm #3 with BIPs and EJs at 2028Z. At 2035Z, they stopped seeding and redirected to growth near Black Diamond. They approached the storm, and began patrol W of High River at 2102Z. The storm proved to be in the dissipating stage, and they repositioned to NW of Cochrane at 2111Z. They arrived at 2128Z and began patrol. They commenced seeding storm #4 with EJs at 2204Z. They stopped using EJs at 2306, descended to the -5C level and then used BIPs only. They continued until they were low on fuel and RTB 0006Z (07/05). They landed at 0023Z (07/05). HS1 was launched for storm #4 at 2230Z. They were airborne at 2240Z and climbed to cloud top. They dropped down to replace HS5 on storm #4, and began seeding with BIPs and EJs at 2258Z. When they exhausted their EJs at 0011Z (07/05), they descended to the -5C level and began seeding with BIP flares at 0018Z (07/05). They stopped seeding and RTB at 0035Z (07/05) as the storm moved past Airdrie, landing at 0044Z (07/05). HS2 was launched for storm #4 at 2230Z. They were airborne at 2243Z and climbed to base seeding altitude. They began seeding the storm with wing-tip generators and BIPs at 2252Z as they continued climbing. They turned

		wing-tip generators off at 0027Z (07/05) after being forced away from the storm by a gust front and ATC restrictions. They RTB 0030Z (07/05), landing at 0037Z (07/05). HS3 was launched for storm #4 at 2249Z. They were airborne at 2258Z and climbed to cloud top. They travelled SW around the line of storms to get to the leading edge of the line near Calgary, and began patrol for Airdrie at 2328Z. After the other top seeder (HS1) exhausted their chemical and descended, HS3 dropped to the -10C block and replaced them. At 0007Z (07/05), they began seeding storm #4 at top with EJs and BIPs. HS3 continued seeding as the storm went through Airdrie and Strathmore, then stopped seeding and began patrol on some towering cumulus W of Calgary at 0127Z (07/05). They commenced seeding storm #5 over Calgary at 0133Z (07/05). This cell dissipated. They RTB at 0205Z (07/05), landing at 0226Z (07/05). HS4 performed a reposition flight to return to Red Deer. They took off from Olds-Didsbury at 2300Z and landed in Red Deer at 2315Z. HS2 was launched at 0140 (07/05) for storm #5 W of Calgary. They took off after fueling and chemming, and were airborne at 0210Z (07/05). They climbed to cloud base. They began patrol SW of Spring Bank as storm #5 diminished. They observed popup cells over and W of Calgary, but nothing materializing into a hail threat. HS2 RTB at 0247Z (07/05), landing at 0254Z (07/05). HS1 was launched at 0155Z (07/05) for development W of Calgary. They took off after fueling, becoming airborne at 0214Z (07/05). They climbed to cloud top and commenced patrol near Calgary. They observed popup cells over and W of Calgary, but nothing materialized into a hail threat. As a cell showed signs of intensification, HS1 began seeding storm #6 with EJs at 0344Z (07/05). They reported very small amounts of liquid water, and continued seeding the storm as it moved through Calgary. They RTB at 0438Z (07/05), landing at 0454Z (07/05). <u>Flight Summary</u> HS4: 1839Z-2111Z; 10 BIP, 216 minutes wing-tip generators; #1 Lacombe, #2 Sylvan Lake; takeoff YQF land EA3. HS3: 1843Z-2106Z; 207 EJ, 14 BIP; #1 Lacombe, #2 Sylvan Lake. HS5: 1946Z (07/04)-0027Z (07/05); 46 EJ, 18

		BIP; #3 Sundre, patrol High River, patrol Cochrane, #4 Airdrie. HS1: 2230Z (07/04)-0049Z (07/05); 290 EJ, 18 BIP; #4 Airdrie. HS2: 2234Z (07/04)-0044Z (07/05); 190 minutes wing-tip generators, 14 BIP; #4 Airdrie HS4: 2249Z-2320Z; no seeding; reposition; takeoff EA3, land YQF. HS3: 2252Z (07/04)-0230Z (07/05); 280 EJ, 11 BIP; patrol Airdrie, #4 Airdrie through Strathmore, patrol Calgary, #5 Calgary. HS2: 0202Z (07/05)-0302Z (07/05); no seeding; patrol Calgary HS1: 0207Z (07/05)-0500Z (07/05); 17 EJ; patrol Calgary, #6 Calgary.
July 5, Friday	Northwest flow at the low levels was causing some cold air advection. Troughing was still occurring, and with several vorticity maxima moving through the project area during the day, showers and storms were probable. Model soundings indicated good shear during the morning, weakening slightly throughout the day, and only moderate amounts of instability. Storms were possible during the afternoon forming along the southern foothills. Evening storms were anticipated to be concentrated in the northern project area, diminishing to showers overnight. Showers began in the foothills during the afternoon, moving into the project area. Some weak, embedded thunderstorms also occurred with no significant hail threats. Showers continued overnight and into the morning. Flash flooding was reported in Calgary. Max cell top: 8.4km, 62.5 max dBz, 36.6 max VIL. Tmax YC = 19.5C and 11.2mm rain. Tmax QF = 20.6C and 7.8mm rain. Tmax Radar = 18.4C and 0.5mm rain.	No aircraft operations.
July 6, Saturday	As the trough axis moved through the project area during the afternoon, forcing was expected to be strong. However, weak instability was expected to limit severity of any thunderstorms. Showers were expected all day, with some moderate storms in the afternoon. Severe hail was not expected. Overnight, temperatures were to get unseasonably cold with no possibility of convection. Showers and overcast skies continued from the morning into the afternoon with some weak thunderstorms moving into the project area as well. The strongest cell passed through Airdrie and Irricana. During the early evening, skies began to clear. Virga and scattered light rain showers occurred overnight.	Seeding operations were conditionally suspended in and around Calgary due to flash flooding concerns. HS5 was launched on a storm approaching Strathmore. As they became airborne, the storm was no longer a threat so they immediately RTB. They were airborne at 2230Z and landed at 2238Z. <u>Flight Summary</u> HS5: 2214Z-2243Z; no seeding; patrol cancelled.

	Drifts of pea to marble size hail were reported in Airdrie and Irricana. A few walnut size stones were also reported. Pea size hail was reported in NE and SW Calgary. Max cell top: 10.6km, 67.0 max dBz, 87.6 max VIL Tmax YC = 16.5C and 0.8mm rain. Tmax QF = 15.6C and 6.6mm rain. Tmax Radar = 15.4C and 1.5mm rain.	
July 7, Sunday	A weak portion of the upper level jet was over the far southern part of AB. The trough which influenced the area during the previous day was now centered over the Fort McMurray area. A wave of weak vorticity was expected to move through during peak heating. Surface pressure values fell during the day. The southern part of the project area experienced weak upslope flow. The Calgary model sounding for 00Z indicated that the atmosphere would be moderately unstable. Speed shear was sufficient for long-lived thunderstorms. A few isolated thunderstorms formed over the foothills in the late afternoon. Then in the late evening, one cell moved into the project area near Cremona and produced a few lightning strikes. Overnight, a few weak convective cells moved through the area. Max cell top: 6.9km, 52.0 max dBz, 11.5 max VIL Tmax YC = 19.6C and no rain. Tmax QF = 20.6C and no rain. Tmax Radar = 20.0C and 1.0mm of rain.	No aircraft operations.
July 8, Monday	The upper level jet core was centered along the far southeastern part of AB. The main trigger for convection was a strong shortwave trough which moved through the area in the morning and afternoon. At the surface, lee cyclogenesis occurred directly over southern AB. Area soundings indicated that the troposphere was fairly moist and moderately unstable with very weak speed shear. A wide line of convective rain showers moved into the region from the SW during the early morning hours. These convective showers then turned into embedded thunderstorms in the late morning. The strongest thunderstorms of the period formed east and southeast of Red Deer during the early afternoon. Radar data indicated that grape size hail may have fallen southeast of Red Deer. Max cell top: 7.6km, 64.0 max dBz, 48.9 max VIL Tmax YC = 15.8C and 11.8mm of rain. Tmax QF = 18.0C and 4.0mm of rain.	No aircraft operations.

	Tmax Radar = 15.7C and 1.0mm of rain.	
July 9, Tuesday	Jet energy was north of the area and was not expected to be a factor. A ridge built over southern AB during the morning and afternoon. The mid-levels of the atmosphere were capped. In the evening, the ridge axis shifted east of the area. A cold front moved into AB from BC but became stationary before reaching the project area. Speed shear was weak. Towering cumulus clouds were observed over the far northern part of the project area during the afternoon. In the midafternoon, a single weak thunderstorm developed in the northern buffer near Rimbey. Max cell top: 6.9km, 51.5 max dBz, 9.6 max VIL Tmax YC = 25.2C and no rain. Tmax QF = 26.1C and no rain. Tmax Radar = 24.4C and no rain.	No aircraft operations.
July 10, Wednesday	Upper level jet energy was well to the NW of the region. A broad midlevel closed low was positioned over northern BC. Central AB experienced SW flow at the mid-levels. Weak to moderate vorticity advection occurred during the afternoon and evening. Lee cyclogenesis was progged to occur north of Rocky MH. The Red Deer 00Z model sounding showed that convective inhibition was present in the low levels of the atmosphere. Dewpoints were much lower just above the surface. Towering cumulus clouds were seen over the northwestern part of the project area during the afternoon and early evening. Around sunset, convection started developing over the northern part of the region. As this convection quickly moved eastward, a few cells grew east of Lacombe before moving out of the project area. Max cell top: 8.4km, 54.0 max dBz, 13.9 max VIL Tmax YC = 27.5C and no rain. Tmax QF = 27.5C and no rain. Tmax Radar = 26.4C and no rain.	HS2 flew a reposition flight. The aircraft was airborne at 2033Z and landed in Rocky MH at 2105Z. HS2 flew a reposition flight. The aircraft was airborne out of Rocky MH at 0126Z (07/11) and landed in CYBW at 0200Z (07/11). <u>Flight Summary</u> HS2: 2023Z-2108Z; no seeding; reposition flight; takeoff CYBW, land Rocky MH. HS2: 0118Z (07/11)-0203Z (07/11); no seeding; reposition flight; takeoff Rocky MH, land CYBW.
July 11, Thursday	An upper level jet streak nosed its way into southern AB during the afternoon. At the mid-levels, a shortwave trough was expected to move into central AB. 500mb temperatures cooled by 4C which acted to destabilize the troposphere. A cold front pushed SE through the region in the morning and afternoon. Both Red Deer and Calgary model soundings indicated that the atmosphere was unstable with strong speed shear. Dewpoints were expected to fall during the day. Thunderstorms started forming along the western	HS4 was launched to explosive growth W of Rocky MH at 1942Z. The flight was airborne at 2007Z. HS4 started base seeding storm #1 W of Sylvan at 2019Z after finding sufficient inflow. They continued seeding this storm as it approached Red Deer. At 2129Z, they stopped seeding and started patrolling an outflow boundary near Olds. They started finding consistent inflow at 2141Z, W of Didsbury, so the aircraft started seeding this storm (#2) at that time. The crew then reported inconsistent

	border of the project area during the early afternoon hours. This line of convection quickly tracked eastward across the area. The strongest of these storms (#1) formed W of Rocky MH and moved eastward through Sylvan, Red Deer, and Innisfail. Radar data suggested that walnut size hail may have occurred SW of Sylvan. Another storm (#2) was triggered by an outflow boundary from the first storm. This storm formed W of Didsbury before tracking eastward. Max cell top: 10.6km, 67.5 max dBz, 75.2 max VIL Tmax YC = 26.3C and no rain. Tmax QF = 20.3C and 1.0mm of rain. Tmax Radar = 21.6C and no rain.	inflow, so they stopped seeding and started patrolling the Carstairs area at 2154Z. HS4 stopped patrolling at 2213Z and RTB. They landed at 2239Z. HS5 was launched at 1950Z to the Sundre area. The aircraft became airborne at 2016Z and climbed to the base seeding altitude as they expedited to a fast moving cell W of Sylvan. Upon arriving at the storm (#1), HS5 started seeding at 2041Z. The crew continued seeding the southern cell as it moved towards Red Deer and Innisfail. At 2129Z the storm system was no longer a threat to the Red Deer area, so they stopped seeding and RTB. The aircraft landed at 2149Z. HS3 was launched to a fast moving and quickly intensifying cell W of Sylvan at 2010Z. The flight was airborne at 2034Z and climbed to top seeding altitude. Upon arriving at the storm (#1), they found explosive growth and started seeding at 2043Z using BIP and EJ flares. HS3 continued seeding this storm as it moved towards Red Deer and Innisfail. At 2130Z they stopped seeding and started patrolling from Olds to Cremona where an outflow boundary was propagating southward towards Calgary. At 2235Z HS3 was finding no new growth along the boundary, so they stopped patrolling and RTB. The flight landed at 2246Z. Flight Summary HS4: 1953Z-2245Z; 11 BIP, 166 minutes wing-tip generators; #1 Sylvan, patrol Olds, #2 Didsbury, patrol Carstairs. HS5: 2003Z-2153Z; 10 BIP; #1 Red Deer. HS3: 2023Z-2250Z; 191 EJ, 7 BIP; #1 Red Deer, patrol Olds to Cremona.
July 12, Friday	The jet stream at the upper levels was over southern AB. A jet streak was expected to nose its way into the project area from Washington during the late afternoon and evening. At the mid-levels, southern AB was experiencing SW flow. Vorticity advection was likely along the jet. A small 850mb theta-e ridge was expected to be in place along the AB/SK border overnight. A surface low formed over MT and an inverted trough extended northwestward from the low over the area. Area model soundings indicated that the atmosphere would be moderate unstable with moderately strong speed shear. The effective bulk shear was around 55kt. Weak thunderstorms formed over the Three Hills area during the morning and early afternoon. Towering cumulus clouds were observed during the afternoon. The evening and early overnight hours then saw	No aircraft operations.

	scattered, weak thunderstorms over most of the project area. Radar data suggested that a small area east of Red Deer may have seen pea size hail. Max cell top: 8.4km, 60.5 max dBz, 23.0 max VIL Tmax YC = 20.8C and a trace of rain. Tmax QF = 20.1C and no rain. Tmax Radar = 19.8C and 3.3mm of rain.	
July 13, Saturday	An upper level jet streak was positioned over the far southeastern part of AB. This jet streak was expected to shift to the east in the afternoon. A shortwave trough pushed into the elbow region of Alberta during the late afternoon and early evening. Vorticity advection was relatively weak. At the surface, the wind was out of the south-southeast at 5 to 10kt. Model soundings showed a moderate amount of instability with around 30kt of effective bulk shear. Weak thunderstorms formed over the foothills during the late morning which moved across the project area starting at around 18Z. Another wave of thunderstorms then moved into the northern part of the region in the early evening. These weak cells gradually dissipated as they pushed eastward into the project area. According to radar data, grape size hail may have occurred NE of Lacombe. Max cell top: 9.1km, 61.0 max dBz, 36.4 max VIL Tmax YC = 17.7C and 4.4mm. Tmax QF = 18.7C and 10.2mm. Tmax Radar = 17.6C and 2.3mm.	No aircraft operations.
July 14, Sunday	A closed low was approaching the area with ample forcing to begin during the late afternoon. Instability and excellent speed shear indicated a chance for severe storms. Thunderstorms were possible during the afternoon, but best chance for initiation was in the evening and overnight. As cyclogenesis occurred and a low level jet set up, severe storms would be capable of sustaining themselves until the early morning. Showers were expected during the morning, with a lingering chance of thunderstorms in the south. During the early afternoon, short lived cells began to form in the foothills. As the afternoon progressed, weak thunderstorms began to move off the foothills and into the project area. Storms strengthened in the evening with some weak thunderstorms and rain showers continuing overnight. 8mm hail fell at the radar. Max cell top: 12.1km, 67.5 max dBz, 104.7 max VIL Tmax YC = 22.4C and no rain.	The radar was down for maintenance in the morning and early afternoon. HS2 was launched for a storm on the foothills W of Calgary at 2039Z. They were airborne at 2052Z and climbed to cloud base. They began seeding storm #1 with wing-tip generators at 2105Z as they found inflow. HS2 began BIP flares at 2122Z as the storm approached Calgary. HS2 continued seeding until 2152Z, when they repositioned to a cell SW of Olds. They began patrol at 2210Z. After finding good inflow, they began seeding storm #2 with wing-tip generators at 2218Z, commencing BIPs at 2227Z. They seeded as the storm passed over Olds, then RTB at 2326Z, landing at 2342Z. HS1 was launched at 2050Z for a cell in the foothills W of Calgary. They were airborne at 2142Z and climbed to cloud top. They briefly seeded storm #1 upon arrival at 2155Z. The storm was in its dissipating stages, so they began patrol in the foothills W of Calgary at

	Tmax QF = 22.6C and 11.8mm rain. Tmax Radar = 20.6C and 5.6mm rain.	2210Z. They repositioned to storm #2 at 2227Z as it approached Olds, beginning seeding with EJs at 2237Z. They seeded until 2256Z, when they repositioned to a cell near Rocky MH. They began seeding storm #3 with EJs and BIPs at 2315Z. They continued until 2359Z, when they repositioned to the W and descended to cloud base as a cell formed in the foothills. HS1 began base seeding storm #4 with BIPs at 0007Z (07/15). As the storm dissipated at 0029Z (07/15), they stopped seeding and repositioned to a cell W of Innisfail, climbing to top and commencing seeding storm #5 with EJs and BIPs at 0042Z (07/15). They seeded until the storms began to dissipate, and RTB at 0138Z (07/15). They landed at 0203Z (07/15). HS4 was launched at 2229Z for a cell W of Rocky MH. They were airborne at 2250Z and climbed to cloud base. They began seeding storm #3 with wing-tip generators and BIPs upon arrival at 2310Z. They seeded storm #3 as it approached Sylvan Lake, then repositioned to the W at 0133Z (07/15). As it became clear the storms were dissipating, they RTB 0141Z (07/15), landing at 0156Z (07/15). HS3 was launched for storm #4 at 0110Z (07/15). They were airborne at 0132Z (07/15) and climbed to cloud top. Storm #4 dissipated as they took off, and they began patrolling Red Deer at 0147Z (07/15). As no seedable targets were observed, they RTB at 0156Z (07/15), landing at 0202Z (07/15). HS2 was launched for storm #4 at 0118Z (07/15). As they became airborne at 0140Z (07/15), all seedable targets dissipated and the aircraft immediately RTB landing at 0152Z (07/15). HS1 was launched at 0540Z (07/15) to a storm W of the Olds-Didsbury area. They were airborne at 0600Z (07/15). HS1 then flew towards the Didsbury area and patrolled for a short time before RTB at 0611Z (07/15). They landed at 0626Z (07/15). <u>Flight Summary</u> HS2: 2042Z-2345Z; 232 minutes wing-tip generators, 15 BIP; #1 Calgary, patrol Olds, #2 Olds. HS1: 2132Z (07/14)-0207Z (07/15); 206 EJ, 6 BIP; #1 Calgary, patrol Calgary, #2 Olds, #3 Rocky MH, #4 Rocky MH, #5 Innisfail. HS4: 2240Z (07/14)-0200Z (07/15); 302 minutes wing-tip generators, 9 BIP; #3 Rocky

		MH. HS3: 0125Z (07/15)-0207Z (07/15); no seeding; patrol Red Deer. HS2: 0130Z (07/15)-0157Z (07/15); no seeding; patrol cancelled. HS1: 0549Z (07/15)-0634Z (07/15); no seeding; patrol Didsbury.
July 15, Monday	A trough axis was moving through the project area during the morning and early afternoon, with ridging beginning later. A few weak, embedded thunderstorms were expected during the morning, before northwest flow and ridging caused a decrease in precipitation and cloud cover. The evening and overnight period were expected to be mostly clear. Showers occurred during the morning and afternoon, gradually clearing during the late afternoon and evening. Skies continued to clear during the late evening and overnight. Max cell top: 6.9km, 60.5 max dBz, 22.2 max VIL Tmax YC = 16.2C and 0.6mm rain. Tmax QF = 15.9C and 9.4mm rain. Tmax Radar = 15.0C and 2.5mm rain.	A radar tour was held at the Olds-Didsbury airport with 17 people in attendance. HS5 performed a PR flight for the radar tour. They were airborne from Spring Bank at 1753Z and landed in Olds-Didsbury at 1817Z. HS5 performed a PR flight after the radar tour. They were airborne from Olds-Didsbury at 2216Z and landed in Spring Bank at 2246Z. <u>Flight Summary</u> HS5: 1735Z-1820Z; no seeding; PR flight; takeoff YBW, land EA3. HS5: 2205Z-2249Z; no seeding; PR flight; takeoff EA3, land YBW.
July 16, Tuesday	With the descent region of the jet over the project area, ridging was expected throughout the day. High pressure would persist through the day and overnight, with mostly clear skies expected. Skies were mostly clear all day, and clear overnight. No TITAN cells. Tmax YC = 21.1C and no rain. Tmax QF = 21.9C and no rain. Tmax Radar = 21.3C and no rain.	No aircraft operations.
July 17, Wednesday	A strong midlevel trough was approaching the area, and with southeast surface flow, thunderstorms were possible during the later afternoon. Showers were expected in the morning and early afternoon as a shortwave preceded the trough, with little chance of thunderstorms due to a strong cap caused by a low level thermal ridge. As the midlevel trough approached the Rockies, cool low level flow would erode the ridge, and the atmosphere would become sufficiently unstable and sheared to produce severe storms. It was possible that the cap would not break sufficiently for surface based convection, in which case less organized elevated convection would be prevalent. Storms would begin in the late afternoon, continuing until around midnight when low energy air would move over the project area and end storm risk.	HS2 was launched at 2212Z for a line of storms SW of Okotoks. They were airborne at 2246Z and climbed to cloud base. They began seeding with wing-tip generators at 2254Z as they approached storm #1, beginning BIP flares at 2305Z. They began patrol near Spring Bank at 2325Z and RTB 2355Z, landing at 0006Z (07/18). HS5 was launched at 2219Z for a line of storms SW of Black Diamond. They were airborne at 2252Z and climbed to the -5C level. They reported a baggage door warning at 2300Z and RTB, landing at 2309Z. HS1 was launched at 2250Z for storm #1. They were airborne at 2305Z and climbed to

	High level cloud moved in during the morning with virga and rain showers prevalent in the early afternoon. During the later afternoon, storms formed along the trough and moved into the southern project area. The storms quickly moved through the project area, and rain persisted through the evening and overnight. Max cell top: 13.6km, 64.0 max dBz, 59.0 max VIL Tmax YC = 23.6C and 3.8mm rain. Tmax QF = 21.8C and no rain. Tmax Radar = 20.4C and 0.3mm rain.	cloud top. They began seeding storm #1 at 2316Z with BIPs as they climbed. They reported moderate to severe turbulence and some liquid water. They continued seeding storm #1 as it became disorganized, moving further to the W. They RTB at 0021Z (07/18) as the storm passed over Calgary and weakened, landing at 0032Z (07/18). Flight Summary HS2: 2237Z (07/17)-0010Z (07/18); 56 minutes wing-tip generators, 1 BIP; #1 Okotoks. HS5: 2238Z-2312Z; no seeding; maintenance flight. HS1: 2255Z (07/17)-0034Z (07/18); 14 BIP; #1 Calgary
July 18, Thursday	As the trough moved to the east, some lingering vorticity remained in the project area producing weak vertical velocities throughout the day. Instability was moderate, and weak thunderstorms were expected during the late afternoon and early evening as temperatures surpassed convective temperature. As the sun set, the atmosphere would become very capped with no chance of thunderstorms overnight. Weak thunderstorms formed in the NW project area in the late afternoon. Showers and weak thunderstorms continued to form throughout the afternoon and evening, mainly along an outflow boundary, with some short lived storms becoming stronger. Popup storms continued through midnight, with showers for the rest of the forecast period. Drifts of pea size hail fell north of the radar. Max cell top: 11.4km, 64.0 max dBz, 51.9 max VIL Tmax YC = 26.1C and no rain. Tmax QF = 26.4C and 0.2mm rain. Tmax Radar = 26.1C and 14.0mm rain.	No aircraft operations.
July 19, Friday	A midlevel trough was expected to begin moving through the area in the midafternoon. With an unstable air mass and warm daytime temperatures, storms were expected to form both along the foothills and in the project area. Longevity of the storms would be limited by weak shear, and storms would produce strong outflow boundaries. No storms were expected after midnight, but showers would persist. Showers and thunderstorms began to form in the midafternoon, continuing to form into the evening. Storms strengthened throughout the afternoon, but most were short lived. Storms weakened during the evening, with some showers continuing overnight. Max cell top: 13.6km, 67.0 max dBz, 102.7 max VIL	HS2 was launched at 2008Z to development NW of Calgary. They were airborne at 2025Z and climbed to cloud base. They began patrolling Calgary at 2030Z. Storms weakened as they moved off the foothills, and they moved N to patrol Crossfield at 2118Z. As no storms materialized, they moved to the Sundre area for a cell growing along the foothills at 2142Z. Nothing seedable was observed and the aircraft was directed to land in Rocky MH, landing at 2213Z. HS1 was launched at 2042Z for development W of Okotoks. They were airborne at 2100Z and climbed to cloud top, beginning to patrol Okotoks at 2118Z. They began seeding storm

	Tmax YC = 25.5C and a trace of rain. Tmax QF = 25.5C and 3.8mm rain. Tmax Radar = 24.3C and 9.1mm rain.	#1 with EJs and BIPs at 2153Z. They RTB at 2238Z as the storm moved past High River, landing at 2252Z. HS3 was launched at 0002Z (07/20) for development N of Lacombe. They were airborne at 0022Z (07/20) and climbed to cloud top. They began seeding storm #2 with EJs at 0032Z (07/20), continuing until the storm passed through Lacombe. They stopped seeding and RTB at 0102Z (07/20), landing at 0114Z (07/20). HS2 was launched at 0049Z (07/20) for development W of Sundre. They were airborne from Rocky MH at 0108Z (07/20) and climbed to cloud base. They began seeding storm #4 with wing-tip generators at 0141Z (07/20). They continued seeding until they lost inflow at 0210Z (07/20), and repositioned to patrol Cochrane. They RTB 0235Z (07/20), landing in Spring Bank at 0242Z (07/20). HS5 was launched at 0054Z (07/20) for a cell NW of Cochrane. They were airborne at 0118Z (07/20) and climbed to cloud top. Upon arrival, they found the storm still back building along the foothills and patrolled for a brief period of time. They began seeding storm #3 with EJs and BIPs at 0138Z (07/20). They stopped seeding and began patrol at 0149Z (07/20) as they encountered glaciated conditions. They recommenced seeding with BIPs and EJs at 0212Z (07/20) as they encountered more liquid water, ceasing again at 0224Z (07/20). At 0228Z (07/20), they repositioned NW of Innisfail, beginning seeding storm #5 with EJs and BIPs at 0245Z (07/20). They continued seeding until the storm weakened substantially, then RTB at 0307Z (07/20). They landed at 0333Z (07/20). HS4 was launched at 0224Z (07/20) to a cell NW of Innisfail. They were airborne at 0238Z (07/20) and climbed to cloud base. They began seeding storm #5 with wing-tip generators upon arrival at 0249Z (07/20). They had trouble finding inflow, and the storm was weakening substantially, so they RTB at 0303Z (07/20), landing at 0312Z (07/20). <u>Flight Summary</u> HS2: 2018Z-2215Z; no seeding; patrol Calgary, patrol Crossfield, patrol Sundre; takeoff YBW, land WRM. HS1: 2048Z-2253Z; 49 EJ, 2 BIP; patrol Okotoks, #1 High River. HS3: 0013Z (07/20)-0121Z (07/20); 57 EJ; #2

		Lacombe HS2: 0055Z (07/20)-0247Z (07/20); 58 minutes wing-tip generators; patrol Didsbury, #4 Didsbury, patrol Cochrane; takeoff WRM, land YBW. HS5: 0104Z (07/20)-0338Z (07/20); 8 EJ, 8 BIP; #3 Cochrane, patrol Cochrane, #5 Innisfail. HS4: 0232Z (07/20)-0316Z (07/20); 28 minutes wing-tip generators; #5 Innisfail.
July 20, Saturday	An approaching jet streak was causing troughing over the project area, with cyclogenesis north of the project area expected during the evening. There was a chance for showers and storms during the afternoon in an area of weak surface convergence. The best chance for storms was during the evening and overnight, as the forming cyclone pushed a cold front into the northern regions of the project area. This would coincide with a medium-scale midlevel trough pushing into the northern parts of the project area. With a very unstable airmass and very good shear, severe supercells were likely. Storms would last into the overnight period as the front pushed farther south into the project area. By 9Z, the front was expected to broaden into a region of cold air advection, and weak ridging would begin after the passage of the midlevel trough. The afternoon was mostly clear through the entire project area. During the evening, severe storms moved into the project area from north, quickly moving through the northern project area. After storms passed, a few showers lingered through the rest of the overnight period. Joel Zimmer reported walnut size hail with some golf ball falling in Red Deer. Terry Krauss reported 3cm hail falling at his house. Marble size hail fell in east Red Deer. The Weather Network posted a picture of greater than golf ball size hail that had fallen in Red Deer. Max cell top: 14.4km, 69.0 max dBz, 145.0 max VIL Tmax YC = 25.6C and no rain. Tmax QF = 26.0C and 5.4mm of rain. Tmax Radar = 24.9C and 0.3mm of rain.	HS2 was launched at 0139Z (07/21) for approaching cells north of the buffer zone. They were airborne at 0213Z (07/21) and climbed to cloud base. They began seeding storm #1 with wing-tip generators and BIPs upon arrival at 0249Z (07/21). They continued seeding as the storm passed over Lacombe, then repositioned to storm #2 at 0339Z (07/21), leaving wing-tip generators on and beginning seeding at 0344Z (07/21). As storm #2 passed through Red Deer at 0433Z (07/21), they stopped seeding and repositioned to a cell N of Sylvan Lake, commencing seeding on storm #4 at 0446Z (07/21). Low on fuel, they stopped seeding at 0458Z (07/21) and RTB, landing at 0527Z (07/21). HS4 was launched at 0159Z (07/21) for approaching cells north of the buffer zone. They were airborne from Red Deer at 0218Z (07/21) and climbed to cloud base. They began seeding storm #1 with wing-tip generators and BIPs upon arrival at 0233Z (07/21). They reported a very large inflow base and strong inflow. At 0333Z (07/21), they stopped BIPs and repositioned to storm #2 as #1 moved past Lacombe. They began seeding storm #2 at 0340Z (07/21). They continued seeding with BIPs and wing-tip generators as the storm passed over Red Deer, then stopped seeding and diverted to Olds-Didsbury at 0442Z (07/21), landing at 0500Z (07/21) in Olds-Didsbury. HS3 was launched at 0205Z (07/21) for approaching cells north of the buffer zone. They were airborne at 0229Z (07/21) and climbed to cloud top. They began seeding storm #1 with EJs and BIPs upon arrival at 0243Z (07/21), reporting very good updraft. They continued seeding as storm #1 moved through all protected cities, and RTB at 0340Z (07/21), landing at 0347Z (07/21). HS5 was launched at 0224Z (07/21) for approaching cells north of the buffer zone. They were airborne at 0250Z (07/21) and

		climbed to cloud top. They began seeding storm #2 with BIPs and EJs upon arrival at 0325Z (07/21). They continued seeding as the storm passed over Red Deer. Then at 0500Z (07/21) the flight descended to base. At 0504Z (07/21), HS5 started base seeding storm #3. The aircraft then stopped seeding and RTB at 0544Z (07/21). They landed at 0601Z (07/21). HS1 was launched at 0350Z (07/21) for storms N of Rocky MH. They were airborne at 0405Z (07/21) and climbed to cloud base. They commenced seeding storm #3 with BIPs upon arrival at 0433Z (07/21). At 0507Z (07/21), HS1 started climbing to top, and at 0516Z (07/21) began top seeding storm #3 with EJs and BIPs. The crew then stopped seeding at 0546Z (07/21) as the storm passed through Innisfail and RTB. The flight landed at 0558Z (07/21). HS3 was relaunched at 0404Z (07/21) after reloading EJ flare racks. They were airborne from Red Deer at 0420Z (07/21) and climbed to cloud top. Due to a lost USB drive from the data logger, AirLink was inoperable for the entire flight, and no flight tracks were recorded. At 0443Z (07/21) the aircraft started seeding storm #3 near Rocky MH. At 0450Z (07/21) the flight started seeding storm #4 for Red Deer while over Bentley. HS3 then stopped seeding at 0521Z (07/21) and diverted to Olds-Didsbury. They landed at 0535Z (07/21). HS3 flew a reposition flight after storms had cleared Red Deer. They were airborne from Olds-Didsbury at 0704Z (07/21) and landed in Red Deer at 0716Z (07/21). HS4 flew a reposition flight after storms had cleared Red Deer. They were airborne from Olds-Didsbury at 0708Z (07/21) and landed in Red Deer at 0725Z (07/21). <u>Flight Summary</u> HS2: 0147Z (07/21)-0532Z (07/21); 232 minutes wing-tip generators, 24 BIP; #1 Lacombe, #2 Red Deer, #4 Red Deer. HS4: 0210Z (07/21)-0504Z (07/21); 260 minutes wing-tip generators, 18 BIP; #1 Lacombe, #2 Red Deer; takeoff YQF, land EA3. HS3: 0216Z (07/21)-0352Z (07/21); 145 EJ, I BIP; #1 Lacombe. HS5: 0240Z (07/21)-0607Z (07/21); 301 EJ, 18 BIP; #2 Red Deer, #3 Innisfail. HS1: 0400Z (07/21)-0600Z (07/21); 95 EJ, 13 BIP; #3 Innisfail. HS3: 0410Z (07/21)-0540Z (07/21); 196 EJ, 5

		BIP; #3 Innisfail, #4 Red Deer; takeoff YQF, land EA3. HS3: 0651Z (07/21)-0721Z (07/21); no seeding; reposition flight; takeoff EA3 land YQF. HS4: 0700Z (07/21)-0731Z (07/21); no seeding; reposition flight; takeoff EA3, land YQF.
July 21, Sunday	The upper level jet was north and east of the area and was not a factor. At the mid-levels, a small weak ridge built over southern AB during the day. In the evening, this ridge flattened, and a shortwave trough moved eastward along the US/Canada border. 500mb temperatures warmed by around 2C over the northern half of the project area. This warming aloft inhibited deep convection. A wave of weak vorticity was expected to move through at around 00Z. Area modified model soundings suggested that strong pulse thunderstorms were possible. Stratocumulus and cumulus clouds were observed over the region during the daytime. Overnight, a wave of convection moved through the area producing elevated thunderstorms. The tallest cell of the night formed over the far western part of Calgary before quickly moving eastward over the northern metropolitan area. According to radar data, pea size hail may have occurred in Calgary. Max cell top: 11.4km, 58.0 max dBz, 27.9 max VIL Tmax YC = 21.9C and no rain. Tmax QF = 20.9C and 4.8mm of rain. Tmax Radar = 20.1C and no rain.	No aircraft operations.
July 22, Monday	Jet energy was north and south of the area. The mid-levels were experiencing zonal flow. A wave of weak to moderately strong vorticity was expected to move through during peak heating. An 850mb theta-e ridge continued to be centered over southern AB during the daytime hours. At the surface, a cold front was progged to push southeastward across the area in the afternoon and evening. The model soundings showed a very unstable atmosphere with moderately strong speed shear. The air mass over the project area was expected to stay capped through early afternoon. Thunderstorms developed over the foothills at around 18Z. These storms initially propagated southward along the foothills. In the early afternoon, a tall storm (#1) developed W of Calgary and moved southeastward along the western boundary of the project area before moving south of the area. Another strong storm (#2) grew W of Sundre and tracked southeastward towards Calgary during the late afternoon. This supercell dissipated just before reaching the northwestern side of Calgary. The rest of the project area saw weaker thunderstorms in the afternoon. In the evening, another storm (#3) grew W of Cochrane and tracked eastward through the city of	HS1 was launched at 1845Z to a cell SW of Calgary. The flight became airborne at 1906Z and climbed to top seeding altitude. At 1910Z, the aircraft started patrolling the Black Diamond and Turner Valley area. Then at 1934Z HS1 started seeding storm #1 as the system tried to move off the foothills. At 2005Z it became apparent that the storm was staying along the foothills, so they stopped seeding. HS1 was next repositioned to the CYBW area at 2012Z. As they expedited to near Cochrane, they dropped to base seeding altitude and started patrolling for Calgary at 2036Z. At 2115Z HS1 started base seeding storm #2 for Calgary. They were low on fuel at 2219Z, so the crew stopped seeding and RTB, landing at 2226Z. HS3 was launched to convection W of Sundre at 2008Z. The aircraft was airborne at 2025Z and climbed to top seeding altitude as they flew towards Sundre. They started patrolling W of Sundre at 2041Z. At 2127Z HS3 started seeding storm #2 with BIP flares only. They then also started using EJ flares. At 2230Z the crew had used up their flares, so they stopped

	Calgary. This storm eventually turned into a line of thunderstorms which moved southeastward across the entire southern half of the project area. Elevated thunderstorms were observed overnight. Radar data suggested that golf ball size hail may have occurred N of Cochrane and SW of Black Diamond. Tennis ball size hail was reported W of the town of Dogpound. Max cell top: 13.6 km, 67.0 max dBz, 120.0 max VIL Tmax YC = 23.6C and 10.0mm of rain. Tmax QF = 21.0C and 0.8mm of rain. Tmax Radar = 20.1C and 1.3mm of rain.	seeding and RTB. The flight landed at 2253Z. HS2 was launched to a supercell NW of Cremona at 2115Z. The flight became airborne at 2133Z and climbed to the base seeding altitude. HS2 then started seeding storm #2 at 2141Z. HS2 continued seeding as the storm neared Calgary. Then at 2326Z the storm (#2) was dissipating so the aircraft stopped seeding and RTB. The flight landed at 2332Z. HS5 was launched to a southeastward moving supercell W of Cremona at 2143Z. The aircraft was airborne at 2204Z and climbed to top seeding altitude over the Cochrane area. Upon arriving at the storm, HS5 replaced HS3 as the top seeder. They started seeding storm #2 NW of Cochrane at 2227Z with both EJ and BIP flares. At 2300Z HS5 reported a new strong push of growth on the SW side of the storm. The crew continued seeding as the storm approached Calgary. Then at 2330Z, the storm was diminishing, so HS5 stopped seeding and RTB. They landed at 2338Z. HS4 was launched at 2211Z to a strong storm NW of Cochrane. The flight became airborne at 2232Z and climbed to base seeding altitude as they flew towards storm #2. Upon arriving at the storm and finding proper inflow, the crew started seeding at 2301Z with wing-tip generators only. They continued seeding as it moved towards Calgary. At 2329Z, HS4 stopped seeding and started patrolling the Calgary area. They then stopped patrolling at 2345Z and RTB, landing at 0010Z (07/23). HS1 was launched for a second time at 2248Z to the same storm (#2). They were airborne at 2254Z and climbed to top seeding altitude to the SW of Calgary. HS1 started patrolling W of the Calgary area at 2305Z. At 0001Z (07/23) the crew was finding no new growth so the aircraft stopped patrolling and RTB. They landed at 0008Z (07/23). HS5 was launched for a second time at 0125Z (07/23) to a cell W of Cochrane. The flight became airborne at 0139Z (07/23) and flew towards the storm W of Calgary. While climbing to top seeding altitude, HS5 started seeding storm #3 using BIP flares at 0146Z (07/23). The crew then started also using EJ flares at 0152Z (07/23). At 0229Z (07/23) the storm was diminishing over Calgary, so the crew stopped seeding and started patrolling the Calgary area. HS5 then stopped patrolling and RTB at 0303Z (07/23), landing at 0311Z

		(07/23). Flight Summary HS1: 1853Z-2229Z; 57 EJ, 24 BIP; #1 Turner Valley and Black Diamond, #2 Calgary. HS3: 2020Z-2259Z; 270 EJ, 23 BIP; patrol Sundre, #2 Calgary. HS2: 2122Z-2337Z; 210 minutes wing-tip generators, 18 BIP; #2 Calgary. HS5: 2155Z-2342Z; 226 EJ, 6 BIP; #2 Calgary. HS4: 2222Z (07/22)-0014Z (07/23); 60 minutes wing-tip generators; #2 Calgary. HS1: 2248Z (07/22)-0011Z (07/23); no seeding; patrol Calgary. HS5: 0133Z (07/23)-0315Z (07/23); 70 EJ, 8 BIP; #3 Calgary.
July 23, Tuesday	An upper level jet streak nosed its way into the project area during the afternoon hours. A small midlevel ridge was present over the region. This ridge was not expected to be strong enough to inhibit deep convection. Vorticity advection was likely during peak heating. An 850mb theta-e ridge was in place over AB throughout the period. At the surface, upslope flow was progged to occur over the foothills. Model soundings indicated that the atmosphere would be very unstable. Effective bulk shear was around 55kt. A strong and tall storm formed over the foothills NW of Cochrane during the early afternoon hours. This storm (#1) moved south-southeastward along the foothills before pushing into the project area SW of Calgary. According to radar data, golf ball size hail may have occurred in this area. This storm eventually moved through Okotoks. Another strong cell (storm #2) formed W of Calgary and tracked through Turner Valley and High River during the late afternoon. Strong storms also developed W of Cremona and Sundre. The first of these storms (#4) developed W of Cremona and tracked through Airdrie. Another very strong system (storm #4) also formed W of Cremona and moved southeastward towards Calgary in the early evening. Storms #5 and #6 formed W of Carstairs and over the CYBW airport, respectively. These storms were short lived and relatively weak in comparison to the other storms that formed during the day. Another storm (#7) formed NW of Rocky MH. This storm moved into the northern buffer zone before weakening. Numerous elevated thunderstorms were also observed overnight. Golf ball size hail was reported in the town of High River. Walnut size hail was reported W of Calgary, near the western boundary of the project area. Grape size hail was reported W of High River.	A radar tour was conducted with 14 people in attendance. HS4 flew a PR flight. The flight was airborne out of CYQF at 1631Z and landed in CEA3 at 1652Z. HS2 was launched at 1947Z to a large cell over the foothills NW of Cochrane. The flight became airborne at 2002Z and climbed to the base seeding altitude. They started seeding storm #1 at 2014Z with wing-tip generators as soon as inflow was found. At 2033Z, the storm (#1) was no longer a threat to Cochrane, so HS2 stopped seeding and started patrolling W of Calgary. The aircraft then started seeding storm #1 again NW of Turner Valley and Black Diamond at 2135Z, using the right wing-tip generator and BIP flares. The left wing-tip generator was no longer functioning. The aircraft continued seeding this storm as it moved towards Okotoks, Turner Valley, and Black Diamond. Then at 2215Z the crew reported nothing seedable as the storm was dissipating. HS2 stopped seeding at 2233Z and RTB. They landed at 2249Z. HS1 was launched at 1959Z to a large threatening cell NW of Cochrane. The aircraft was airborne at 2012Z and climbed to top seeding altitude along the south side of the storm (#1). They started patrolling for Calgary at 2025Z. At 2118Z the aircraft started seeding storm #1. HS1 continued seeding this storm as it tracked southeastward towards Okotoks, Turner Valley, and Black Diamond. They then reported at 2215Z that they were having a harder time finding feeder clouds, and the storm appeared to be weakening. The aircraft stopped seeding and was redirected to another storm W of Calgary at 2233Z. HS1 started

	Pea size hail occurred in southern Airdrie. Max cell top: 15.1km, 69.0 max dBz, 170.5 max VIL Tmax YC = 22.1C and 0.2mm of rain. Tmax QF = 23.3C and a trace of rain. Tmax Radar = 22.1C and a trace of rain.	seeding storm #2 SW of Calgary at 2241Z. They continued to seed this storm as it moved through Turner Valley and towards High River. At 2355Z the plane was low on fuel and out of seeding material, so they stopped seeding and RTB. The flight landed at 0008Z (07/24). HS4 was launched out of CEA3 at 2253Z to a cell just S of Cremona. They became airborne at 2308Z and climbed to base seeding altitude. At 2322Z, the crew started seeding storm #3 with wing-tip generators for Airdrie. HS4 then stopped seeding at 2334Z and was repositioned to a stronger storm (#2) NW of High River. At 2356Z, the flight patrolled the Cochrane area for a short time before RTB to CYBW at 0000Z (07/24). The landed at 0006Z (07/24). HS5 was launched at 2259Z to convection north of Cochrane. The flight was airborne at 2319Z and climbed to top seeding altitude. HS5 started seeding storm #3 for Airdrie at 2329Z. The aircraft continued seeding as it moved towards Airdrie. They stopped seeding at 2341Z and were redirected to another cell W of Cremona. The aircraft then began patrolling the Cremona area at 2345Z. At 0006Z (07/24) the flight started seeding storm #4 NW of Calgary. Then at 0131Z (07/24) they RTB shortly after using up all of their seeding material. The aircraft landed at 0140Z (07/24). HS2 was launched at 0027Z (07/24) to a tall storm NW of Cochrane. The aircraft became airborne at 0041Z and climbed to base seeding altitude. At 0050Z (07/24) they started seeding storm #4 NW of Calgary with wing-tip generators and BIP flares. The crew continued seeding as the storm pushed closer to the Calgary metropolitan area. They then stopped seeding and RTB at 0138Z (07/23), landing at 0142Z (07/24). HS3 was launched at 0029Z (07/24) to a large storm NW of Cochrane. The flight was airborne at 0047Z (07/24) and climbed to top seeding altitude as they expedited to the Calgary area. Then at 0109Z, HS3 started patrolling N of Cochrane. They waited for the other top seeder, HS5, to use up their seeding material before moving in closer to the storm to seed. HS3 began seeding storm #4 at 0131Z (07/24). The crew reported abundant super-cooled liquid water at 0134Z (07/24). At 0143Z (07/24) the flight also started using BIP flares. They then stopped seeding at 0149Z (07/24) and started patrolling out ahead of the same storm

		for the town of Strathmore. HS3 was then repositioned to new growth just west of Calgary at 0155Z (07/24). HS3 started seeding storm #6 at 0202Z (07/24) over the CYBW airport. At 0218Z (07/24) HS3 stopped seeding and patrolled briefly. HS3 RTB at 0225Z (07/24), landing at 0245Z (07/24). HS4 was launched out of CYBW at 0027Z (07/24) to a strong storm NW of Cochrane. The aircraft was airborne at 0102Z (07/24) and climbed to base seeding altitude over the Cochrane area. They started seeding storm #4 with wing-tip generators at 0109Z (07/24). At 0117Z (07/24) the crew started finding better inflow so they started also seeding with BIP flares. The crew then stopped seeding at 0147Z (07/24) and were repositioned to another storm NW of Didsbury. HS4 then started seeding storm #5, W of Carstairs, with wing-tip generators at 0157Z (07/24). At 0211Z (07/24) HS4 stopped seeding and was redirected to a growing cell over the CYBW airport. Starting at 0214Z (07/24), HS4 ended up patrolling the Carstairs area for a short time before RTB at 0218Z (07/24). The aircraft landed in CYQF at 0239Z (07/24). HS3 was launched at 0401Z (07/24) for cells NW of Rocky MH. They were airborne at 0415Z (07/24) and climbed to cloud top. As they were cleared by ATC to enter into the vicinity of Rocky MH, they began seeding storm #7 with EJs and BIPs at 0438Z. They encountered little liquid water, turbulent conditions, and poor visibility, and stopped seeding at 0452Z. They continued patrol as the storm continued to lose structure, and RTB 0500Z, landing at 0515Z (07/24). HS4 was launched at 0401Z (07/24) for cells NW of Rocky MH. They were airborne at 0421Z (07/24) and climbed to cloud base. As they were cleared by ATC to enter into the vicinity of Rocky MH, they began seeding storm #7 with wing-tip generators at 0443Z (07/24). They encountered low bases and poor visibility, and RTB at 0446Z (07/24). They landed at 0511Z (07/24). <u>Flight Summary</u> HS4: 1620Z-1655Z; no seeding; PR flight; takeoff CYQF, land CEA3. HS2: 1954Z-2254Z; 98 minutes wing-tip generators, 8 BIP; #1 Cochrane, patrol Calgary, #1 Turner Valley and Okotoks. HS1: 2005Z (07/23)-0013Z (07/24); 289 EJ, 5 BIP; patrol Calgary, #1 Turner Valley and

		Okotoks. #2 Turner Valley and High River. HS4: 2302Z (07/23)-0010Z (07/24); 26 minutes wing-tip generators; #3 Airdrie, patrol Cochrane; takeoff CEA3, land CYBW. HS5: 2309Z (07/23)-0143Z (07/24); 304 EJ, 16 BIP; #3 Airdrie, patrol Cremona, #4 Calgary. HS2: 0035Z (07/24)-0145Z (07/24); 96 minutes wing-tip generators, 10 BIP; #4 Calgary. HS3: 0039Z (07/24)-0251Z (07/24); 216 EJ, 10 BIP; #4 Calgary, patrol Strathmore, #6 Calgary. HS4: 0051Z (07/24)-0245Z (07/24); 104 minutes wing-tip generators, 1 BIP; #4 Calgary, #5 Carstairs; takeoff CYBW, land CYQF. HS3: 0405Z (07/24)-0532Z (07/24); 93 EJ, 4 BIP; #7 Rocky MH. HS4: 0413Z (07/24)-0515Z (07/24); 6 minutes wing-tip generators; #7 Rocky MH.
July 24, Wednesday	The position of the upper level jet was creating positive vorticity advection over the region. The mid-levels saw a wave of vorticity move through at around the time of peak heating. An 850mb theta-e ridge remained in place over southern AB. The foothills saw weak upslope flow in the afternoon and evening. Area model soundings showed an unstable atmosphere with around 45kts of effective bulk shear. Although the atmosphere was expected to stay slightly unstable overnight, no major trigger mechanisms were expected. A supercell formed NW of Rocky MH during the early morning hours. This storm (#1) tracked southeastward through Eckville, Sylvan, and Innisfail. In the early afternoon, deep convection initiated over the foothills W of Turner Valley. These storms tracked southward along the foothills and did not enter into the project area. In the midafternoon, explosive growth occurred over the southeastern part of Calgary. The growth quickly formed into a fairly tall storm (#2) over southern Calgary. This storm eventually moved southward through Okotoks and High River. Another storm (#3) formed just to the SW of Calgary and tracked southeastward towards Okotoks, Turner Valley, and Black Diamond. In the evening, an outflow boundary moved southward through the project area. This boundary kicked off numerous tower cumulus clouds and a few thunderstorms. One of these storms (#4) became severe and moved through Strathmore. Radar data suggested that golf ball size hail may have occurred over southeastern Calgary and northeast of Rocky MH. Pea size hail was reported in southeast Calgary on Global TV. Grape and walnut size hailstones were also reported in southeast Calgary.	HS3 was launched at 1302Z to a supercell NW of Sylvan. The flight was airborne at 1320Z and began climbing to the top seeding altitude. HS3 started seeding along the southeastern edge of storm #1 NW of Sylvan at 1327Z. The flight then descended to shed ice at 1418Z. At 1428Z the aircraft started climbing back up to the top seeding altitude and started seeding again at 1431Z. The flight then stopped seeding and RTB at 1440Z. The aircraft landed at 1453Z. HS2 flew a maintenance flight. The aircraft was airborne out of CYBW at 1330Z and diverted to CEA3 at 1358Z due to a strong convective cell over the CYQF airport. HS2 flew another maintenance flight. The aircraft was airborne out of CEA3 at 1512Z and landed in CYQF at 1530Z. HS2 flew a third maintenance flight. The aircraft was airborne out of CYQF at 2019Z and landed in CYBW at 2049Z. HS2 was launched at 2142Z to a cell over Calgary. The aircraft was airborne at 2204Z and climbed to base seeding altitude while flying towards the storm. Upon reaching the storm (#2), the crew quickly found inflow and started seeding at 2211Z using wing-tip generators and BIP flares. HS2 continued seeding this storm as it moved southward through the towns of Okotoks and High River. At 2254Z the crew spotted a tornado 1 mile east of the Okotoks airport. This information was relayed to Environment Canada. Then at 2325Z HS2 was repositioned to NW of Okotoks. At 2336Z the crew started seeding storm #3 N of Turner Valley and Black

	Max cell top: 15.1km, 68.0 max dBz, 209.5 max VIL Tmax YC = 21.9C and 0.6mm of rain. Tmax QF = 23.4C and 1.6mm of rain. Tmax Radar = 21.7C and a trace of rain.	Diamond. At 2344Z HS2 stopped seeding and RTB, landing at 2355Z. HS5 was launched at 2146Z to a storm with explosive growth over southeastern Calgary. The flight became airborne at 2209Z and climbed to top seeding altitude. HS5 started seeding storm #2 at 2217Z with BIP flares as they climbed through feeder clouds along the western side of the storm. Then at 2221Z the crew started also using EJ flares. HS5 continued seeding the storm as it moved through the towns Okotoks and High River. At 2330Z, the crew had used up all of their EJ flares, so they stopped seeding and RTB. The flight landed at 2342Z. HS1 was launched at 2258Z to the same storm (#2) that HS5 and HS2 were working near Okotoks and High River. The aircraft was airborne at 2316Z and climbed to top seeding altitude W of the storm. At 2340Z they started patrolling NW of Okotoks. The flight stopped patrolling and RTB at 2359Z. The aircraft landed at 0010Z (07/25). HS4 was launched at 0013Z (07/25) to the Olds area for patrol. The flight was airborne at 0037Z (07/25) and climbed to the base seeding altitude. At 0050Z (07/25) HS4 started patrolling from Olds to Sundre. They followed an outflow boundary as it moved southward across the project area. At 0130Z (07/25) the crew started patrolling the Carstairs and Crossfield area. The aircraft next patrolled the Cochrane area starting at 0203Z (07/25). They were then repositioned to a strong cell which was moving southward towards Strathmore at 0221Z (07/25). The crew started seeding storm #4, N of Strathmore at 0240Z (07/25). The storm then started diminishing as it approached Strathmore, so HS4 stopped seeding and RTB at 0307Z (07/25). They landed at 0346Z (07/25). <u>Flight Summary</u> HS3: 1313Z-1459Z; 206 EJ, 19 BIP; #1 Sylvan to Innisfail. HS2: 1326Z-1402Z; no seeding; maintenance flight; takeoff CYBW, land CEA3. HS2: 1509Z-1533Z; no seeding; maintenance flight; takeoff CEA3, land CYQF. HS2: 2003Z-2052Z; no seeding; maintenance flight; takeoff CYQF, land CYBW. HS2: 2150Z-2359Z; 186 minutes wing-tip generators, 14 BIP; #2 southern Calgary to High River, #3 N of Turner Valley and Black Diamond.

		HS5: 2158Z-2349Z; 303 EJ, 14 BIP; #2 southern Calgary to High River. HS1: 2309Z (07/24)-0012Z (07/25); no seeding; patrol NW of Okotoks. HS4: 0030Z (07/25)-0350Z (07/25); 54 minutes wing-tip generators; patrol Olds to Sundre, patrol Carstairs and Crossfield; patrol Cochrane, #4 Strathmore.
July 25, Thursday	The upper level jet was centered over southern AB. At the mid-levels, a weak ridge was positioned along the border of BC and AB. Lobes of weak vorticity passed over the region during the later afternoon and evening. 850mb theta-e ridging continued to keep the atmosphere unstable during the day and night. The surface wind flow was out of the SE, so weak upslope flow was likely along the foothills. The 00Z Calgary model sounding showed a loaded gun situation with moderate inhibition in the low levels. Low level stratus clouds were in place over the project area through the early evening due to convective inhibition. During the mid-evening hours, intense elevated storms developed over the mountains and quickly moved eastward into the project area. Storm #1 formed near Banff and tracked through Cochrane and northern Calgary before dissipating. The strongest thunderstorm of the day formed over the foothills west of Longview. This storm moved east-southeastward through the southern buffer zone at around the time of sunset. Radar data indicated that walnut size hail may have fallen south of High River. Large marble size hail was reported in Cochrane. Max cell top: 14.4km, 65.0 max dBz, 84.8 max VIL Tmax YC = 18.3C and 0.8mm of rain. Tmax QF = 17.7C and no rain. Tmax Radar = 16.5C and no rain.	HS1 flew a maintenance flight. The aircraft was airborne out of CYBW at 1443Z and landed in CYQF at 1517Z. HS5 was launched for a cell W of Cochrane at 0315Z (07/26). They were airborne at 0337Z (07/26) and climbed to cloud top. They encountered very poor visibility and observed cloud bases at a very high altitude. They began seeding storm #1 with BIPs at 0359Z (07/26). They then reported no updrafts or seedable activity. They RTB 0406Z (07/26), landing at 0418Z (07/26). <u>Flight Summary</u> HS1: 1434Z-1520Z; no seeding; maintenance flight; takeoff CYBW, land CYQF. HS5: 0325Z (07/26)-0421Z (07/26); 1 BIP; #1 Calgary.
July 26, Friday	A strong upper level low was moving into the area from the west, with a weak cold front in place over northwest Alberta. Several vorticity maxima were expected to move through west central Alberta as the low approached, possibly producing weak thunderstorms in the far northwest project area during the evening. As the cold front began moving through the area, weak thunderstorms and rain were possible further south during the late evening and overnight. Skies were partly cloudy most of the day. During the late afternoon, some rain showers and a weak thunderstorm occurred in the far northwest buffer zone. During the evening, a strong thunderstorm was observed in the far northwest range of the radar coverage. Skies remained cloudy overnight.	HS1 performed a maintenance flight. They were airborne from Red Deer at 0115Z (07/27) and landed in Spring Bank at 0144Z (07/27). <u>Flight Summary</u> HS1: 0100Z (07/27)-0148Z (07/27); no seeding; maintenance flight; takeoff YQF, land YBW.

	Max cell top: 8.4km, 54.0 max dBz, 12.1 max VIL Tmax YC = 23.2C and no rain. Tmax QF = 22.4C and no rain. Tmax Radar = 21.7C and no rain.	
July 27, Saturday	A cold front was located just south of the project area. With the project area under a stable airmass, hail storms were not expected. Several strong vorticity maxima were expected to provide sufficient forcing for rain showers over the entire project area. Weak thundershowers were possible in the southern project area during the early evening as a vorticity maximum moved through. Overnight, showers were possible, but the airmass became too capped for organized convection. Rain showers moved through the project area during the afternoon. During the evening, a second wave of weak thunderstorms moved into the project area becoming rain showers. Rain continued through the overnight period. Max cell top: 9.1km, 62.0 max dBz, 30.8 max VIL Tmax YC = 19.2C and no rain. Tmax QF = 17.6C and 7.6mm of rain. Tmax Radar = 17.3C and no rain.	No aircraft operations.
July 28, Sunday	An upper level low was moving from Alberta into Saskatchewan. Model soundings were uncapped during the late afternoon. Shear was weak, and instability was limited. As a weak high pressure ridge formed over the project area, some upslope flow was expected to begin during the late afternoon, mainly in the southern project area. Some weak thunderstorms were possible at this time. Overnight, the atmosphere was expected to be stable. Rain showers and some weak thunderstorms began during the afternoon in the northern project area. These continued through the evening with a few stronger thunderstorms in the southern project region. Rain showers continued through the overnight period. Pea size hail and ice pellets occurred in Okotoks which covered the ground an inch deep. Max cell top: 12.1km, 63.5 max dBz, 69.7 max VIL Tmax YC = 17.8C and 1.0mm rain. Tmax QF = 18.1C and 0.6mm rain. Tmax Radar = 17.9C and 0.3mm rain.	No aircraft operations.
July 29, Monday	A broad upper level trough was moving through central Alberta with northwest flow over the region. Forcing from the trough was strong. Overcast skies would	No aircraft operations.

	keep temperatures low. With only marginal instability, hail was unlikely. A few weak thunderstorms and rain were expected in the later afternoon. Overnight, a ridge was expected to build with skies clearing into the next forecast period. Rain showers occurred throughout the day with heavier rain and a few weak thunderstorms during the late afternoon and evening. Skies cleared overnight. Max cell top: 7.6km, 61.5 max dBz, 32.1 max VIL Tmax YC = 12.0C and 1.0mm rain. Tmax QF = 15.4C and no rain. Tmax Radar = 14.0C and no rain.	
July 30, Tuesday	High pressure was expected to remain in place during the day as an upper level ridge continued to build. Marginal instability existed in the lower levels of the atmosphere, and there was a possibility of short lived popup convective showers during the late afternoon. Clearing was expected overnight. Fair weather cumulus prevailed during the afternoon, and then skies cleared during the evening and overnight. No TITAN cells. Tmax YC = 19.1C and no rain. Tmax QF = 18.9C and no rain. Tmax Radar = 18.7C and no rain.	No aircraft operations.
July 31, Wednesday	Weak high pressure was in place over southern Alberta with an upper level trough slowly swinging through the project area during the day. The atmosphere was slightly unstable with very weak shear. Showers and isolated weak thunderstorms were expected during the late afternoon and evening. Clear skies were expected overnight. Skies were mainly clear during the day with rain showers forming along the foothills during the afternoon. A few weak thunderstorms developed briefly but they were not a hail threat. No precipitation occurred overnight. Max cell top: 9.1km, 63.0 max dBz, 37.9 max VIL Tmax YC = 24.9C and no rain. Tmax QF = 22.9C and no rain. Tmax Radar = 23.3C and no rain.	A radar tour was held at the Olds-Didsbury airport. 20 people were in attendance. HS1 performed a maintenance flight. They were airborne from Springbank at 1351Z and landed in Red Deer at 1416Z. HS3 performed a PR flight for the radar tour. They were airborne from Red Deer at 1715Z and landed in Olds-Didsbury at 1728Z. HS3 performed a PR flight after the end of the radar tour. They were airborne from Olds-Didsbury at 2205Z and landed in Red Deer at 2216Z. HS1 performed a maintenance flight. They were airborne from Red Deer at 2236Z and landed in Springbank at 2303Z. <u>Flight Summary</u> HS1: 1345Z-1424Z; no seeding; maintenance flight; takeoff YBW land YQF. HS3: 1707Z-1731Z; no seeding; PR flight; takeoff YQF land EA3.

		HS3: 2201Z-2221Z; no seeding; PR flight; takeoff EA3 land YQF. HS1: 2230Z-2306Z; no seeding; maintenance flight; takeoff YQF land YBW.
August 1, Thursday	A weak upper level low was moving into the project area with several waves of vorticity moving through during the day. During the afternoon, some jet ascent coupled with this vorticity advection would be the main focus for initiation. Instability was moderate, but morning rain stabilized the atmosphere over much of the project area. Shear was nonexistent, so weak short lived thunderstorms were expected during the afternoon and evening. Showers were expected overnight as more vorticity moved into the region. Throughout the afternoon, rain showers and weak thunderstorms formed within the radar coverage, mainly over the foothills and far western project area. Storms were short lived and non-severe. During the late afternoon and evening, precipitation ceased. Overnight, some virga and rain showers moved through the southern project area. Max cell top: 9.1km, 63.0 max dBz, 41.6 max VIL Tmax YC = 20.3C and no rain. Tmax QF = 23.2C and no rain. Tmax Radar = 18.8C and 2.3mm rain.	No aircraft operations.
August 2, Friday	An upper level low was stationary over Washington, with a weak low along the Alberta-Montana border. Vorticity was expected to move into the southern project area throughout the day creating heavy rain showers in the southern project area. The atmosphere was unstable, but with no wind shear, there was no risk of severe thunderstorms. Weak storms were possible during the afternoon in clear parts of the southern project area, with a slight possibility of initiation in the rest of the project area due to warm surface temperatures. During the evening, skies were expected to gradually clear with a chance of showers in the far southern project area. Showers occurred across the project area throughout the afternoon with a few weak thunderstorms in the far southern reaches of the project area. Rain showers became more isolated during the late afternoon, and skies cleared overnight. Max cell top: 9.1km, 60.5 max dBz, 39.2 max VIL Tmax YC = 21.1C and no data for rain. Tmax QF = 23.0C and a trace of rain. Tmax Radar = 20.6C and 2.8mm of rain.	No aircraft operations.
August 3,	Upper level jet energy stayed south of the area. At the	No aircraft operations.

Saturday	mid-levels, the small closed low was now centered along the Alberta/Montana border. In the evening, the low was expected to move to the east as a shortwave trough slowly dug southward along the BC/AB border. A surface low formed near the elbow of Alberta. Area soundings suggested that moderately strong pulse thunderstorms were possible. Light convective rain showers fell near Sundre, Caroline, and Rocky MH during the late evening and overnight. The rest of the project area saw isolated towering cumulus clouds during the day and night. No TITAN cells, 41.0 max dBz. Tmax YC = 21.4C and no rain. Tmax QF = 22.4C and no rain. Tmax Radar = 20.6C and no rain.	
August 4, Sunday	Upper level jet energy continued to stay south of the region. The main trigger mechanism for thunderstorms was a shortwave midlevel trough which slowly moved southward along the BC/AB border. Vorticity advection was moderately strong along the trough axis. Surface pressure values were progged to fall through the early evening before rising again. Both CYQF and CYYC model soundings indicated that the atmosphere was moderately unstable with weak speed shear. This suggested that strong pulse thunderstorms were a possibility. Thunderstorms started forming along the foothills W of Calgary in the early afternoon. One of these cells (storm #1) developed into a tall storm which tracked eastward towards Airdrie. This storm eventually dissipated just before reaching Airdrie. The rest of the afternoon and early evening hours saw scattered weak thunderstorms. Overnight, scattered convective rain showers fell mainly over the northern half of the project area. Max cell top: 12.9km, 65.5 max dBz, 78.6 max VIL Tmax YC = 22.1C and a trace of rain. Tmax QF = 23.2C and 0.2mm of rain. Tmax Radar = 21.3C and a trace of rain.	HS1 was launched at 2030Z to a growing cell N of Cochrane. The aircraft became airborne at 2047Z. Upon reaching the storm (#1) W of Airdrie, they started dragging BIP flares at 2052Z while climbing to top seeding altitude. HS1 then reported having mechanical problems at 2054Z, so the crew began descent to base seeding altitude. They continued seeding with BIP flares as they descended. At 2102Z, HS1 started base seeding the same storm (#1). Then at 2120Z the storm system was rapidly dissipating W of Airdrie, so the crew stopped seeding and RTB. They landed at 2126Z. HS5 was launched at 2205Z to a storm SW of Calgary. The flight was airborne at 2225Z and started climbing to the top seeding altitude. They started patrolling the Calgary area at 2233Z. Then at 2237Z the aircraft stopped patrolling and RTB. They landed at 2258Z. <u>Flight Summary</u> HS1: 2037Z-2128Z; 5 BIP; #1 Airdrie. HS5: 2212Z-2301Z; no seeding; patrol Calgary.
August 5, Monday	Upper level jet energy was west and south of the area. At the mid-levels, a shortwave trough continued to slowly creep southeastward across southern AB. Vorticity advection was expected to be moderately strong along the trough axis. Surface pressure values were progged to steadily rise in the evening and overnight. The 00Z Calgary model sounding showed a moderately unstable atmosphere with weak speed shear. The effective bulk layer shear was only around 10kt which suggested that only short-lived storms were possible.	No aircraft operations.

	Several pulse and short-lived popup thunderstorms developed along the foothills and over the project area in the early afternoon. At around 21Z a short-lived storm grew over northern Calgary for several radar scans. Pea size hail was reported in Calgary from this storm. The rest of the afternoon and early evening saw weak convection and thunderstorms. Radar data suggested that grape size hail may have occurred NW of Innisfail. Overnight, thunderstorms stayed north of the project area. Max cell top: 9.9km, 64.0 max dBz, 55.9 max VIL Tmax YC = 21.0C and 8.6mm of rain. Tmax QF = 21.1C and 1.0mm of rain. Tmax Radar = 20.7C and 10.2mm of rain.	
August 6, Tuesday	The upper jet stream shifted further to the north and was now over southern AB. The mid-levels saw west-northwesterly flow. Several lobes of moderately strong vorticity were expected over the region during the forecast period. 850mb theta-e ridging was in place over AB and BC. A cold front pushed southward over the prairies. This front was progged to become stationary over central AB before reaching the project area. Both CYQF and CYYC 00Z model soundings indicated moderate instability with around 45kt of effective bulk shear. Intense deep convection started forming over the foothills at around 20Z. The storms propagated southward along the foothills and did not enter into the project area in the afternoon. In the evening, these storms weakened as they moved into the far western project boundary. Radar data suggested that pea size hail may have occurred in the eastern part of the southern buffer zone. Max cell top: 8.4km, 53.0 max dBz, 21.8 max VIL Tmax YC = 21.0C and 3.4mm of rain. Tmax QF = 21.1C and no rain. Tmax Radar = 20.4C and 0.3mm of rain.	HS4 flew a reposition flight from CYQF to Rocky MH. The aircraft was airborne at 2210Z and landed at 2228Z. HS4 then flew a second reposition flight returning to Red Deer. The aircraft became airborne out of Rocky MH at 0030Z (08/07) and landed in CYQF at 0048Z (08/07). <u>Flight Summary</u> HS4: 2157Z-2236Z; no seeding; reposition flight; takeoff CYQF, land Rocky MH. HS4: 0020Z (08/07)-0052Z (08/07); no seeding; reposition flight; takeoff Rocky MH, land CYQF.
August 7, Wednesday	Upper level jet wind speeds were expected to increase over the area during the day. The midlevel flow continued to be northwesterly. Small vorticity maxima moved through the NW flow and were the main trigger mechanism for thunderstorms. The strongest positive vorticity advection was expected in the afternoon. At the surface, weak upslope flow was progged to occur. The 18Z Red Deer model thermodynamic sounding indicated that the atmosphere would be unstable with around 30kt of speed shear. Several convective cells started forming near Rocky MH and Lacombe in the early afternoon. This	HS4 was launched at 2036Z to a growing convective cell near Bentley. The aircraft became airborne at 2058Z. They then started patrolling NW of Red Deer at 2105Z. At 2121Z, the convection near Red Deer was no longer a hail threat, so they stopped patrolling and RTB. The flight landed at 2132Z. <u>Flight Summary</u> HS4: 2050Z-2137Z; no seeding; patrol Red Deer.

	convection gradually moved south-southeastward during the afternoon. The strongest thunderstorm of the day formed W of Airdrie. These storms tracked southeastward between Airdrie and Calgary before dissipating. Radar data indicated that up to grape size hail may have occurred SW of Airdrie, but there were no reports of such. The region then saw weak isolated thunderstorms in the evening. Max cell top: 9.9km, 66.0 max dBz, 54.6 max VIL Tmax YC = 22.6C and 6.2mm of rain. Tmax QF = 21.4C and 0.6mm of rain. Tmax Radar = 21.2C and 1.3mm of rain.	
August 8, Thursday	Upper level jet energy was located over central AB. The mid and upper level flow continued to be northwesterly. Lobes of vorticity moved through during the afternoon, evening, and overnight. Vorticity advection was strongest at around the time of peak heating. At the surface, winds were mainly out of the east to east-southeast. This meant that areas of surface convergence were likely along parts of the foothills. Area model soundings showed slightly unstable conditions. The region saw stratiform low level cloud cover for most of the day. Parts of the area saw mist during the morning and afternoon. Scattered convective rain showers also fell during the afternoon. In the late evening, a couple of weak thunderstorms moved off the foothills and into the southern project area before dissipating. A few lightning strikes were observed west and southwest of High River. There were no hail threats. Max cell top: 5.4km, 51.5 max dBz, 4.8 max VIL Tmax YC = 15.0C and 1.4mm of rain. Tmax QF = 14.1C and 7.2mm of rain. Tmax Radar = 13.8C and 1.8 rain.	A radar tour was held at the Olds-Didsbury Radar with 13 people in attendance. HS2 flew a PR flight from CYBW to CEA3. The flight was airborne at 1743Z and landed at 1811Z. HS2 then flew a return PR flight. The flight was airborne out of CEA3 at 2217Z and landed back in CYBW at 2236Z. <u>Flight Summary</u> HS2: 1734Z-1816Z; no seeding; PR flight; takeoff CYBW, land CEA3. HS2: 2209Z-2239Z; no seeding; PR flight; takeoff CEA3, land CYBW.
August 9, Friday	The upper level jet stream weakened over central AB during the daytime. The mid and upper level flow remained northwesterly. Several lobes of vorticity were expected to move through the flow. Forcing was strongest over the northern half of the project area. A stationary front was progged to reach the mountains and foothills in the evening. Model soundings showed a moderately unstable atmosphere with 20 to 30kt of speed shear. In the afternoon, large storms formed over the foothills. These thunderstorms were slow moving and stayed along the foothills. In the late evening, a single, short lived thunderstorm formed south of the town of Black Diamond inside the project boundary. Radar data indicated that pea size hail may have fell from the	No aircraft operations.

	storm. Overnight, the southern half of the project area saw scattered light convective rain showers. There were no significant hail threats. Max cell top: 7.6km, 59.5 max dBz, 24.1 max VIL Tmax YC = 21.0C and a trace of rain. Tmax QF = 20.6C and no rain. Tmax Radar = 19.7C and no rain.	
August 10, Saturday	Upper level jet energy was southeast of the area. The mid-levels continued to see northwesterly flow, but a small ridge was expected to build northward along the BC/AB border during the day. This ridge was not expected to be strong enough to inhibit deep convection. 500mb and 700mb vertical velocity data indicated that thunderstorms would stick to the foothills. An 850mb theta-e ridge was expected to stay in place over the area throughout the period. A stationary front was draped along the Rocky mountains. Model soundings showed a very unstable, capped atmosphere. The cell and storm motion suggested that storms would likely stay over the foothills. Deep convection initiated along the southern foothills during the early afternoon. Storms propagated towards the south and did not enter into the project area. In the late afternoon the convective temperature was reached south of Strathmore and a cluster of tall cells developed in this area. According to radar data, grape size may have fallen south of Strathmore. In the evening the convection inside the project area gradually lost strength as the surface temperatures cooled. Max cell top: 12.9km, 62.0 max dBz, 65.7 max VIL Tmax YC = 25.2C and 0.4mm of rain. Tmax QF = 25.5C and no rain. Tmax Radar = 24.6C and no rain.	HS1 flew a maintenance flight. The aircraft was airborne at 1927Z and landed at 1948Z. <u>Flight Summary</u> HS1: 1915Z-1951Z; no seeding; maintenance flight.
August 11, Sunday	A closed low was stationary off the coast of Washington with a weaker closed low in Northern Alberta and a ridge over southern Alberta. A vorticity maximum was expected to move from British Columbia into central Alberta throughout the forecast period. With a high energy airmass in place, storms were expected throughout the day. Wind shear was marginal, limiting storm severity. Storms were also expected to form over the foothills during the hottest time of the day, possibly moving into the project area. Overnight, a very strong cap was in place, and the vorticity maximum was expected to be E of the project area, so no severe weather was expected. During the late afternoon, showers began to move into the project area from the west. As the evening	HS3 was launched at 0439Z (08/12) to a strengthening storm west of Airdrie. The aircraft was airborne at 0454Z (08/12) and started climbing to the top seeding altitude as they expedited to the storm. Then at 0515Z (08/12) HS3 started seeding storm #1 NW of Calgary using BIP and EJ flares. At 0524Z (08/12) they reported a rich seeding target environment. Then at 0609Z (08/12), the cell was no longer a threat to Airdrie and Calgary, so they stopped seeding and RTB. They landed at 0627Z (08/12). HS4 was launched at 0507Z (08/12) to tall convective cells near the Red Deer area. The flight became airborne at 0524Z (08/12) and

	progressed, a few stronger cells moved into the project area, dissipating before they reached any target cities. During the late evening and overnight, some stronger storms moved off the foothills threatening Airdrie and northern Calgary. Weak thunderstorms lasted until the morning hours in the northern project area. Max cell top: 13.6km, 66.0 max dBz, 101.7 max VIL Tmax YC = 26.0C and no rain. Tmax QF = 27.3C and no rain. Tmax Radar = 25.8C and no rain.	was repositioned to the Calgary area. HS4 then started seeding storm #1 W of Airdrie at 0555Z (08/12) using wing-tip generators. The flight was heavily restricted by ATC while they were trying to seed due to the storm being just north of CYYC. At 0603Z (08/12) the crew stopped seeding and RTB. The flight landed at 0630Z (08/12). HS2 was launched at 0517Z (08/12) to a strong cell NW of Calgary. The aircraft was airborne at 0534Z (08/12) and began their climb to the base seeding altitude. The flight started seeding storm #1 north of Calgary at 0540Z (08/12) using wing-tip generators and BIP flares. The flight was heavily restricted by ATC while they were trying to seed due to the storm being just north of CYYC. At 0607Z (08/12), HS2 stopped seeding and RTB. They landed at 0616Z (08/12). HS1 was launched at 0540Z (08/12) to an intensifying storm (#1) north of Calgary. The flight was airborne at 0605Z (08/12) and repositioned to the Airdrie area as they climbed to the top seeding altitude. HS1 started seeding storm #1 for Irricana using EJ and BIP flares at 0622Z (08/12). At 0632Z (08/12) they stopped seeding storm #1 and were repositioned to new growth W of Okotoks. HS1 started seeding storm #2 near Okotoks at 0642Z (08/12). Then at 0652Z (08/12) the storm was no longer a threat to Okotoks, so they stopped seeding and were redirected to the CYBW area for patrol. HS1 stopped patrolling and RTB at 0659Z (08/12). The flight landed at 0706Z (08/12). <u>Flight Summary</u> HS3: 0448Z (08/12)-0634Z (08/12); 238EJ, 9 BIP; #1 Calgary and Airdrie. HS4: 0515Z (08/12)-0633Z (08/12); 16 minutes wing-tip generators; #1 Calgary and Airdrie. HS2: 0526Z (08/12)-0621Z (08/12); 48 minutes wing-tip generators, 3 BIP; #1 Calgary and Airdrie. HS1: 0555Z (08/12)-0710Z (08/12); 62 EJ, 2 BIP; #1 Irricana, #2 Okotoks.
August 12, Monday	A closed low persisted over the Pacific Northwest with a weaker closed low in Northern Alberta and a ridge over southern Alberta. A vorticity maximum was expected to move from the Montana border into central Alberta throughout the entire forecast period. With a high energy airmass in place, storms were expected throughout the day and overnight. Wind shear was poor, limiting storm severity. Storms were also expected to form over the foothills during the warmest	HS1 performed a maintenance flight. They were airborne at 2050Z and landed at 2100Z. HS5 was launched at 0248Z (08/13) for development SW of Turner Valley. They were airborne at 0312Z (08/13) and climbed to cloud top. They began seeding storm #1 with EJs at 0328Z (08/13). As storm #1 moved into the project area, it weakened significantly, and HS5

	part of the day, but would most likely remain stationary over the hills. Storms were visible east of the project area during the morning and afternoon with weak thunderstorms moving into the Southeastern project area. During the evening, a few storms moved into the southwest project area. They dissipated as they moved into protected cities. Storms and showers ended overnight. Max cell top: 13.6km, 65.5 max dBz, 97.6 max VIL Tmax YC = 23.7C and no rain. Tmax QF = 22.4C and 0.2mm rain. Tmax Radar = 21.7C and 0.5mm rain.	stopped seeding and began patrol at 0338Z (08/13). As all precipitation in the area diminished, HS5 RTB at 0405Z (08/13), landing at 0417Z (08/13). Flight Summary HS1: 2042Z-2102Z; no seeding; maintenance flight. HS5: 0300Z (08/13)-0423Z (08/13); 13 EJ; #1 Calgary.
August 13, Tuesday	A weak ridge was in place over southern Alberta with a very unstable airmass due to continued southeast flow. The atmosphere would be capped for much of the day, making survival of thunderstorms within the project area questionable. Storms were expected to form along the foothills during the late afternoon, moving into the project area under weak shear. A vorticity maximum passing just north of the project area during the evening would produce a chance of storms in the north. Overnight, the atmosphere was expected to be capped. With no triggers in the project area, precipitation was not expected. Storms began to form over the foothills during the late afternoon, dissipating as they moved into the project area. Showers continued to move through during the evening. Skies cleared overnight. Max cell top: 13.6km, 63.0 max dBz, 56.0 max VIL Tmax YC = 25.0C and no rain. Tmax QF = 25.1C and no rain. Tmax Radar = 23.3C and no rain.	HS4 was launched towards development near Sundre at 2106Z. They were airborne at 2130Z and climbed to cloud base. As they approached the storm, they reported a large pedestal, green tint, and heavy rain. They began seeding storm #1 with wingtip generators at 2152Z. They stopped seeding and began patrol as they lost inflow at 2240Z, and RTB at 2252Z as the cell completely dissipated. They landed at 2308Z. HS2 was launched towards development NW of Calgary at 2219Z (08/13). They were airborne at 2237Z (08/13) and climbed to cloud base. They began patrolling Calgary at 2249Z (08/13) as a cell slowly moved SE out of the foothills. As the cell dissipated, they repositioned to a cell west of Rocky MH and began patrol at 2345Z (08/13). They RTB 2354Z (08/13), landing at 0024Z (08/14). Flight Summary HS4: 2117Z-2313Z; 94 minutes wingtip generators; #1 Cremona, patrol Cremona. HS2: 2229Z (08/13)-0028Z (08/14); no seeding; patrol Calgary, patrol Rocky MH.
August 14, Wednesday	A ridge was building over southern Alberta. With a capped atmosphere, convective initiation was questionable. Storms were most likely to form over the foothills during the late afternoon, with some possibly moving into the project area. The atmosphere was unstable, but poor shear would preclude severe hail storms. During the evening, the wind would take on a more westerly component. A shortwave moving through overnight was expected to cause showers. Skies were mostly cloudy all day, but no precipitation occurred. Skies were partly cloudy overnight. No TITAN cells.	22 people attended a radar tour at the Olds-Didsbury airport. HS3 performed a PR flight to reposition for the radar tour. They were airborne from Red Deer at 1728Z and landed in Olds-Didsbury at 1740Z. HS3 performed a PR flight after the radar tour. They were airborne from Olds-Didsbury at 2324Z and landed in Red Deer at 2339Z. Flight Summary HS3: 1720Z-1744Z; no seeding; PR flight; takeoff YQF land EA3

	Tmax YC = 29.1C and no rain. Tmax QF = 27.9C and no rain. Tmax Radar = 26.4C and no rain.	HS3: 2313Z-2344Z; no seeding; PR flight; takeoff EA3 land YQF.
August 15, Thursday	A shortwave moving through the project area during the morning was causing a few rain showers and mostly cloudy skies. During the afternoon, skies were expected to partially clear. With temperatures increasing, some modest instability was expected during the late afternoon. A cap was expected to be in place during the day. With high temperatures somewhat uncertain due to clouds, the cap would erode. The best chance at initiation was during the evening when a strong shortwave would move into the area. Because the atmosphere would be stabilizing at that time, only a few weak thunderstorms and showers were expected. Skies were mostly cloudy during the day with showers forming in the northern project area overnight. Max cell top: 9.1km, 68.0 max dBz, 41.6 max VIL Tmax YC = 29.4C and no rain. Tmax QF = 26.8C and no rain. Tmax Radar = 28.1C and no rain.	No aircraft operations.
August 16, Friday	The atmosphere in the northern project area was very unstable with decreasing instability in the southern project area. With good speed shear, severe thunderstorms were expected in the northern project area, forming along a cold front. A strong shortwave moving into the southern project area during the afternoon was expected to trigger some storms, but they were expected to be fairly weak. Overnight, capping and weaker instability would preclude hail storms. A few showers and weak thunderstorms occurred in the project area during the afternoon and early evening. A strong, splitting supercell formed northwest of Sylvan and tracked into Red Deer, with a weaker storm following shortly after. During the rest of the evening, isolated weak thunderstorms continued to spontaneously grow in and around the project area, but did not threaten any target cities. 7mm to 12mm hail was reported in Red Deer by Joel Zimmer. Dime size hail in Red Deer was reported through social media. Max cell top: 12.9km, 68.0 max dBz, 120.7 max VIL Tmax YC = 29.3C and no rain. Tmax QF = 24.9C and no rain. Tmax Radar = 24.5C and no rain.	HS2 was launched for development west of Innisfail at 2212Z. They were airborne at 2234Z and climbed to cloud base. The cell quickly dissipated, and they RTB, landing at 2246Z. HS4 was launched to a cell northwest of Bentley at 0016Z (08/17). They were airborne at 0032Z (08/17) and climbed to cloud base. They began patrol for Bentley at 0046Z (08/17). The cell gradually diminished, and they repositioned for a cell W of Eckville at 0117Z (08/17). They began seeding storm #1 with wing-tip generators upon arrival at 0131Z (08/17). As the storm maintained intensity, they began seeding with BIP flares at 0142Z (08/17). They continued seeding as the storm passed through Sylvan Lake and Red Deer, and RTB at 0316Z (08/17). They landed at 0325Z (08/17). HS3 was launched to a cell northwest of Sylvan Lake at 0148Z (08/17). They were airborne at 0201Z (08/17) and climbed to cloud top. They began seeding storm #1 with BIPs and EJs at 0208Z. They continued seeding as the storm passed through Sylvan Lake and Red Deer, and RTB at 0319Z. They landed at 0325Z (08/17) HS3 was launched again at 0353Z for

		development northwest of Sylvan Lake. They were airborne at 0409Z (08/17) and climbed to cloud top. They began seeding storm #2 with EJs and BIPs at 0414Z. They continued seeding as the storm moved through Sylvan Lake and Red Deer, then RTB at 0505Z. They landed at 0513Z (08/17). Flight Summary HS2: 2225Z-2248Z; no seeding; patrol Spring Bank cancelled. HS4: 0020Z (08/17)-0328Z (08/17); 210 minutes wing-tip generators, 14 BIP; patrol Bentley, #1 Sylvan Lake through Red Deer. HS3: 0154Z (08/17)-0331Z (08/17); 182 EJ, 13 BIP; #1 Sylvan Lake through Red Deer. HS3: 0404Z (08/17)-0518Z (08/17); 158 EJ, 5 BIP; #2 Sylvan Lake through Red Deer.
August 17, Saturday	An upper level trough was expected to move into the project area during the afternoon and evening, acting as a potent trigger. Instability was limited, with the warm, moist airmass gradually moving east during the day. Storms were possible during the afternoon, and rain showers were expected during the evening. Skies would clear overnight. Storms began to form during the afternoon, but they were North and East of the project area buffer zones. Some rain showers occurred inside the project area. During the evening, some weak thunderstorms formed in the northern buffer zone and travelled east. All precipitation turned to rain and virga after sunset. Max cell top: 9.9km, 58.5 max dBz, 29.9 max VIL Tmax YC = 27.6C and 0.6mm rain. Tmax QF = 28.1C and no rain. Tmax Radar = 26.7C and no rain.	No aircraft operations.
August 18, Sunday	A strong upper level jet streak started to nose its way into central AB during the afternoon. The wind flow continued to be westerly at the mid and upper levels. 500mb temperatures were warming aloft which inhibited deep convection. Moderately strong vorticity advection was expected over the far northern part of the project area. Surface winds were westerly to southerly. Area model soundings indicated that the atmosphere was only slightly unstable. Virga was observed southeast of Red Deer during the morning hours. Cumulus and towering cumulus clouds were also seen near Rocky MH. All thunderstorms stayed north of the project area. 33.0 max dBz Tmax YC = 27.5C and no rain.	No aircraft operations.

	Tmax QF = 25.9C and no rain. Tmax Radar = 25.6C and no rain.	
August 19, Monday	The upper level jet stream continued to be centered over central AB. A broad midlevel trough was positioned over central BC. This trough was expected to move into AB during the overnight hours. The main triggers were waves of vorticity moving through the flow. A weak cold front also pushed southward through southern AB and SK during the day. The 00Z Red Deer model sounding showed that the atmosphere was moderately unstable. Effective bulk speed shear values were around 40kt, so long-lived thunderstorms were likely. Thunderstorms were first observed north of Rocky MH during the afternoon. These convective cells tracked eastward into the northern buffer zone and eventually moved through the town of Ponoka. Radar data suggested that grape size hail may have occurred east of Lacombe in the eastern buffer zone. The northern project area then saw scattered convective rain showers overnight. Max cell top: 9.9km, 62.5 max dBz, 51.9 max VIL Tmax YC = 25.9C and no rain. Tmax QF = 24.4C and no rain. Tmax Radar = 24.6C and no rain.	A radar tour occurred at the Olds-Didsbury Radar with 20 people in attendance. HS4 flew a PR flight from CYQF to CEA3. The flight was airborne at 1652Z and landed at 1707Z. HS4 then flew a return PR flight. The flight was airborne out of CEA3 at 2152Z and landed back in CYQF at 2208Z. <u>Flight Summary</u> HS4: 1642Z-1709Z; no seeding; PR flight; takeoff CYQF, land CEA3. HS4: 2143Z-2212Z; no seeding; PR flight; takeoff CEA3, land CYQF.
August 20, Tuesday	The right entrance region of an upper level jet streak was positioned over the region. This jet positive vorticity advection was the main trigger mechanism for thunderstorms. A midlevel shortwave trough was over northern AB. This was causing some cyclonic curvature to occur over the project area. At the surface, the winds were out of the NW to W at 5 to 10kt. Surface dewpoints were expected to gradually fall throughout the period. Both Red Deer and Calgary model soundings indicated that the atmosphere would be moderately unstable. Speed shear values were fairly strong which suggested that long-lived thunderstorms were a possibility. Scattered weak thunderstorms formed over the northern project area during the morning and afternoon. According to radar data, grape size hail may have occurred west and south of Lacombe. Very small hail (0.5cm) was reported at the CYQF airport at around 20Z. Convective rain showers were observed during the evening. Max cell top: 9.1km, 61.5 max dBz, 33.7 max VIL Tmax YC = 24.0C and no rain. Tmax QF = 20.4C and 1.0mm of rain. Tmax Radar = 21.3C and 1.3mm of rain.	No aircraft operations.

August 21, Wednesday	The upper level jet stream continued to be in place over the area in the morning. This jet weakened slightly as it shifted northward during the period. A midlevel ridge built over the southern half of AB, and only weak vorticity advection was expected. 500mb temperatures warmed significantly during the day which inhibited deep convection. Surface high pressure was centered along the BC/AB border throughout the period. Area model soundings showed that the troposphere would be stable. Cirrus and fair weather cumulus clouds were seen over parts of the project area during the day and night. No radar echoes were observed. Tmax YC = 23.0C and no rain. Tmax QF = 21.5C and no rain. Tmax Radar = 20.7C and no rain.	No aircraft operations.
August 22, Thursday	Upper level jet energy was well to the north along the border of AB and the Northwest Territories. The mid and upper level ridge was expected to flatten during the period. Vorticity advection was weak during the day and night. The low levels of the troposphere remained dry. At the surface, a low formed over Montana and an inverted trough extended northward from the low into AB. Model soundings suggested that the atmosphere would be slightly unstable with a strong cap. Altocumulus, cirrocumulus, cirrostratus, and cirrus clouds were seen in the afternoon and evening. No radar echoes were observed. Tmax YC = 27.9C and no rain. Tmax QF = 26.6C and no rain. Tmax Radar = 25.3C and no rain.	A radar tour was conducted at the Olds-Didsbury Radar with 20 people in attendance. HS5 flew a PR flight. The flight was airborne out of CYBW at 1727Z and landed in CEA3 at 1752Z. HS5 then flew a return PR flight from CEA3 to CYBW. The flight was airborne at 2232Z and landed at 2307Z. <u>Flight Summary</u> HS5: 1713Z-1755Z; no seeding; PR flight; takeoff CYBW, land CEA3. HS5: 2220Z-2311Z; no seeding; PR flight; takeoff CEA3, land CYBW.
August 23, Friday	The main trigger mechanism for thunderstorms was a shortwave trough moving northeastward across the project area during the afternoon and evening. Vorticity advection was expected to be strong over parts of the region. Surface winds were out of the west to southwest, so no upslope conditions were expected. Area model soundings showed a moderately unstable airmass over the area. The soundings also indicated that the atmosphere was moderately capped. A cluster of cells developed over the foothills southwest of High River around 21Z. This embedded convection moved northeastward through High River, Okotoks, Calgary, and Strathmore. These cells gradually diminished as they moved across the project area, producing mainly rain showers. Radar data suggested that grape size hail may have occurred west of Okotoks. Pea size hail was reported near Okotoks. The skies then cleared in the evening and	HS1 was launched at 2238Z to a cluster of cells south-southwest of Calgary. The aircraft became airborne at 2254Z and climbed to the top seeding altitude over Calgary. They started patrolling the Calgary area at 2259Z. Then at 2326Z HS1 stopped patrolling and RTB. The flight landed at 2339Z. <u>Flight Summary</u> HS1: 2244Z-2342Z; no seeding; patrol Calgary to Strathmore.

	remained mostly clear for the rest of the period. Max cell top: 10.6km, 60.0 max dBz, 37.6 max VIL Tmax YC = 25.6C and a trace of rain. Tmax QF = 22.9C and no rain. Tmax Radar = 21.2C and no rain.	
August 24, Saturday	The mid-levels of the troposphere continued to see southwesterly flow. Positive vorticity advection was expected to be relatively weak during the afternoon and evening. Overnight, stronger vorticity advection was likely as a shortwave trough began to move northeastward through the area. Surface winds remained westerly to southwesterly. The airmass was moderately unstable with around 20kt of effective bulk shear. Fair weather cumulus clouds formed over parts of the project area in the afternoon. In the evening, a wave of weak convection moved off the foothills producing virga and a few isolated light rain showers. Overnight, TITAN cells started moving northeastward into the far southern part of the project area. At around 09Z, a weak elevated thunderstorm moved northeastward through High River. Radar data indicated that this storm produced only rain showers. Max cell top: 9.9km, 55.0 max dBz, 15.9 max VIL Tmax YC = 27.1C and no rain. Tmax QF = 26.5C and no rain. Tmax Radar = 26.9C and no rain.	No aircraft operations.
August 25, Sunday	The atmosphere was capped and slightly unstable, but the placement of the jet stream was producing lift throughout the day. Initiation of weak thunderstorms was possible along the foothills during the early evening, moving into the project area under strong westerly flow. Overnight, the atmosphere was stable, but a very strong shortwave was expected to move through creating a chance of showers and weak thunderstorms. During the mid-afternoon, a few showers and weak thunderstorms began to form in the far northwestern project area. Most cells remained outside the buffer zone. Precipitation ended during the evening. Overnight, showers and thunderstorms began to move N through the entire project area along the strong shortwave, continuing through the morning hours. Max cell top: 9.9km, 63.5 max dBz, 37.1 max VIL Tmax YC = 26.4C and no rain. Tmax QF = 23.1C and no rain. Tmax Radar = 21.6C and no rain.	No aircraft operations.

August 26, Monday	An upper level trough was moving into the project area shifting winds to southwesterly during the afternoon. Showers and storms were expected to form along the foothills and surface trough in the late afternoon. Severe storms were expected in the North where a much higher energy airmass was in place. Overnight, showers were expected as some vorticity advection occurred, but the atmosphere was stable. During the late afternoon, weak thunderstorms began forming in the foothills in the northwest corner of the project area. Most activity was to the north of the buffer zone with a few cells moving into the project area. Cells moved out of the project area during the evening with no precipitation overnight. Max cell top: 12.9km, 66.5 max dBz, 93.2 max VIL Tmax YC = 25.6C and no rain. Tmax QF = 26.2C and .6mm rain. Tmax Radar = 23.9C and 1.8mm rain.	HS4 was launched for development near Rocky MH at 2212Z (08/26). They were airborne at 2232Z (08/26) and climbed to cloud base. They began patrolling Rocky MH upon arrival at 2247Z (08/26), finding only a very small base and no inflow. They ended patrol as the storm dissipated and RTB 0004Z (08/27), landing at 0014Z (08/27). HS4 was launched for a cell NW of Red Deer at 0354Z (08/27). They were airborne at 0413Z (08/27). Visibilities were very limited, and with the cell weakening, they RTB shortly after takeoff at 0420Z (08/27), landing at 0423Z (08/27). <u>Flight Summary</u> HS4: 2225Z (08/26)-0017Z (08/27); no seeding; patrol Rocky MH. HS4:0403Z (08/27)-0427Z (08/27); no seeding; patrol Red Deer cancelled.
August 27, Tuesday	With the jet stream mainly to the North, a ridge was building over the project area. The atmosphere was mostly stable due to a midlevel cap, so no severe weather was expected. Showers were possible in the northwest project area during the evening as some moist, midlevel air moved in while vorticity advection occurred. Skies were clear over most of the project area all forecast period, with some virga in the western buffer during the evening and overnight. No TITAN cells. Tmax YC = 26.6C and no rain. Tmax QF = 26.5C and no rain. Tmax Radar = 25.3C and no rain.	No aircraft operations.
August 28, Wednesday	The atmosphere was unstable with excellent shear, but a strong cap was expected to be in place all day. The main risk of initiation was during the early evening when a weak upper level trough moved through the area. With upslope flow, storms were possible over the foothills, quickly weakening as they moved into the project area. Overnight, no precipitation was expected. Skies were partly cloudy and hazy. During the afternoon, weak rain and thundershowers began in the Northwest project area. During the evening, a solitary brief thunderstorm occurred west of Innisfail. Some weak showers and virga moved through the project area overnight. Max cell top: 10.6km, 63.0 max dBz, 45.1 max VIL	18 people attended a tour at the Olds-Didsbury radar. HS1 flew a PR flight for the tour. They were airborne from Springbank at 1709Z and landed in Olds-Didsbury at 1728Z. HS1 flew a PR flight after the tour. They were airborne from Olds-Didsbury at 2141Z and landed in Springbank at 2202Z. <u>Flight Summary</u> HS1: 1700Z-1730Z; no seeding; PR flight; takeoff YBW land EA3. HS1: 2138Z-2204Z; no seeding; PR flight; takeoff EA3 land YBW.

	Tmax YC = 27.5C and no rain. Tmax QF = 27.8C and no rain. Tmax Radar = 25.6C and no rain.	
August 29, Thursday	A large scale, upper level trough was beginning to move into the area with pressure expected to fall through the entire forecast period. Upper level disturbances preceding the trough would provide opportunities for initiation. With moist southeast surface winds, the atmosphere was unstable with good shear. The lower levels were capped, which would help to reduce severity of the storms. As cyclogenesis occurred in the evening, flow would shift westerly, and a strong cold front would move through the project area around midnight. Minimal precipitation was expected behind the front. Fast moving storms moved into the project area from the Southwest during the late afternoon. Storm #2 was a severe supercell that intensified over Cochrane and moved to the North-Northeast, weakening as it moved towards Highway 2. Storms produced strong wind gusts. Storms and showers continued during the evening, with showers lingering in the northern project area during the overnight period. Loonie size hail was reported northeast of Cochrane. Winds gusting to 51kt were observed at CYYC. Max cell top: 14.4km, 67.5 max dBz, 107.3 max VIL Tmax YC = 29.8C and 4.6mm rain. Tmax QF = 24.5C and 0.2mm rain. Tmax Radar = 26.1C and no rain.	HS5 was launched at 2239Z (08/29) for development in the southwest buffer. They were airborne at 2251Z (08/29) and climbed to cloud top. They started seeding storm #1 with BIPs and EJs at 2311Z (08/29), reporting embedded conditions. They continued seeding in mixed water and ice, with strong updrafts, as the storm moved into Calgary. They repositioned towards Cochrane at 2343Z (08/29), circumventing a large area of downdraft. They continued seeding storm #2 with BIPs and EJs until 0026Z (08/30), when they repositioned to patrol SW of Sundre. As storms weakened, they RTB at 0034Z (08/30), landing 0049Z (08/30). HS2 was launched at 2250Z (08/29) for development in the SW buffer. They were airborne at 2309Z (08/29) and climbed to cloud base. They began seeding with wingtip generators as they approached cloud base at 2320Z (08/29). They began BIPs at 2332Z (08/29), and continued seeding in turbulent conditions. They repositioned towards Cochrane at 2343Z (08/29), and began seeding storm #2 with wingtip generators and BIPs at 2354Z (08/29). They stopped seeding and began patrol at 0021Z as they lost inflow. They stopped seeding and repositioned to patrol development SW of Sundre at 0025Z (08/30), and RTB at 0039Z (08/30) as storms weakened. They landed at 0053Z (08/30). HS1 was launched at 2312Z (08/29) for development in the SW buffer. They were airborne at 2326Z (08/29) and climbed to cloud base. They began seeding storm #1 with BIPs at 2332Z (08/29). They repositioned towards Cochrane at 2343Z (08/29), and began seeding storm #2 with BIPs at 2355Z (08/29). They continued until 0014Z (08/30), when they RTB, landing at 0025Z (08/30). HS3 was launched at 0141Z (08/30) for cells S of Rocky MH. They were airborne at 0204Z (08/30) and climbed to cloud base. They began patrolling Eckville at 0210Z (08/30), finding little development. They RTB 0224Z (08/30), landing at 0237Z (08/30). <u>Flight Summary</u> HS5: 2244Z (08/29)-0052Z (08/30); 162 EJ, 10 BIP; #1 Calgary, #2 Cochrane through

		Didsbury, patrol Sundre. HS2: 2258Z (08/29)-0058Z (08/30); 122 minutes wingtip generators, 1 BIP; #1 Calgary, #2 Cochrane through Didsbury, patrol Didsbury, patrol Sundre. HS1: 2316Z (08/29)-0027Z (08/30); 7 BIP; #1 Calgary, #2 Cochrane through Didsbury; base seeding. HS3: 0150Z (08/30)-0240Z (08/30); no seeding; patrol Eckville.
August 30, Friday	The upper level low continued to move into Alberta today with strong forcing from noon to around midnight. The atmosphere was only modestly unstable today, with drying at all levels under westerly flow. Rain showers were expected all day with a few thunderstorms in the late afternoon and evening. Storms began to form in the northwest project area during the mid-afternoon. The most severe storms occurred in the northern project area with weak thunderstorms and showers in the south. Showers lingered into the evening with clearing beginning overnight. Max cell top: 12.1km, 63.5 max dBz, 77.8 max VIL Tmax YC = 25.8C and .4mm rain. Tmax QF = 24.5C and .8mm rain. Tmax Radar = 24.6C and no rain.	HS4 was launched at 2118Z for development NW of Rocky MH. They were airborne at 2128Z and climbed to cloud base. They reported a right burner failure after takeoff. They began briefly seeding storm #1 at 2150Z with one burner. The storm dissipated on the next radar scan, and at 2152Z, they stopped seeding and repositioned further south, beginning to patrol for Caroline at 2206Z. As storms remained outside of protected areas, they RTB at 2217Z, landing at 2228Z. HS5 was launched for development NW of Rocky MH at 2102Z. They were airborne at 2149Z and climbed to cloud top. As conditions became embedded at top, they dropped to base and began patrolling Sundre at 2217Z. They RTB at 2234Z as storms continued to weaken, landing at 2303Z. HS4 launched again at 2249Z. They were airborne at 2249Z and climbed to cloud base. Due to embedded conditions, nothing seedable was found. They RTB at 2309Z, landing at 2321Z. HS3 was launched at 2244Z for a storm near Sylvan Lake. They were airborne at 2257Z, and began top seeding storm #2 with BIPs at 2300Z. They added EJs at 2305Z as they reached altitude. They continued seeding in embedded conditions as the storm passed through Blackfalds, and RTB at 2327Z, landing at 2334Z. <u>Flight Summary</u> HS4: 2121Z-2230Z; 2 minutes wingtip generators, right burner failure; #1 Rocky MH, patrol Caroline. HS5: 2137Z-2306Z; no seeding; patrol Sundre HS4: 2245Z-2328Z; no seeding; patrol Blackfalds. HS3: 2252Z-2340Z; 64 EJ, 7 BIP; #2 Blackfalds.
August 31, Saturday	With a ridge in place all day, flow from the Northwest, and a low level thermal ridge, no severe weather was	HS4 performed a maintenance flight. They were airborne at 1830Z and landed at 1838Z.

	expected. The atmosphere was stable, and no triggers present. Winds would shift from the northwest to the south during the afternoon as high pressure developed. Skies would be clear overnight while the ridge began to weaken. Fair weather cumulus persisted during the day with clearing overnight. No TITAN cells. Tmax YC = 22.9C and no rain. Tmax QF = 23.3C and no rain. Tmax Radar = 22.0C and no rain.	Flight Summary HS4: 1822Z-1842Z; no seeding; maintenance flight.
September 1, Sunday	Upper level jet energy was mainly to the west of AB. At the mid-levels, the ridge flattened during the daytime hours. Weak vorticity advection was expected off and on throughout the day. Surface pressure values were progged to fall through the evening. The model soundings for the region indicated that the atmosphere would be slightly unstable with a strong cap. Mostly clear skies were observed throughout the period. No echoes occurred on radar. Tmax YC = 27.8C and no rain. Tmax QF = 26.3C and no rain. Tmax Radar = 25.8C and no rain.	No aircraft operations.
September 2, Monday	A southwesterly jet was positioned over the far northern part of the project area. Midlevel charts showed a small ridge centered over the Rocky mountains. A strong but small lobe of vorticity moved northeastward across the region at around the time of peak heating. A surface cold front was progged to push southward into the northern part of the project during the overnight hours. The 00Z Calgary model sounding showed a moderately capped atmosphere with around 500J/kg of CAPE. Scattered to broken, upper level clouds flowed over the region throughout the period. Isolated convective rain showers fell over the southern half of the project area in the afternoon. 40.5 max dBz, 2.6 max VIL Tmax YC = 27.9C and no rain. Tmax QF = 27.8C and no rain. Tmax Radar = 27.6C and no rain.	No aircraft operations.
September 3, Tuesday	The core of the upper level jet stream was well to the north. A midlevel ridge was centered over eastern AB. Small lobes of vorticity were expected to move northeastward through the area in the afternoon and	No aircraft operations.

	evening. An 850mb theta-e ridge was also positioned along the Rocky mountains which helped to keep the atmosphere unstable. The 00Z CYYC model sounding showed a moderately capped but unstable airmass. Effective bulk shear values were around 50kt. Mid and upper level clouds moved northeastward into the project area in the afternoon. These clouds continued to flow over the region for the rest of the period. According to radar data, virga may have occurred SW of Calgary and near High River. 36.5 max dBz Tmax YC = 23.6C and no rain. Tmax QF = 25.6C and no rain. Tmax Radar = 23.7C and no rain.	
September 4, Wednesday	The upper level jet stream continued to be well to the north of AB. At the mid-levels, the ridge axis was centered over the AB/SK border. 500 and 700mb vertical velocity charts showed little to no rising motions over the region. Surface winds were light and variable. Area model soundings showed a mostly stable atmosphere. Skies were mostly clear during the morning and afternoon. In the evening, cirrus and cirrocumulus clouds were seen over the region. No echoes were observed on radar. Tmax YC = 30.1C and no rain. Tmax QF = 29.8C and no rain. Tmax Radar = 29.2C and no rain.	HS2 flew a maintenance flight. The aircraft was airborne out of Springbank at 1336Z and landed in Red Deer at 1414Z. HS2 then flew a return maintenance flight. They were airborne out of Red Deer at 2023Z and landed in Springbank at 2054Z. <u>Flight Summary</u> HS2: 1333Z-1418Z; no seeding; maintenance flight; takeoff CYBW, land CYQF. HS2: 2018Z-2056Z; no seeding; maintenance flight; takeoff CYQF, land CYBW.
September 5, Thursday	At the upper levels, a cut-off low was centered over the coast of Washington and Oregon. A ridge was expected to stay in place over AB through the afternoon. In the evening, the ridge shifted to the east as the cut-off low began to move northeastward toward southern AB. Several lobes of vorticity pushed into the region during the period. At the surface, the wind was northeasterly at around 10kt, so upslope flow was expected. Model soundings showed an unstable but moderately capped airmass. The atmosphere remained capped during the daytime hours, and only stratocumulus and cirrocumulus clouds were seen over the area. Overnight, thunderstorms formed in the southern part of the project area. Convective rain showers were observed over the rest of the region. Max cell top: 9.1km, 52.5 max dBz, 12.9 max VIL Tmax YC = 29.2C and a trace of rain. Tmax QF = 26.7C and a trace of rain. Tmax Radar = 26.4C and 0.8mm of rain.	No aircraft operations.

September 6, Friday	An upper level jet streak nosed its way into the area. The upper level cut-off low was now centered along the border of Washington and southern BC. Due to the low and jet streak, forcing was strong over the region throughout the period. Surface winds were expected to be northeasterly upslope flow. Area model soundings indicated that the atmosphere would be slightly unstable for most of the period. Convective rain showers fell over most of the project area in the morning. In the late afternoon, a cluster of convective cells started forming west of High River. This band of convection eventually moved northward across the entire region in the evening. Several lightning strikes were observed from this cluster of cells. Max cell top: 7.6km, 56.0 max dBz, 10.2 max VIL Tmax YC = 20.5C and 15.0mm of rain. Tmax QF = 18.6C and 12.6mm of rain. Tmax Radar = 17.6C and 20.6mm of rain.	18 people attended the radar tour at the Olds-Didsbury airport. HS2 flew a PR flight from Springbank to the Olds-Didsbury airport. They were airborne at 1735Z and landed at 1757Z. HS2 then flew a return PR flight. The aircraft was airborne out of the Olds-Didsbury airport at 2211Z and landed in Springbank at 2232Z. Flight Summary HS2: 1725Z-1759Z; no seeding; PR flight; takeoff CYBW, land CEA3. HS2: 2205Z-2239Z; no seeding; PR flight; takeoff CEA3, land CYBW.
September 7, Saturday	The mid and upper level cut-off low continued to be centered along the Washington and southern BC border. This low was expected to slowly slide eastward during the period. Upper level forcing was abundant due to the low. 500mb temperatures cooled during the day which helped to destabilize the atmosphere. At the surface and low levels, the wind flow continued to be from the east which was favorable for upslope conditions. Model soundings for the area showed a moderately unstable airmass. Speed shear was very weak. Embedded thunderstorms occurred over the project area during the day. Most of the project area saw convective rain showers. Parts of the region experienced moderate to heavy rain showers off and on throughout the period. Max cell top: 7.6km, 53.0 max dBz, 16.7 max VIL Tmax YC = 14.0C and 20.0mm of rain. Tmax QF = 17.1C and 0.8mm of rain. Tmax Radar = 14.2C and 14.2mm of rain.	No aircraft operations.
September 8, Sunday	The upper level low was moving east along the Montana/Alberta border with the main forcing to the south, but some vorticity advection was trailing into the project area. Clearing skies and moist low levels made for an unstable atmosphere, but there was only marginal shear. Flow was from the northeast creating upslope3 along the foothills. Any storms initiating along the foothills were unlikely to move into the project area due to the wind direction. Insolation	HS5 was launched for cells north of Airdrie at 0007Z (09/09). They were airborne at 0042Z (09/09) and climbed to cloud top. They began patrolling Calgary upon arrival at 0050Z (09/09). As storms diminished, they RTB 0103Z (09/09), landing at 0122Z (09/09). Flight Summary HS5: 0033Z (09/09)-0126Z (09/09); no seeding;

	would produce a risk of thunderstorm initiation within the project area during the late afternoon. As the low continued to move east overnight, flow would shift to the northwest and ridging would begin. Short-lived thunderstorms began to form in the western project area during the afternoon. Storms became stronger and more widespread as the day wore on, although their longevity did not increase. In the early evening, as temperatures began to fall, storms quickly weakened into rain showers which gradually diminished overnight. Max cell top: 12.1km, 64.0 max dBz, 81.8 max VIL. Tmax YC = 22.0C and 1.0mm rain. Tmax QF = 22.5C and no rain. Tmax Radar = 21.9C and 0.3mm rain.	patrol Calgary.
September 9, Monday	A ridge was beginning to build, and the flow was from the northwest at all levels. With clear skies and a moist surface layer, the atmosphere was weakly unstable. High cloud bases, a midlevel cap, and dry mid and lower levels would preclude severe convection. A weak trough would pass through the project area, associated with a low in the Northwest Territories. With some wind shear, and storm motion toward the southeast, it was possible that cells could form in the foothills and move into the project area, weakening as they left the foothills. Overnight, clearing was expected as the ridge continued to build. Cumulus clouds were observed over the foothills, but skies in the project area stayed mostly clear. An isolated rain shower occurred overnight in the northeast project area. No TITAN cells. Tmax YC = 24.5C and no rain. Tmax QF = 23.5C and no rain. Tmax Radar = 23.2C and no rain.	No aircraft operations.
September 10, Tuesday	A ridge was building over the region with a northerly flow over the project area. A midlevel cap, along with fairly cool surface temperatures and low dewpoints, produced an absolutely stable atmosphere. Mostly clear skies were expected during the day, with clearing and winds shifting to the south overnight. Skies were mostly clear all forecast period, with some cumulus clouds observed over the foothills. No TITAN cells. Tmax YC = 23.9C and no rain. Tmax QF = 23.3C and no rain. Tmax Radar = 23.4C and no rain.	No aircraft operations.

September 11, Wednesday	A ridge was well-established over the region. The atmosphere was stable. With high pressure over the area, skies would be clear throughout the forecast period. Skies were clear throughout the forecast period. No TITAN cells. Tmax YC = 25.0C and no rain. Tmax QF = 25.5C and no rain. Tmax Radar = 23.9C and no rain.	No aircraft operations.
September 12, Thursday	The ridge would weaken slightly as a low continued to form in the Northwest Territories. Pressures were expected to decrease gradually during the forecast period, but a dry atmosphere with a strong cap precluded any precipitation. Skies remained clear all day. No TITAN cells. Tmax YC = 28.8C and no rain. Tmax QF = 30.1C and no rain. Tmax Radar = 28.1C and no rain.	No aircraft operations.
September 13, Friday	A developing low in the Northwest Territories continued moving eastward, and pressure in the project area was beginning to rise. A high pressure system would begin to form in the western Northwest Territories and move southeast overnight, shifting winds from the north to the south. With a strongly capped and very dry atmosphere, skies were expected to remain clear throughout forecast period, with gusty winds during the day. Skies remained clear all day and night. No TITAN cells. Tmax YC = 27.5C and no rain. Tmax QF = 27.5C and no rain. Tmax Radar = 26.4C and no rain.	No aircraft operations.
September 14, Saturday	High pressure remained solidly in place as the ridge persisted. As the surface high moved into Manitoba during the evening and overnight, an approaching large scale trough would cause pressure to begin dropping into the project area. A midlevel thermal ridge resulted in a stable atmosphere, and no precipitation was expected. Skies were clear all day and night. No TITAN cells.	No aircraft operations.

	Tmax YC = 23.7C and no rain. Tmax QF = 23.9C and no rain.	
September 15, Sunday	A large scale trough was beginning to move into Alberta, and pressures would begin to fall during the afternoon. A dry atmosphere with a midlevel cap was expected to prevent any precipitation during the day. There was a chance of showers in the northwest project area, where midlevel temperatures would be lower. Clouds would increase overnight. No storms were expected. Skies were mostly clear throughout the day and evening. No TITAN cells. Tmax YC = 25.8C and no rain. Tmax QF = 27.6C and no rain.	No aircraft operations.

Appendix C – Aircraft Operations Summary Table

	HS1	HS2	HS3	HS4	HS5
JUNE	5:51	19:28	11:06	11:06	8:47
JULY	29:15	30:03	23:26	23:15	23:54
AUGUST	6:07	6:29	7:10	13:44	7:22
SEPTEMBER	0:00	2:31	0:00	0:00	0:53

	HAILSTOP 1 Beech King Air			HAILSTOP 2 - Cessna 340A				HAILSTOP 3 Beech King Air			HAILSTOP 4 - Cessna 340A				HAILSTOP 5 Beech King Air				
STORM DAY	Flight Time	EJ Flares	BIP Flares	Flight Time	EJ Flares	BIP Flares	Gen Time	Flight Time	EJ Flares	BIP Flares	Flight Time	EJ Flares	BIP Flares	Gen Time	Flight Time	EJ Flares	BIP Flares	No. of Storms	Daily Agl (grams)
JUNE																			
7-Jun-13				0:48		1	44	2:22	180	9	2:45		2	108				3	5,834
12-Jun-13								1:27	30	3	1:42							2	1,050
14-Jun-13															1:23	44	7	1	1,930
15-Jun-13	1:11	78	3	2:21		9	164											3	3,829
17-Jun-13	1:28	1	4	3:44		15	234				1:34		4	94	3:20	304	9	4	11,837
18-Jun-13	1:13	5	12												0:09			1	1,900
25-Jun-13								0:55	68	4								1	1,960
26-Jun-13								1:32	294	2								1	6,180
29-Jun-13				3:45		15	278	2:43	306	20	2:28		9	98	0:50		4	5	14,395
JULY																			
2-Jul-13				0:42														0	0
4-Jul-13	4:44	307	18	3:46		14	190	5:34	487	25	2:27		10	216	4:22	46	18	6	30,710
6-Jul-13															0:08			0	0
11-Jul-13								2:12	191	7	2:32		11	166	1:33		10	2	8,494
14-Jul-13	4:47	206	6	3:02		15	232	0:30			3:06		9	302				5	10,146
17-Jul-13	1:27		14	1:20		1	56											1	2,410
19-Jul-13	1:52	49	2	3:22			58	0:52	57		0:34			28	2:15	8	8	5	4,026
20-Jul-13	1:53	95	13	3:14		24	232	2:45	341	6	2:59		18	260	3:11	301	18	4	27,996
22-Jul-13	4:34	57	24	1:59		18	210	2:28	270	23	1:38			60	3:06	296	14	3	25,082
23-Jul-13	3:56	289	5	3:48		18	194	2:58	309	14	3:25		1	136	2:21	304	16	7	27,083
24-Jul-13	0:54			1:51		14	186	1:33	206	19	3:09			54	1:33	303	14	4	17,916
26-Jul-13															0:41		1	1	150
AUGUST																			
4-Aug-13	0:39		5												0:55			1	750
7-Aug-13											0:34							0	0
11-Aug-13	1:01	62	2	0:42		3	48	1:33	238	9	1:06			16				2	8,283
12-Aug-13															1:05	13		1	260
13-Aug-13				1:47							1:38			94				1	269
16-Aug-13				0:12				2:26	340	18	2:53		14	210				2	12,200
23-Aug-13	0:45																	0	0
26-Aug-13											1:52							0	0
29-Aug-13	0:59		7	1:44		1	122	0:33							1:58	162	10	2	6,289
30-Aug-13								0:37	64	7	1:32			2	1:14			2	2,336
SEPTEMBER																			
9-Sep-13															0:33			0	0

Appendix D – Flight Summary Table

ALBERTA HAIL SUPPRESSION PROJECT 2013 - Universal Time Coordinates

MONTHLY FLIGHT TIME TOTAL:	JUNE	JULY	AUGUST	SEPTEMBER	*Season Total*
HS1	5:51	29:15	6:07	0:00	**41:13**
HS2	19:28	30:03	6:29	2:31	**58:31**
HS3	11:06	23:26	7:10	0:00	**41:42**
HS4	11:06	23:15	13:44	0:00	**48:05**
HS5	8:47	23:54	7:22	0:53	**40:56**
					230:27

MONTHLY FLARE USAGE:		JUNE	JULY	AUGUST	SEPTEMBER	*Season Total*
HS1	BIP	19	82	14	0	**115**
	EJECT	84	1003	62	0	**1149**
HS2	BIP	40	104	4	0	**148**
	EJECT	0	0	0	0	**0**
	BURNERS	720	1358	170	0	**2248**
HS3	BIP	38	94	34	0	**166**
	EJECT	878	1861	642	0	**3381**
HS4	BIP	15	49	14	0	**78**
	EJECT	0	0	0	0	**0**
	BURNERS	300	1222	322	0	**1844**
HS5	BIP	20	99	10	0	**129**
	EJECT	348	1258	175	0	**1781**

HailStop #1 - N904DK
HailStop #2- N457DM
HailStop #3- N522JP
HailStop #4- N98585
HailStop #5- N518TS

	TOTAL TIME	AIR TIME
Seeding hours:	170:56	151:45
Patrol hours:	22:13	17:11
Reposition hours:	4:56	3:00
PR hours:	12:56	7:57
Mx hours:	9:31	6:05
Training hours:	0:00	0:00
Ferry hours:	0:00	0:00
Cur hours:	9:55	6:33
	230:27	192:31

(Storm-day chemical totals ONLY include flares spent for seeding).
(Storm-day totals ONLY include flight hours for seed and patrol).

TOTALS	# Flights: 162			230:27			192:31	6311	636	4092		Storm-Day Sub-Totals: Total Time for the Day	Total EJ	Total BIP	Total Burner	** Only flares spent for seeding.		70			
Date (UTC)	Aircraft	Engine On (UTC)	Engine Off (UTC)	Total Time (hh:mm)	Take-Off Time (UTC)	Landing Time (UTC)	Air Time (hh:mm) (all flights)	EJ (#) *used in flight tests	BIP (#) *used in flight tests	Burner Minutes *Test burns	Flight Type	193:09	6311	636	4092	Seed Amount (Per Day) (Grams)	Season Seed Accumulation (Grams)**	# Storms	Captain	Co-Pilot	Observer
01-Jun-13	HS2	18:28	19:40	1:12	18:44	19:37	0:53	0	0	0	CUR	0:00	0	0	0	0	0	0	MM	JF	
07-Jun-13	HS3	16:45	17:26	0:41	16:52	17:13	0:21	0	0	0	PR					0	0	0	RT	JZ	
07-Jun-13	HS4	20:21	23:21	3:00	20:30	23:15	2:45	0	2	108	SEED					0	0	1	LD	JN	
07-Jun-13	HS3	21:02	23:36	2:34	21:08	23:30	2:22	180	9	0	SEED					0	0	2	RT	JZ	
07-Jun-13	HS2	22:11	23:08	0:57	22:18	23:06	0:48	0	1	44	SEED	6:31	180	12	152	5834	5834	0	JF	BS	
11-Jun-13	HS2	18:57	19:37	0:40	19:09	19:34	0:25	0	0	0	CUR					0	5834	0	MM	BS	
11-Jun-13	HS1	19:00	19:33	0:33	19:19	19:31	0:12	0	0	0	CUR					0	5834	0	BM	AB	

WEATHER MODIFICATION INCORPORATED

11-Jun-13	HS5	19:45	20:38	0:53	20:06	20:36	0:30	0	0	0	CUR	0:00	0	0	0	0	5834	0	JL	JE	
12-Jun-13	HS4	23:44	1:38	1:54	23:52	1:34	1:42	0	0	0	PATROL					0	5834	0	LD	JN	
13-Jun-13	HS3	2:01	3:40	1:39	2:07	3:34	1:27	30	3	0	SEED	3:33	30	3	0	1050	6884	2	RT	JZ	
14-Jun-13	HS5	20:03	21:45	1:42	20:17	21:40	1:23	44	7	0	SEED	1:42	44	7	0	1930	8814	1	JL	JF	JE
15-Jun-13	HS2	19:02	20:52	1:50	19:09	20:50	1:41	0	8	140	SEED					0	8814	1	MM	BS	
15-Jun-13	HS1	19:06	20:28	1:22	19:14	20:25	1:11	78	3	0	SEED					0	8814	1	BM	AB	
15-Jun-13	HS2	23:50	0:40	0:50	23:57	0:37	0:40	0	1	24	SEED	4:02	78	12	164	3829	12643	1	MM	BS	
17-Jun-13	HS2	18:28	22:25	3:57	18:37	22:21	3:44	0	15	234	SEED					0	12643	1	MM	BS	
17-Jun-13	HS5	18:36	22:12	3:36	18:48	22:08	3:20	304	9	0	SEED					0	12643	2	JL	JF	
17-Jun-13	HS4	20:00	21:55	1:55	20:16	21:50	1:34	0	4	94	SEED					0	12643	1	LD	JN	
17-Jun-13	HS1	20:45	22:20	1:35	20:50	22:18	1:28	1	4	0	SEED	11:03	305	32	328	11837	24481	0	BM	JE	
18-Jun-13	HS1	15:00	16:27	1:27	15:10	16:23	1:13	5	12	0	SEED					0	24481	1	BM	AB	
18-Jun-13	HS5	16:50	17:24	0:34	17:10	17:19	0:09	0	0	0	PATROL					0	24481	0	JL	JF	
18-Jun-13	HS1	19:47	20:17	0:30	19:52	20:15	0:23	0	0	0	PR					0	24481	0	BM	AB	
18-Jun-13	HS1	22:59	23:23	0:24	23:04	23:21	0:17	0	0	0	PR	2:01	5	12	0	1900	26381	0	BM	AB	
24-Jun-13	HS2	22:00	23:20	1:20	22:28	23:17	0:49	0	0	0	CUR	0:00	0	0	0	0	26381	0	MZ	JF	
25-Jun-13	HS3	21:58	23:05	1:07	22:04	22:59	0:55	68	4	0	SEED	1:07	68	4	0	1960	28341	1	RT	JZ	
26-Jun-13	HS2	15:54	16:30	0:36	16:07	16:27	0:20	0	0	0	PR					0	28341	0	MZ	JF	BS
26-Jun-13	HS2	22:03	22:36	0:33	22:12	22:34	0:22	0	0	0	PR					0	28341	0	MZ	JF	BS
27-Jun-13	HS3	2:38	4:18	1:40	2:44	4:16	1:32	294	2	0	SEED	1:40	294	2	0	6180	34521	1	RT	JZ	
27-Jun-13	HS2	15:20	17:06	1:46	15:33	17:03	1:30	0	0	0	CUR					0	34521	0	MZ	JF	
27-Jun-13	HS4	18:36	19:27	0:51	18:47	19:20	0:33	0	0	0	CUR					0	34521	0	LD	JN	
27-Jun-13	HS5	20:20	21:20	1:00	20:40	21:16	0:36	0	0	0	CUR	0:00	0	0	0	0	34521	0	JL	JE	
28-Jun-13	HS2	18:20	19:16	0:56	18:33	19:09	0:36	0	0	0	CUR					0	34521	0	MZ	JF	
28-Jun-13	HS3	19:46	20:17	0:31	19:58	20:11	0:13	0	0	0	MX					0	34521	0	RT	JZ	
28-Jun-13	HS2	21:18	22:02	0:44	21:29	21:58	0:29	0	0	0	CUR	0:00	0	0	0	0	34521	0	MZ	JF	
29-Jun-13	HS4	21:25	23:24	1:59	21:36	23:12	1:36	0	4	31	SEED					0	34521	1	LD	JN	
29-Jun-13	HS2	22:34	0:22	1:48	22:43	0:18	1:35	0	7	110	SEED					0	34521	1	MZ	JF	BS
30-Jun-13	HS3	2:15	5:09	2:54	2:19	5:02	2:43	306	20	0	SEED					0	34521	2	RT	JZ	
30-Jun-13	HS4	2:17	3:23	1:06	2:25	3:17	0:52	0	5	67	SEED					0	34521	0	JD	JN	
30-Jun-13	HS2	2:19	4:38	2:19	2:24	4:34	2:10	0	8	168	SEED					0	34521	1	MZ	BS	JF
30-Jun-13	HS5	4:05	5:07	1:02	4:15	5:05	0:50	0	4	0	SEED	11:08	306	48	376	14395	48915	0	JL	JE	
30-Jun-13	HS4	18:52	19:13	0:21	19:00	19:07	0:07	0	0	0	MX	0:00	0	0	0	0	48915	0	LD	JN	
02-Jul-13	HS2	13:15	14:03	0:48	13:25	13:54	0:29	0	0	0	MX					0	48915	0	MZ	BS	
02-Jul-13	HS2	23:43	0:35	0:52	23:50	0:32	0:42	0	0	0	PATROL					0	48915	0	MZ	BS	
03-Jul-13	HS2	3:00	3:43	0:43	3:07	3:41	0:34	0	0	0	REPO	0:52	0	0	0	0	48915	0	MZ	BS	
03-Jul-13	HS3	17:14	17:37	0:23	17:20	17:35	0:15	0	0	0	PR					0	48915	0	RT	JZ	
03-Jul-13	HS3	21:51	22:12	0:21	21:55	22:07	0:12	0	0	0	PR	0:00	0	0	0	0	48915	0	RT	JZ	
04-Jul-13	HS4	18:39	21:11	2:32	18:57	21:09	2:12	0	10	216	SEED					0	48915	2	LD	JN	
04-Jul-13	HS3	18:43	21:06	2:23	18:54	21:00	2:06	207	14	0	SEED					0	48915	0	RT	JZ	
04-Jul-13	HS5	19:46	0:27	4:41	20:01	0:23	4:22	46	18	0	SEED					0	48915	2	JL	JE	
04-Jul-13	HS1	22:30	0:49	2:19	22:40	0:44	2:04	290	18	0	SEED					0	48915	0	BM	AB	
04-Jul-13	HS2	22:34	0:44	2:10	22:43	0:37	1:54	0	14	190	SEED					0	48915	0	MZ	BS	
04-Jul-13	HS4	22:49	23:20	0:31	23:00	23:15	0:15	0	0	0	REPO					0	48915	0	LD	JN	

04-Jul-13	HS3	22:52	2:30	3:38	22:58	2:26	3:28	280	11	0	SEED					0	48915	1	RT	JF	
04-Jul-13	HS2	2:02	3:02	1:00	2:10	2:54	0:44	0	0	0	PATROL					0	48915	0	MZ	BS	
04-Jul-13	HS1	2:07	5:00	2:53	2:14	4:54	2:40	17	0	0	SEED	21:36	840	85	406	30710	79626	1	BM	AB	
06-Jul-13	HS5	22:14	22:43	0:29	22:30	22:38	0:08	0	0	0	PATROL	0:29	0	0	0	0	79626	0	JL	JE	
10-Jul-13	HS2	20:23	21:08	0:45	20:33	21:05	0:32	0	0	0	REPO					0	79626	0	MZ	BS	
11-Jul-13	HS2	1:18	2:03	0:45	1:26	2:00	0:34	0	0	0	REPO	0:00	0	0	0	0	79626	0	MZ	BS	
11-Jul-13	HS4	19:53	22:45	2:52	20:07	22:39	2:32	0	11	166	SEED					0	79626	2	JN	JF	
11-Jul-13	HS5	20:03	21:53	1:50	20:16	21:49	1:33	0	10	0	SEED					0	79626	0	JL	JE	
11-Jul-13	HS3	20:23	22:50	2:27	20:34	22:46	2:12	191	7	0	SEED	7:09	191	28	166	8494	88120	0	RT	JZ	
14-Jul-13	HS2	20:42	23:45	3:03	20:52	23:42	2:50	0	15	232	SEED					0	88120	2	MZ	BS	
14-Jul-13	HS1	21:32	2:07	4:35	21:42	2:03	4:21	206	6	0	SEED					0	88120	3	BM	AB	
14-Jul-13	HS4	22:40	2:00	3:20	22:50	1:56	3:06	0	9	302	SEED					0	88120	0	LD	JN	
15-Jul-13	HS3	1:25	2:07	0:42	1:32	2:02	0:30	0	0	0	PATROL					0	88120	0	RT	JZ	
15-Jul-13	HS2	1:30	1:57	0:27	1:40	1:52	0:12	0	0	0	PATROL					0	88120	0	MZ	BS	
15-Jul-13	HS1	5:49	6:34	0:45	6:00	6:26	0:26	0	0	0	PATROL	12:52	206	30	534	10146	98266	0	BM	AB	
15-Jul-13	HS5	17:35	18:20	0:45	17:53	18:17	0:24	0	0	0	PR					0	98266	0	JL	JE	
15-Jul-13	HS5	22:05	22:49	0:44	22:16	22:46	0:30	0	0	0	PR	0:00	0	0	0	0	98266	0	JL	JE	
17-Jul-13	HS2	22:37	0:10	1:33	22:46	0:06	1:20	0	1	56	SEED					0	98266	1	MZ	BS	
17-Jul-13	HS5	22:38	23:12	0:34	22:52	23:09	0:17	0	0	0	MX					0	98266	0	JL	JE	
17-Jul-13	HS1	22:55	0:34	1:39	23:05	0:32	1:27	0	14	0	SEED	3:12	0	15	56	2410	100676	0	BM	AB	
19-Jul-13	HS2	20:18	22:15	1:57	20:25	22:13	1:48	0	0	0	PATROL					0	100676	0	MZ	BS	
19-Jul-13	HS1	20:48	22:53	2:05	21:00	22:52	1:52	49	2	0	SEED					0	100676	1	BM	JE	
20-Jul-13	HS3	0:13	1:21	1:08	0:22	1:14	0:52	57	0	0	SEED					0	100676	1	RT	JF	MT
20-Jul-13	HS2	0:55	2:47	1:52	1:08	2:42	1:34	0	0	58	SEED					0	100676	1	MZ	BS	
20-Jul-13	HS5	1:04	3:38	2:34	1:18	3:33	2:15	8	8	0	SEED					0	100676	2	JL	AB	
20-Jul-13	HS4	2:32	3:16	0:44	2:38	3:12	0:34	0	0	28	SEED	10:20	114	10	86	4026	104702	0	LD	JN	
21-Jul-13	HS2	1:47	5:32	3:45	2:13	5:27	3:14	0	24	232	SEED					0	104702	3	MZ	BS	
21-Jul-13	HS4	2:10	5:04	2:54	2:18	5:00	2:42	0	18	260	SEED					0	104702	0	LD	JN	
21-Jul-13	HS3	2:16	3:52	1:36	2:29	3:47	1:18	145	1	0	SEED					0	104702	0	RT	MT	
21-Jul-13	HS5	2:40	6:07	3:27	2:50	6:01	3:11	301	18	0	SEED					0	104702	1	JL	AB	JF
21-Jul-13	HS1	4:00	6:00	2:00	4:05	5:58	1:53	95	13	0	SEED					0	104702	0	BM	JE	
21-Jul-13	HS3	4:10	5:40	1:30	4:20	5:35	1:15	196	5	0	SEED					0	104702	0	RT	MT	
21-Jul-13	HS3	6:51	7:21	0:30	7:04	7:16	0:12	0	0	0	REPO					0	104702	0	RT	MT	
21-Jul-13	HS4	7:00	7:31	0:31	7:08	7:25	0:17	0	0	0	REPO	15:12	737	79	492	27996	132698	0	LD	JN	
22-Jul-13	HS1	18:53	22:29	3:36	19:06	22:26	3:20	57	24	0	SEED					0	132698	2	BM	JE	
22-Jul-13	HS3	20:20	22:59	2:39	20:25	22:53	2:28	270	23	0	SEED					0	132698	0	RT	MT	
22-Jul-13	HS2	21:22	23:37	2:15	21:33	23:32	1:59	0	18	210	SEED					0	132698	0	MZ	BS	
22-Jul-13	HS5	21:55	23:42	1:47	22:04	23:38	1:34	226	6	0	SEED					0	132698	0	JF	AB	
22-Jul-13	HS4	22:22	0:14	1:52	22:32	0:10	1:38	0	0	60	SEED					0	132698	0	LD	JN	
22-Jul-13	HS1	22:48	0:11	1:23	22:54	0:08	1:14	0	0	0	PATROL					0	132698	0	BM	JE	
23-Jul-13	HS5	1:33	3:15	1:42	1:39	3:11	1:32	70	8	0	SEED	15:14	623	79	270	25082	157780	1	JF	AB	
23-Jul-13	HS4	16:20	16:55	0:35	16:31	16:52	0:21	0	0	0	PR					0	157780	0	LD	JN	
23-Jul-13	HS2	19:54	22:54	3:00	20:02	22:49	2:47	0	8	98	SEED					0	157780	1	MZ	BS	
23-Jul-13	HS1	20:05	0:13	4:08	20:12	0:08	3:56	289	5	0	SEED					0	157780	1	BM	JE	

23-Jul-13	HS4	23:02	0:10	1:08	23:08	0:06	0:58	0	0	26	SEED					0	157780	1	LD	JN	
23-Jul-13	HS5	23:09	1:43	2:34	23:19	1:40	2:21	304	16	0	SEED					0	157780	2	JF	AB	
24-Jul-13	HS2	0:35	1:45	1:10	0:41	1:42	1:01	0	10	96	SEED					0	157780	0	MT	BS	
24-Jul-13	HS3	0:39	2:51	2:12	0:47	2:45	1:58	216	10	0	SEED					0	157780	1	RT	MT	
24-Jul-13	HS4	0:51	2:45	1:54	1:02	2:39	1:37	0	1	104	SEED					0	157780	0	LD	JN	
24-Jul-13	HS3	4:05	5:32	1:27	4:15	5:15	1:00	93	4	0	SEED					0	157780	1	RT	MT	
24-Jul-13	HS4	4:13	5:15	1:02	4:21	5:11	0:50	0	0	6	SEED	18:35	902	54	330	27083	184863	0	LD	JN	
24-Jul-13	HS3	13:13	14:59	1:46	13:20	14:53	1:33	206	19	0	SEED					0	184863	1	RT	MT	
24-Jul-13	HS2	13:26	14:02	0:36	13:30	13:58	0:28	0	0	0	MX					0	184863	0	MZ	JE	
24-Jul-13	HS2	15:09	15:33	0:24	15:12	15:30	0:18	0	0	0	MX					0	184863	0	MZ	JE	
24-Jul-13	HS2	20:03	20:52	0:49	20:19	20:49	0:30	0	0	0	MX					0	184863	0	MZ	JE	
24-Jul-13	HS2	21:50	23:59	2:09	22:04	23:55	1:51	0	14	186	SEED					0	184863	2	MZ	JE	
24-Jul-13	HS5	21:58	23:49	1:51	22:09	23:42	1:33	303	14	0	SEED					0	184863	0	JF	AB	
24-Jul-13	HS1	23:09	0:12	1:03	23:16	0:10	0:54	0	0	0	PATROL					0	184863	0	BM	BS	
25-Jul-13	HS4	0:30	3:50	3:20	0:37	3:46	3:09	0	0	54	SEED	10:09	509	47	240	17916	202779	1	LD	JN	
25-Jul-13	HS1	14:34	15:20	0:46	14:43	15:17	0:34	0	0	0	MX					0	202779	0	BM	JE	
26-Jul-13	HS5	3:25	4:21	0:56	3:37	4:18	0:41	0	1	0	SEED	0:56	0	1	0	150	202929	1	JL	JF	AB
27-Jul-13	HS1	1:00	1:48	0:48	1:15	1:44	0:29	0	0	0	MX	0:00	0	0	0	0	202929	0	BM	JE	
31-Jul-13	HS1	13:45	14:24	0:39	13:51	14:16	0:25	0	0	0	MX					0	202929	0	BM	JE	
31-Jul-13	HS3	17:07	17:31	0:24	17:15	17:28	0:13	0	0	0	PR					0	202929	0	RT	MT	
31-Jul-13	HS3	22:01	22:21	0:20	22:05	22:16	0:11	0	0	0	PR					0	202929	0	RT	MT	
31-Jul-13	HS1	22:30	23:06	0:36	22:36	23:03	0:27	0	0	0	MX	0:00	0	0	0	0	202929	0	BM	JE	
04-Aug-13	HS1	20:37	21:28	0:51	20:47	21:26	0:39	0	5	0	SEED					0	202929	1	BM	JE	
04-Aug-13	HS5	22:12	23:01	0:49	22:25	22:58	0:33	0	0	0	PATROL	1:40	0	5	0	750	203679	0	JL	AB	
06-Aug-13	HS4	21:57	22:36	0:39	22:10	22:28	0:18	0	0	0	REPO					0	203679	0	LD	JN	
07-Aug-13	HS4	0:20	0:52	0:32	0:30	0:48	0:18	0	0	0	REPO	0:00	0	0	0	0	203679	0	LD	JN	
07-Aug-13	HS4	20:50	21:37	0:47	20:58	21:32	0:34	0	0	0	PATROL	0:47	0	0	0	0	203679	0	LD	JN	
08-Aug-13	HS2	17:34	18:16	0:42	17:43	18:11	0:28	0	0	0	PR					0	203679	0	MZ	BS	
08-Aug-13	HS2	22:09	22:39	0:30	22:17	22:36	0:19	0	0	0	PR	0:00	0	0	0	0	203679	0	MZ	BS	
10-Aug-13	HS1	19:15	19:51	0:36	19:27	19:48	0:21	0	0	0	MX	0:00	0	0	0	0	203679	0	BM	JE	MZ
12-Aug-13	HS3	4:48	6:34	1:46	4:54	6:27	1:33	238	9	0	SEED					0	203679	1	RT	MT	
12-Aug-13	HS4	5:15	6:33	1:18	5:24	6:30	1:06	0	0	16	SEED					0	203679	0	LD	JN	
12-Aug-13	HS2	5:26	6:21	0:55	5:34	6:16	0:42	0	3	48	SEED					0	203679	0	MZ	JE	
12-Aug-13	HS1	5:55	7:10	1:15	6:05	7:06	1:01	62	2	0	SEED	5:14	300	14	64	8283	211962	1	BM	AB	
12-Aug-13	HS1	20:42	21:02	0:20	20:50	21:00	0:10	0	0	0	MX					0	211962	0	BM	JE	
13-Aug-13	HS5	3:00	4:23	1:23	3:12	4:17	1:05	13	0	0	SEED	1:23	13	0	0	260	212222	1	JF	JL	AB
13-Aug-13	HS4	21:17	23:13	1:56	21:30	23:08	1:38	0	0	94	SEED					0	212222	1	LD	JN	
13-Aug-13	HS2	22:29	0:28	1:59	22:37	0:24	1:47	0	0	0	PATROL	3:55	0	0	94	269	212490	0	MZ	BS	
14-Aug-13	HS3	17:20	17:44	0:24	17:28	17:40	0:12	0	0	0	PR					0	212490	0	RT	MT	
14-Aug-13	HS3	23:13	23:44	0:31	23:24	23:39	0:15	0	0	0	PR	0:00	0	0	0	0	212490	0	RT	MT	
16-Aug-13	HS2	22:25	22:48	0:23	22:34	22:46	0:12	0	0	0	PATROL					0	212490	0	JF	BS	
17-Aug-13	HS4	0:20	3:28	3:08	0:32	3:25	2:53	0	14	210	SEED					0	212490	1	LD	JN	
17-Aug-13	HS3	1:54	3:31	1:37	2:01	3:25	1:24	182	13	0	SEED					0	212490	0	RT	MT	
17-Aug-13	HS3	4:04	5:18	1:14	4:09	5:13	1:04	158	5	0	SEED	6:22	340	32	210	12200	224691	1	RT	MT	

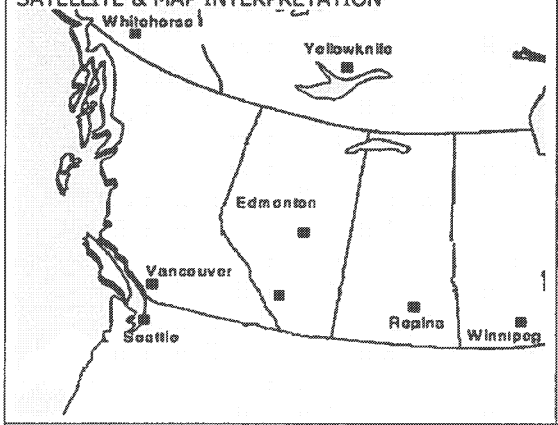
19-Aug-13	HS4	16:42	17:09	0:27	16:52	17:07	0:15	0	0	0	PR					0	224691	0	LD	JN	
19-Aug-13	HS4	21:43	22:12	0:29	21:52	22:08	0:16	0	0	0	PR	0:00	0	0	0	0	224691	0	LD	JN	
22-Aug-13	HS5	17:13	17:55	0:42	17:27	17:52	0:25	0	0	0	PR					0	224691	0	JL	AB	
22-Aug-13	HS5	22:20	23:11	0:51	22:32	23:07	0:35	0	0	0	PR	0:00	0	0	0	0	224691	0	JL	AB	
23-Aug-13	HS1	22:44	23:42	0:58	22:54	23:39	0:45	0	0	0	PATROL	0:58	0	0	0	0	224691	0	JF	JE	
26-Aug-13	HS4	22:25	0:17	1:52	22:32	0:14	1:42	0	0	0	PATROL					0	224691	0	LD	JN	
27-Aug-13	HS4	4:03	4:27	0:24	4:13	4:23	0:10	0	0	0	PATROL	2:16	0	0	0	0	224691	0	LD	JN	
28-Aug-13	HS1	17:00	17:30	0:30	17:09	17:28	0:19	0	0	0	PR					0	224691	0	BM	JE	
28-Aug-13	HS1	21:38	22:04	0:26	21:41	22:02	0:21	0	0	0	PR	0:00	0	0	0	0	224691	0	BM	JE	
29-Aug-13	HS5	22:44	0:52	2:08	22:51	0:49	1:58	162	10	0	SEED					0	224691	2	JL	AB	JF
29-Aug-13	HS2	22:58	0:58	2:00	23:09	0:53	1:44	0	1	122	SEED					0	224691	0	MZ	BS	
29-Aug-13	HS1	23:16	0:27	1:11	23:26	0:25	0:59	0	7	0	SEED					0	224691	0	BM	JE	
30-Aug-13	HS3	1:50	2:40	0:50	2:04	2:37	0:33	0	0	0	PATROL	6:09	162	18	122	6289	230979	0	RT	MT	
30-Aug-13	HS4	21:21	22:30	1:09	21:28	22:28	1:00	0	0	2	SEED					0	230979	1	LD	JN	
30-Aug-13	HS5	21:37	23:06	1:29	21:49	23:03	1:14	0	0	0	PATROL					0	230979	0	JL	AB	
30-Aug-13	HS4	22:45	23:28	0:43	22:49	23:21	0:32	0	0	0	PATROL					0	230979	0	LD	JN	
30-Aug-13	HS3	22:52	23:40	0:48	22:57	23:34	0:37	64	7	0	SEED	4:09	64	7	2	2336	233315	1	RT	MT	
31-Aug-13	HS4	18:22	18:42	0:20	18:30	18:38	0:08	0	0	0	MX	0:00	0	0	0	0	233315	0	LD	JN	
04-Sep-13	HS2	13:33	14:18	0:45	13:36	14:14	0:38	0	0	0	MX					0	233315	0	MZ	JE	
04-Sep-13	HS2	20:18	20:56	0:38	20:23	20:54	0:31	0	0	0	MX	0:00	0	0	0	0	233315	0	MZ	JE	
06-Sep-13	HS2	17:25	17:59	0:34	17:35	17:57	0:22	0	0	0	PR					0	233315	0	MZ	JE	
06-Sep-13	HS2	22:05	22:39	0:34	22:11	22:32	0:21	0	0	0	PR	0:00	0	0	0	0	233315	0	MZ	JE	
09-Sep-13	HS5	0:33	1:26	0:53	0:42	1:22	0:40	0	0	0	PATROL	0:53	0	0	0	0	233315	0	JL	AB	JF

PILOT/OBSERVER	Initials	PILOT/OBSERVER	Initials
Brook Meuller	BM	Dan Gilbert	DG
Jacob Eeuwes	JE	Brad Waller	BW
Andreas Bertoni	AB	Joe Pehoski	JP
John Lisberg	JL	Bruce Boe	BB
Roger Tilbury	RT	Terry Krauss	TK
Joel Zimmer	JZ	LJ Dunn	LD
Matthias Morel	MM	Brent Shewchuk	BS
Jenelle Newman	JN	Mark Zuccon	MZ
Jody Fischer	JF	Mike Torris	MT

Appendix E – Forms

Weather Forecast Worksheet

SATELLITE & MAP INTERPRETATION



DATE

Forecaster

SYNOPSIS

OPERATIONAL INFORMATION FORECAST:

FCST CDC: Tmax:

Freezing Level: Dew Pt:

-5 C: Tconv:

-10 C:

Max Cloud Top Height:

Cloud Base Height/Temp:

Cell Motion:

Storm Motion:

Outlook CDC:

FORECAST

HAILCAST MODEL FCST Diam. (cm):

ACTUAL WX OBSERVED

CDC

SOUNDINGS:

- **LI:**
- **SI:**
- **TOTAL TOTALS:**
- **Precip. Water (in):**
- **CAPE (J/kg):**

WINDS

250 mb

500 mb

600 mb

700 mb

850 mb

Sfc

jet PVA		short wave trof		thickness advection		wind shear	
upsiope flow		frontal lift		night radiation cooling		morning fog	
morning ACC or cloud street		Insolation		latent instability		loaded gun	
chinook		cloud cover		gusty winds		Dry Slot or Line	
NE moisture advection		Other:					

	Summation coverage		Weather nature		Precipitation type		Obscuration type
SKC	nil cloud	MI	Shallow (FG)	DZ	Drizzle	BR	Mist (≥ 5/8 sm)
FEW	≤ 2/8	BC	Patches (FG)	RA	Rain	FG	Fog (< 5/8 sm)
SCT	3/8 to 4/8	PR	Partial (FG)	SN	Snow	FU	Smoke (≤ 6sm)
BKN	5/8 to 7/8	DR	Drifting	SG	Snow grains (never showery)	VA	Volcanic ash (any vsby)
OVC	8/8	BL	Blowing	IC	Ice crystals (≤ 6sm)	DU	Dust (≤ 6sm)
CLR	nil cloud < 10,000' (auto)	SH	Showers	PL	Ice pellets (frozen rain)	SA	Sand (≤ 6sm)
	≥ 6 sm, no CB, no sig wx,	TS	Thunder	GR	Hail	HZ	Haze (≤ 6sm)
CAVOK	nil cld < 5000' or below	FZ	Freezing	GS	Snow pellets (showery)	PO	Dust whirls
	highest min sector altitude	VC	Vicinity	UP	Unknown (auto)	SQ	Squalls
		FC	Funnel cld			SS	Sandstorm (< 5/8 sm)
		+FC	Tornado/ Waterspout		GRADU >1/2hr TEMPO <1 hr	+SS	Sandstorm (< 5/16 sm)
					RAPID <1/2hr INTER <<1hr	DS	Duststorm (< 5/8 sm)
						+DS	Duststorm (< 5/16 sm)

WMI Radar Observer Log

WMI Radar Log

2013 Alberta Hail Suppression Project

Olds-Didsbury Radar Operations Centre

Date (UTC): _____

Operator(s): _____ Page: _____ of _____

TIME hh:mm (UTC)	Radar Summary PPINE, status, TITAN cell etc	Remarks, Action, Decision	Carvel Radar*	Strathmore Radar*

*provide Environment Canada radar summary when Olds-Didsbury radar shows no echoes.

WEATHER MODIFICATION INCORPORATED

WMI Seeding Aircraft Flight Log

WMI Cloud Seeding Flight Log - Alberta 2013					Hobbs Off:		Engine Off:		Landing:		Date: mm/dd @ start of flight, ZULU!	
Dep Airport:		Mission Type:			Hobbs On:		Engine On:		Takeoff:			
REV 2-2013					Total HOBBS:		Total Engine:		Flight Time:		Page #:	
Pilot:		Copilot:		N-Number:		HS#						
Time (UTC)	Event No.	Lat. (deg & min)	Long. (deg & min)	Alt. (ft)	Generators On	Generators Off	Flares Ejectable	Flares BIP	Remarks and Observations			
( )		Total Seeding Attempted:										
TOTAL Generator Time (List it above) Both Units! HH:MM		Less Misfires:										
		Total Flares Used:										

Mission Type Categories :

Seeding Flt	SEED	Ferry Flt	FER	Reposition Flt	REPO
Patrol Flt	PAT	Publicity Flt	PR		
Maintenance	MX	Currency Flt	CUR		

WEATHER MODIFICATION INCORPORATED

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Appendix F – Aircraft Specifications

Several types of aircraft are presently utilized on the project. Though all are twin-engine, the engine type and other performance characteristics make each significantly different from the others. Of the four HAILSTOP aircraft presently used on the project, two are turboprop (prop-jet) aircraft, and the other two are powered by turbocharged, reciprocating piston engines. While the turboprop aircraft are faster and more powerful, they are also more expensive to operate, so the two piston-engine aircraft are used to operate where less performance is needed—at cloud base.

Cessna 340A Aircraft

Primary mission: cloud base seeding
Power Type, Turbocharged piston twin engine
6290 lbs gross weight
4184 lbs empty weight
1802 lbs useful load
310 hp per engine
280 mph max speed
263 mph rec. cruise
82 mph stall dirty
183 - 203 gals fuel capacity
29,800 feet all engine service ceiling
15,800 feet single engine service ceiling
1650 feet per minute all engine rate of climb
315 feet per minute single engine rate of climb
2175 feet for takeoff over 50 foot obstruction
1615 feet for takeoff ground roll
1850 feet land over 50 foot obstruction
770 foot land ground roll
34 ft 4 in length
12 ft 7 in height
38 ft 1 in wingspan

Beechcraft King Air C90

Primary mission: cloud-top seeding
Power Type, Turboprop twin engine
PT6A-21 engines
Full deicing capabilities
9650 lbs gross weight
6382 lbs empty weight
3268 lbs useful load
550 hp per engine
208 kts max speed
185 kts recommended cruise
74 kts dirty stall
384 gals fuel capacity
30,000 feet all engine service ceiling
14,200 single engine service ceiling
1500 feet per minute all engine rate of climb
350 feet per minute single engine rate of climb
3100 for takeoff over a 50 foot obstruction
2250 feet take off roll
1730 feet for landing over 50 foot obstacle
800 foot landing roll
35 ft 6 in length
14 ft 3 in height
50 ft 3 in wingspan

Appendix G – Ground School Agenda

WEATHER MODIFICATION INCORPORATED

Alberta Hail Suppression Project (AHSP)

2013 Ground School – Monday May 27th Calgary, Alberta

Ramada Downtown Calgary – Niagara Room
708 Eight Avenue SW, Calgary AB
Phone (403) 263-7600

09:30	Field Personnel Pictures
10:00	WMI Representation and Professionalism WMI Job Responsibilities/ Duties Jody Fischer, WMI Chief Pilot & Canada Project Manager Bruce Boe, WMI Director of Meteorology
10:30	Approved Flight Operations Aircraft Maintenance Procedures & Pilot Discussion Aircraft Binders, NAFTA Aircraft Refueling Procedures Jody Fischer
11:00	SharePoint Introduction Paperwork Procedures Erin Fischer, WMI Project Assistant
11:45	Accounting – Company Expense Reports
12:00	Team Lunch (WMI Provided)
13:00	Hands-on SharePoint Session with Field Crew Erin Fischer
14:30	Cloud Seeding Chemical Inventory & Procedures Jody & Erin Fischer
14:45	Additional Project Discussion – Q & A
15:15	End of Ground School

WEATHER MODIFICATION INCORPORATED

Alberta Hail Suppression Project (AHSP)

2013 Ground School – Tuesday May 28th Calgary, Alberta

Intact Zone Training Centre – Red Room
12th Floor- Energy Plaza East Tower
311-6th Avenue SW, Calgary AB

08:45	Welcome and Staff Introductions Mr. Jim Sweeney, WMI Vice President Dr. Terry Krauss, ASWMS Project Director Mr. Bruce Boe, WMI Director of Meteorology
09:00	Introduction from the Insurance Industry Todd Klapak, Alberta Severe Weather Management Society Board Chairman, Intact Insurance
09:15	History of the Alberta Hail Suppression Program Terry Krauss
10:00	Break
10:15	Hail Program Overview and Status of Hail Suppression Concepts Bruce Boe
10:45	Overview of 1996-2012 Alberta Operations Brad Waller, WMI Project Meteorologist
11:30	Severe Weather Forecasting & Daily Forecast Sheet Dan Gilbert, WMI Chief Meteorologist
12:00	Lunch (On-Site – AHSP Provided)
12:45	ATC Controlling Procedures YYC TCU Edmonton Control Center (TBA) YBW Springbank Tower (TBA)
13:30	Job Responsibilities/ Duties Bruce Boe Terry Krauss

14:00Aviation Weather & Special Procedures
Cloud Seeding Aircraft & Equipment
Targeting - Seeding Rates
Storm Tracking and Directing
Jody Fischer, WMI Chief Pilot & Canada Project Manager

14:45 Break

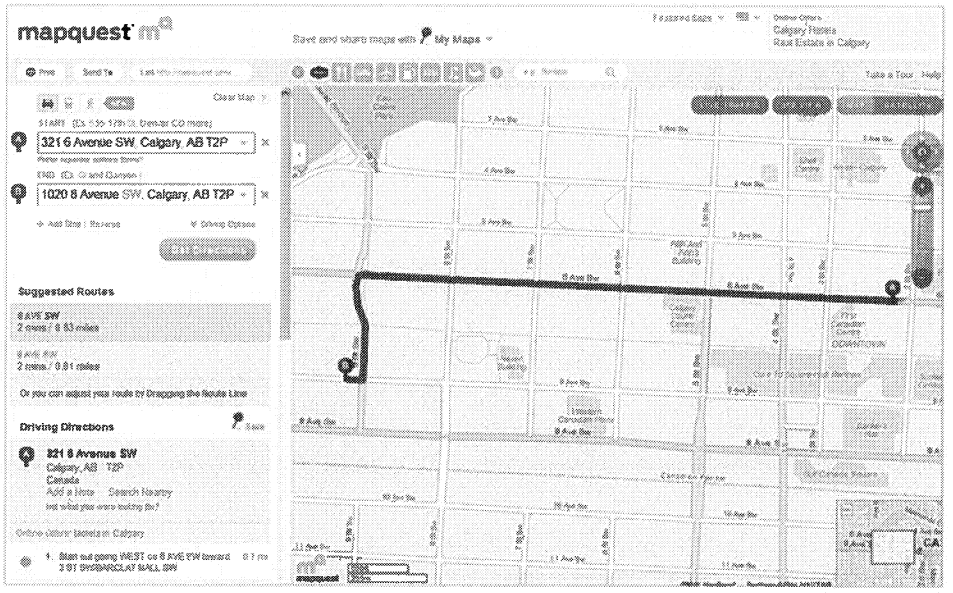
15:00 Alberta Radar Upgrade & Operational Implications
CDC Forecast Verification and the Need for Hail Reports
Dan Gilbert

15:20 Daily Routines & Procedures
Dan Gilbert

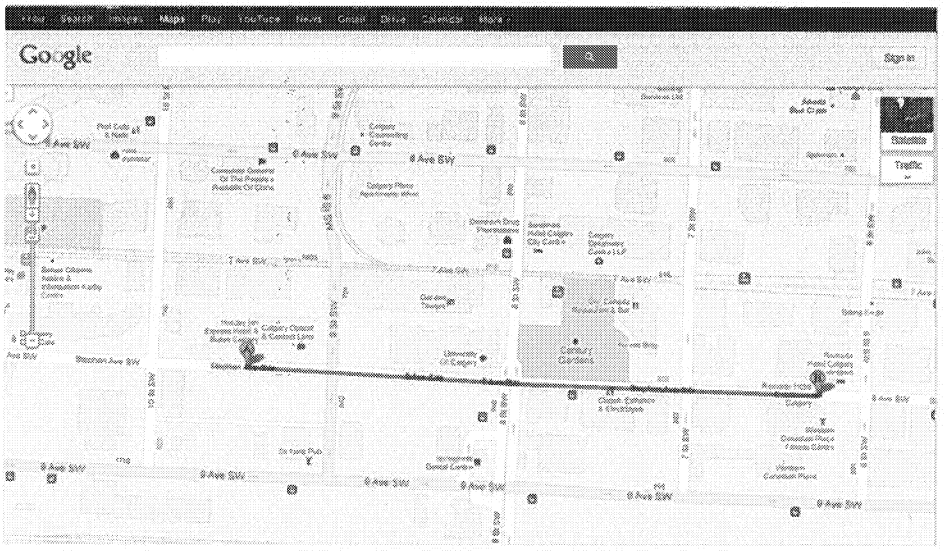
15:30 Safety and Emergency Procedures
Jody Fischer

16:00 End of Ground School

Directions from Holiday Inn Express Downtown to Intact Training Center:



Directions from Holiday Inn Express Downtown to Ramada Downtown:



If you need directions or any other assistance before or during ground school please contact:

Jody Fischer – jfischer@weathermodification, 701.371.6138 (text or call)

Appendix H – Airborne Seeding Solution

- Chemical Formulation: 2% AgI - 0.5 NH_4I - 0.1 $C_6H_4Cl_2$ - 1.0 $NaClO_4$
- Recommended Burn Rate: ~2.0 gph
- Nucleation Mechanism: Condensation Freezing
- Total Solution Weight: 33.5 lbs.
- Volume: ~ 5.0 gallons, (20 liters) scale for other amounts
- Seeding Aerosol: $AgI_{0.85}AgCl_{0.15}NaCl$

Constituent	Chemical Formulation	Molecular Wt.(g/mole)	Mass (g)	Weight (lb.)	Volume (gal)
Silver Iodide	AgI	234.77	304.2	0.67	n/a
Ammonium Iodide	NH_4I	144.94	93.9	0.21	n/a
Paradichlorobenzene	$C_6H_4Cl_2$	147.00	19.0	0.042	n/a
Sodium Perchlorate,99%	$NaClO_4$	140.48	181.8	0.40	n/a
Water	H_2O	17.99	607.7 or less	1.34	0.202
Acetone	$(CH_3)_2CO$	58.08	13985.5	30.84	4.645

Note: Sodium Perchlorate, anhydrous can be utilized in the formula by adjusting the weight or mass to include 0.34 lb or 158.1 g respectively, although proper handling becomes more difficult. Water amounts should be increased to 1.40 lb or 630 g (0.21 gal).

Note: Use 2.4 urinal pucks (85 gram Paradichloro-benzene) for 205 litre barrel of acetone.

Mixing procedures are as follows:

1.) Combine AgI and acetone in a 5 gallon container and begin stirring;
2.) Combine ammonium iodide, sodium perchlorate and water in another small container and stir until the solution is clear and cool (caution the perchlorate is a strong oxidizer and needs to be done at room temperatures, don't do this in a hot hanger)
3.) Add the ammonium iodide, sodium perchlorate and water mixture to the stirring silver iodide/acetone slurry;
4.) Continue mixing until the solution is clear;
5.) Add the paradichlorobenzene any time after you have added container #2 and the solution is beginning to clear;
6.) Continue mixing for another 10 minutes until very clear; and
7.) Pump the solution into the aircraft generator immediately after mixing or store in an appropriate labeled sealed container. Storage containers can be either stainless or plastic (polypropylene).

Supplier: Solution Blend Service, 2720 7th Avenue N.E., Calgary, AB, T2A 5G6 403-207-9840