

Annual Report of Alberta Severe Weather Management Society Hail Suppression Efforts

2021 Operations – June 1 through 15 September

Information prepared by Weather Modification LLC, dba Weather Modification International (WMI)

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All cloud seeding flights were conducted in accordance with the scientific principles described in the *Notice of Intent to Engage in Weather Modification Activities* submitted to Environment Canada on May 28, 2021, within the limits of the operations area delineated therein.

Accordingly, some acronyms used in the following tables require explanations, provided below.

Missions by Type (top left table)

Total time – the elapsed time from engine start to engine stop.

Air time – the elapsed time from takeoff to landing.

SEED – time flown on missions during which any seeding was conducted, regardless of amount.

PATROL – time flown in anticipation of encountering potential severe weather, when seeding did not occur.

REPO – (Reposition) time flown when aircraft were flown to other airports in anticipation of severe weather.

PR – flights made to the project operations centre for the purposes of the insurance industry-accredited lectures.

DUAL – flights flown for dual-mode seeding, that is, the combined use of ice-forming and drop-forming seeding agents.

MX – maintenance flights. Maintenance flights were to ensure functionality after repairs, and at the expense of WMI.

Aircraft Identifiers

Hailstop #1, HS1 – tail number N904DK, based in Springbank

Hailstop #2, HS2 – tail number N6111V, based in Springbank

Hailstop #3, HS3 – tail number N127ZW, based in Red Deer

Hailstop #4, HS4 – tail number N522JP, based in Red Deer

Hailstop #5, HS5 – tail number N518TS, based in Springbank

Flare Usage (by aircraft, top right table)

BIP – burn-in-place flare, contains 150g of ice-forming seeding agent

HBIP – burn-in-place flare, contains 1000g of drop-forming seeding agent (salt)

EJ – ejectable flare, contains 20g of ice-forming seeding agent

TOTAL GRAMS – the total mass of seeding agent released in each category, in grams.

Flight Time (by aircraft, by month, found below the *Flare Usage* table)

Self-explanatory.

TOTAL HOURS – the total time flown by all five Hailstop aircraft in each month, given in hours and minutes.

Operations Summary (the large table that comprises the remainder of the document)

Flights – the total number of flights flown for project purposes (not maintenance)

UTC DATE – Universal Time Coordinates, or UTC, is used worldwide for all meteorological and aviation purposes. UTC is six hours ahead of Mountain Daylight Time (MDT), so to convert UTC to MDT, subtract six hours.

HAILSTOP – the aircraft flying the mission, e.g. HS2 = Hailstop 2, based in Springbank (see Aircraft Identifiers, above)

OPS # -- The flight number for each specific aircraft, used only for administrative purposes.

ENGINES ON – the UTC time engines were started for that mission.

ENGINES OFF -- the UTC time engines were shut down after that mission.

TOTAL TIME – the time the engines ran, in hours and minutes.

MISSION TYPE – see *Missions by Type*, above.

EJ # – the number of ice-forming EJ flares expended on the mission.

BIP # -- the number of ice-forming BIP flares expended on the mission.

HYGRO # -- the number of droplet-forming hygroscopic (salt) flares expended on the mission.

TOTAL TIME FOR DAY – the total time accrued by all HS aircraft on each day.

EJ – the total number of EJ pyrotechnics (flares) used on each date.

BIP – the total number of BIP pyrotechnics (flares) used on each date.


AGI SEED AMOUNT PER DAY – the total mass of ice-forming seeding agent released on each date. This is the total of the amounts in the EJs and BIPs.

HYGROSCOPIC FLARES – the total number of droplet-forming (salt) flares burned on each date.

CaCl SEED AMOUNT PER DAY – the total mass of calcium chloride salt dispersed through the use of HYGRO flares on each date.

Storms – the total number of storm complexes seeded on each date.

At the bottom of the table, season totals are provided.

ALBERTA HAIL SUPPRESSION PROJECT 2021 - Universal Time Coordinates												
		Last Data Revision Date:		10/12/2021								
		AIR TIME		FLARE USAGE	HS1	HS2	HS3	HS4	HS5			
SEED		122:03		BIP (150g)	194	152	213	176	237			
PATROL		12:14		HBIP (1000g)	31	0	0	0	0			
REPO		2:00		EJ (20g)	261	1656	832	27	615			
PR		0:00										
DUAL		8:50										
MX		2:52										
FERRY		0:00										
CUR		0:00		FLIGHT TIME	HS1	HS2	HS3	HS4	HS5			
TOTALS		147:59		JUNE	2:18	3:56	3:53	9:55	9:43			
				JULY	22:26	23:41	19:42	17:17	20:20			
HAILSTOP #1				AUGUST	6:53	8:49	7:04	6:51	3:34			
HAILSTOP #2				SEPTEMBER	0:00	0:00	0:00	0:00	0:00			
HAILSTOP #3				TOTAL BY HS#	31:37	36:26	30:39	34:03	33:37			
HAILSTOP #4												
HAILSTOP #5												
										STORM DAY SUB-TOTALS		
										(Storm-day chemical totals ONLY include flares spent for seeding).		
										* Indicates pyrotechnic material expended for testing.		
										HYGROSCOPIC SEEDING		
UTC DATE	HAILSTOP	ENGINES ON (UTC)	ENGINES OFF (UTC)	TOTAL TIME (hh:mm)	MISSION TYPE	EJ (#)	BIP (#)	HYGRO (#)	SEEDING TIME PER DAY	GLACIO SEED AMOUNT PER DAY (Grams)	CACI2 SEED AMOUNT PER DAY (Grams)	# Storms
04-Jun-21	HS4	19:37	22:14	2:37	SEED	10	3	3	2:37	650	0	2
05-Jun-21	HS5	18:09	20:04	1:55	SEED	0	17	0		0	0	
05-Jun-21	HS3	23:43	0:28	0:45	PATROL	0	0	0	2:40	2550	0	2
09-Jun-21	HS4	23:30	0:30	1:00	MX	0	0	0	0:00	0	0	0
14-Jun-21	HS1	19:57	22:15	2:18	SEED	91	13	0		0	0	
14-Jun-21	HS3	20:46	21:59	1:13	SEED	0	10	0		0	0	
14-Jun-21	HS2	21:44	1:40	3:56	SEED	142	9	0		0	0	
14-Jun-21	HS5	23:41	4:33	4:52	SEED	0	40	0		0	0	
15-Jun-21	HS4	0:40	4:47	4:07	SEED	0	37	0	16:26	21010	0	4
15-Jun-21	HS3	14:44	16:39	1:55	SEED	0	34	0		0	0	
15-Jun-21	HS4	15:39	17:00	1:21	SEED	0	16	0		0	0	
15-Jun-21	HS5	22:43	1:39	2:56	SEED	20	4	0	6:12	8500	0	3
29-Jun-21	HS4	15:15	16:05	0:50	MX	0	0	0	0:00	0	0	0
01-Jul-21	HS2	17:30	18:15	0:45	MX	0	0	0	0:00	0	0	0
02-Jul-21	HS5	18:59	23:17	4:18	SEED	298	13	0		0	0	
02-Jul-21	HS4	19:09	20:26	1:17	PATROL	0	0	0		0	0	
02-Jul-21	HS1	19:11	23:45	4:34	SEED	0	36	0		0	0	
02-Jul-21	HS2	19:45	20:59	1:14	PATROL	0	0	0		0	0	
02-Jul-21	HS4	21:04	0:42	3:38	SEED	0	18	0		0	0	
02-Jul-21	HS2	21:56	1:49	3:53	SEED	161	26	0		0	0	
02-Jul-21	HS3	23:46	2:28	2:42	SEED	0	21	0		0	0	
03-Jul-21	HS1	1:45	2:28	0:43	REPO	0	0	0		0	0	
03-Jul-21	HS5	1:52	2:35	0:43	REPO	0	0	0		0	0	
03-Jul-21	HS4	4:55	5:30	0:35	REPO	0	0	0	21:36	26280	0	4

											HYGROSC OPIC SEEDING	
UTC DATE	HAILSTOP	ENGINES ON (UTC)	ENGINES OFF (UTC)	TOTAL TIME (hh:mm)	MISSION TYPE	EJ (#)	BIP (#)	HYGRO (#)	SEEDING TIME PER DAY	GLACIO SEED AMOUNT PER DAY (Grams)	CACI2 SEED AMOUNT PER DAY (Grams)	# Storms
03-Jul-21	HS5	22:21	1:32	3:11	SEED	0	22	0		0	0	
03-Jul-21	HS1	22:20	1:06	2:46	SEED	159	15	0		0	0	
03-Jul-21	HS2	22:22	2:36	4:14	SEED	200	13	0		0	0	
03-Jul-21	HS4	23:17	1:53	2:36	SEED	0	23	0		0	0	
04-Jul-21	HS3	0:04	3:14	3:10	SEED	0	11	0		0	0	
04-Jul-21	HS1	2:04	3:32	1:28	SEED	11	5	0	17:25	20750	0	2
04-Jul-21	HS5	20:27	23:28	3:01	SEED	0	12	0		0	0	
04-Jul-21	HS2	20:31	23:21	2:50	SEED	0	12	0		0	0	
04-Jul-21	HS1	20:36	22:04	1:28	PATROL	0	0	0		0	0	
04-Jul-21	HS1	22:53	23:33	0:40	REPO	0	0	0	7:19	3600	0	1
05-Jul-21	HS3	22:16	23:16	1:00	MX	0	0	0	0:00	0	0	0
06-Jul-21	HS2	20:50	23:04	2:14	SEED	44	0	0		0	0	
06-Jul-21	HS5	21:53	23:11	1:18	PATROL	0	0	0		0	0	
06-Jul-21	HS3	22:10	1:08	2:58	PATROL	0	0	0		0	0	
07-Jul-21	HS2	0:47	2:49	2:02	SEED	214	17	0		0	0	
07-Jul-21	HS1	0:46	2:42	1:56	SEED	0	28	0		0	0	
07-Jul-21	HS5	1:14	2:43	1:29	SEED	0	24	0		0	0	
07-Jul-21	HS5	4:17	5:31	1:14	SEED	56	11	0	13:11	18280	0	3
07-Jul-21	HS5	20:45	21:16	0:31	PATROL	0	0	0		0	0	
08-Jul-21	HS2	2:08	3:53	1:45	SEED	217	11	0		0	0	
08-Jul-21	HS5	2:10	4:00	1:50	SEED	0	29	0		0	0	
08-Jul-21	HS1	2:10	4:30	2:20	SEED	0	26	0		0	0	
08-Jul-21	HS4	2:57	4:23	1:26	SEED	17	4	0	7:52	15180	0	1
10-Jul-21	HS3	21:21	22:43	1:22	PATROL	0	0	0	1:22	0	0	0
21-Jul-21	HS1	2:45	4:45	2:00	PATROL	0	0	0	2:00	0	0	0
22-Jul-21	HS3	1:41	4:19	2:38	SEED	189	30	0		0	0	
22-Jul-21	HS4	2:30	4:26	1:56	SEED	0	15	0	4:34	10530	0	1
22-Jul-21	HS4	18:16	20:52	2:36	SEED	0	19	0		0	0	
22-Jul-21	HS1	18:17	20:17	2:00	DUAL	0	11	14		0	0	
22-Jul-21	HS3	18:24	20:23	1:59	DUAL	163	8	0		0	0	
22-Jul-21	HS2	19:21	20:58	1:37	SEED	36	6	0	8:12	10580	14000	2
26-Jul-21	HS4	1:38	4:23	2:45	SEED	0	32	0		0	0	
26-Jul-21	HS3	1:39	5:32	3:53	SEED	271	44	0		0	0	
26-Jul-21	HS1	2:07	4:38	2:31	SEED	0	28	0		0	0	
26-Jul-21	HS2	2:29	5:36	3:07	SEED	133	30	0		0	0	
26-Jul-21	HS5	2:58	5:43	2:45	SEED	241	27	0		0	0	
26-Jul-21	HS4	5:22	5:50	0:28	REPO	0	0	0	15:01	37050	0	2
04-Aug-21	HS4	22:13	2:14	4:01	SEED	0	9	0		0	0	
05-Aug-21	HS2	0:38	2:50	2:12	SEED	139	2	0		0	0	
05-Aug-21	HS1	1:25	2:57	1:32	SEED	0	6	0	7:45	5330	0	2
21-Aug-21	HS2	17:39	18:00	0:21	MX	0	0	0		0	0	
21-Aug-21	HS5	17:40	18:10	0:30	MX	0	0	0		0	0	
21-Aug-21	HS1	18:09	18:47	0:38	MX	0	0	0		0	0	
21-Aug-21	HS4	19:00	19:46	0:46	MX	0	0	0		0	0	
21-Aug-21	HS3	20:15	20:52	0:37	MX	0	0	0	0:00	0	0	0
22-Aug-21	HS2	21:33	23:54	2:21	SEED	177	15	0		0	0	
22-Aug-21	HS3	21:44	1:24	3:40	DUAL	147	43	0		0	0	
22-Aug-21	HS1	23:26	1:38	2:12	DUAL	0	12	17		0	0	
22-Aug-21	HS4	23:40	1:44	2:04	PATROL	0	0	0	10:17	16980	17000	1
31-Aug-21	HS2	21:38	1:33	3:55	SEED	193	11	0		0	0	
31-Aug-21	HS5	21:44	0:48	3:04	SEED	0	38	0		0	0	
31-Aug-21	HS3	22:11	0:58	2:47	SEED	62	12	0		0	0	
31-Aug-21	HS1	23:15	1:46	2:31	SEED	0	14	0	12:17	16350	0	5
						3391	972	31	156:46	213620	31000	35
SEASON TOTALS						TOTAL EJ FLARES	TOTAL BIP FLARE	TOTAL HYGRO FLARES	HOURS FLOWN	TOTAL GLACIO- GENIC SEEDING AGENT	TOTAL CaCl SEEDING AGENT	TOTAL # OF STORMS SEEDED