



# University of Wyoming ASCII 2011

## AgI Seeding of Clouds Impact Investigation

January 4, 2012 - March 4, 2012

### Project Status

Updated: Thu Dec 20 17:10

#### Alert level

Fri, Dec 21	None
Sat, Dec 22	None
Sun, Dec 23	None
Mon, Dec 24	None
Tue, Dec 25	None

[Summary of IOPs](#)

[Data and Forms](#)

[Aerosol Plots](#)

[Forecast Links](#)

[Plot of ASCII flight hours](#)

[Google Earth KML file of proposed flight tracks.](#)

Date/Gnd Notes	Flight # (* .kml)	Status	Times (UTC)	Hours	Crew/Notes
<i>Flights</i>					
		RSE joint case--completed 4 full ladders, along wind + loiter between ladders 2 and 3, and another along wind leg following the completion of ladder 4. Most of the pattern was within			<a href="#">T Drew</a>

<a href="#">3 Mar</a>	RF18	1000 ft of cloud top, liquid waters were generally 0.2 g/m3 throughout the flight. Applanix omnistar was intermittent (re-installed our Applanix unit yesterday before this flight); CIP computer crashed early but restarted without any data loss, LWC100 iced over during 4th ladder, 2DP iced over near end of 4th ladder. No other known instrument problems.	1750 - 2155	4.2	Q Miao <a href="#">J French</a> S Ward
1 Mar	RF17	ASCII only case, follow on to RF16. This flight was in evening of 29 Feb (but after 00Z, 1 Mar)--conducted two full ladder patterns with seeding generators turned off. Applanix Omnistar was intermittent. CIP computer crashed once and was successfully restarted. No other known instrument problems.	0134 - 0340	2.2	<a href="#">B Wadsworth</a> T Deshler <a href="#">L Oolman</a> J Stemmler
<a href="#">29 Feb</a>	RF16	ASCII only case, but because of limitations with WMI and start time for follow-on RSE, plan is to conduct two ladders with generators turned on--return to LAR, refuel and conduct another flight with 2 ladders with generators turned off. Two ladders were completed at FL130, light to light/moderate ice; lost 2DP right at end of the last leg. Applanix omnistar was intermittent. CIP computer crashed once and was restarted. No other known instrument problems.	2230 - 0028	2.1	<a href="#">B Wadsworth</a> <a href="#">Q Miao</a> <a href="#">J French</a> T Deshler
<a href="#">29 Feb</a>	RF15	Blowing snow case--clouds and precip over SM Range required some "flexibility" in the pattern. Conducted first leg at FL125 and second leg (upwind) at FL090--but cloud required us to conduct remaining legs under IFR at FL130. Conducted 2.5 patterns (each consisting of 5 legs) with a sounding from FL130 to 500 ft AGL following the last pattern northwest of the Sierra Madre. Legs 1 and 5 on all patterns showed significant cloud/snowfall with echo all the way to ground.	1507 - 1833	3.6	<a href="#">T Drew</a> <a href="#">Q Miao</a> <a href="#">J French</a>
<a href="#">28 Feb</a>	RF14	ASCII only case; Second flight for the day. Conducted 4 full ladder patterns @ FL130 with along wind leg between ladders 3 & 4. Applanix omnistar was intermittent; no other instrument problems.	1926 - 2253	3.5	<a href="#">B Wadsworth</a> <a href="#">Q Miao</a> <a href="#">J French</a> G Sever
<a href="#">28 Feb</a>	RF13	ASCII only case with early morning (630 AM) takeoff planned. Forecast in Laramie required alternate limiting our time on station therefore precluding our ability to conduct along wind leg. Snow started falling at LAR before pullout, so startup was in hangar and pullout under power. Conducted four full ladder patterns. Light icing only during pattern. WCR had 7 "port scrambles"--all were caught within 30 seconds. Applanix omnistar was intermittent.	1333 - 1648	3.4	<a href="#">T Drew</a> <a href="#">Q Miao</a> <a href="#">J French</a> J Wurman
<a href="#">22 Feb</a>	<a href="#">RF12</a>	Flew (nearly) four ladder patterns with along wind pattern between 2nd and 3rd ladder. Models and real-time data indicated a lot of liquid prior to flight. Decided to begin from FL145/FL160 for first couple of ladders so as not to jeopardize the flight. On fourth ladder, descend to FL140--by third leg we had picked up a lot of ice and decided to abort remainder of the flight. Lost FSSP, LWC100, and 2DP. Ice was shed prior to landing.	1329 - 1656	3.4	<a href="#">B Wadsworth</a> <a href="#">Q Miao</a> <a href="#">J French</a> I Zhorov
<a href="#">21 Feb</a>	<a href="#">RF11</a>	Flew four ladder patterns with along wind pattern between 2nd and 3rd and added a bit of "loiter time". Clouds contained lots of liquid water at FL130--and ice up the aircraft quite a bit during the first ladder pattern. Conducted the 2nd and 3rd ladders at FL160, above cloud because we collected so much ice. Fourth ladder was conducted (in part at FL130). During the lower altitude ladders, we lost some instruments due to ice--FSSP, CDP, LWC100, 2DP. They all came back by the end of the flight. When we landed still a lot of ice on aircraft.	1932 - 2321	3.9	<a href="#">T Drew</a> <a href="#">Q Miao</a> <a href="#">J French</a> R Baker
		Flew four ladder patterns with along wind pattern between 2nd and 3rd and following fourth ladder. Clouds were deep during the first half of the flight, with plenty of ice falling from above.	2230 -		<a href="#">T Drew</a> <a href="#">Q Miao</a>

<a href="#">14 Feb</a>	<a href="#">RF10</a>	Later in flight, most clouds were below flight level, WCL indicated clouds contained liquid. No known problems.	0215	3.8	<a href="#">J French</a> <a href="#">S Ward</a>
<a href="#">13 Feb</a>	<a href="#">RF09</a>	Flew four ladder patterns with along wind pattern between 2nd and 3rd and following fourth ladder. First flight back after repair to aircraft tail. No known problems.	1900 - 2235	3.7	<a href="#">T Drew</a> <a href="#">Q Miao</a> <a href="#">J French</a> EMPTY
<a href="#">12 Feb</a>		Ground only case			
<a href="#">10 Feb</a>		Ground only case			
<a href="#">20 Jan</a>	<a href="#">RF08</a>	Flew the standard ASCII 4 ladder pattern. The seeding generators were not turned on for this mission. A dent in the horizontal stabilizer was found after the flight. The CDP apparently iced over at 1532. The 2D-P was iced over 1534-1546. The CIP computer rebooted around 1701. The WCR beams may have been scrambled towards the end of the last ladder.	1346- 1736	4.0	<a href="#">A Bandani</a> <a href="#">Q Miao</a> <a href="#">L Oolman</a> J Ritzman
<a href="#">19 Jan</a>	<a href="#">RF07</a>	Mission aborted due to severe icing. Drops larger than 30 microns encountered.	1644- 1746	1.1	<a href="#">T Drew</a> <a href="#">Q Miao</a> <a href="#">L Oolman</a> B Emery
<a href="#">18 Jan</a>	<a href="#">RF06</a>	Second flight for the data. Flew three ASCII ladders.	2356- 0313	3.4	<a href="#">A Bandani</a> <a href="#">D Kristovich</a> <a href="#">J French</a> J Stemmler
<a href="#">18 Jan</a>	<a href="#">RF05</a>	Blowing snow case.	1453- 1819	3.5	<a href="#">T Drew</a> <a href="#">D Kristovich</a> <a href="#">J French</a> B Emery
<a href="#">16 Jan</a>	<a href="#">RF04</a>	RSE case. Second flight to coincide with the seeding generators being turned on. Laramie was below minimums when we returned so we landed in Cheyenne.	1817- 2055	2.8 0.4	<a href="#">T Drew</a> <a href="#">D Kristovich</a> <a href="#">J French</a> L Oolman
<a href="#">16 Jan</a>	<a href="#">RF03</a>	RSE case. Either the Sierra Madre or the Medicine Bow generators were to be turned on. The conditions didn't develop as fast as WMI thought, so seeding was delayed. The mission was terminated after two ladders. Omnistar was disabled for this flight. The LWC100 probe iced over after 1511, the 2D-P after 1530.	1415- 1641	2.5	<a href="#">T Drew</a> <a href="#">D Kristovich</a> <a href="#">J French</a> <a href="#">L Oolman</a>
09 Jan	<a href="#">RF02</a>	Control case for blowing snow study.	1721- 2055	3.7	<a href="#">T Drew</a> <a href="#">D Kristovich</a> <a href="#">L Oolman</a> L Bard
07 Jan	<a href="#">RF01</a>	Weak, upslope case. The Applanix quit accepting GPS updates shortly after take off.	1437- 1758	3.5	<a href="#">T Drew</a> <a href="#">D Kristovich</a> <a href="#">L Oolman</a>

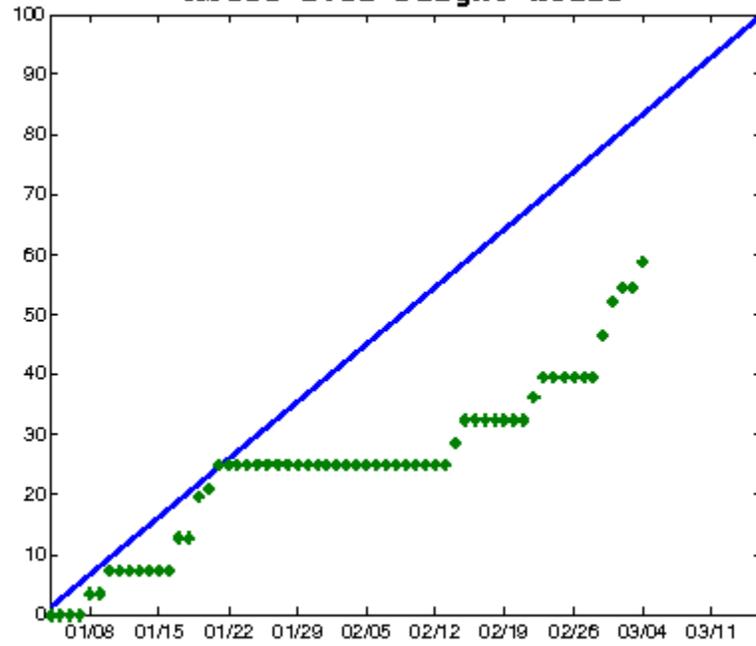
*Test Flights*

13 Feb	TF	Pilot Proficiency	2330 - 2400	0.6	B Wadsworth
05 Jan	TF05	Check of loaner Applanix computer. Flew BN06 to BN05.	1720- 1829	1.2	T Drew B Pokharel <a href="#">L Oolman</a> B Liu
03 Jan	TF04	Post break flight to check instruments. Weren't able to get into any clouds.	1753- 1854	1.1	T Drew A Wettlaufer <a href="#">L Oolman</a> B Liu
19 Dec	TF03	Test flight through clouds	1718- 1809	1.0	T Drew J Ritzman <a href="#">L Oolman</a> B Liu
08 Dec	TF02	Flight to check the alignment of the lidar. Unfortunately, there were no clouds high enough to fly through. Omnistar was activated prior to the flight. The Applanix lost its real-time solution just after take off. After the reset, it did not feed the data system the real-time values so the raw file should be processed with the PCMCIA data. The new probe tips were installed on the CIP.	2133- 2238	1.2	T Drew G Randolph <a href="#">L Oolman</a> B Liu
05 Dec	TF01	Test flight, mostly for the radar. Completed circles and pitching maneuvers. There was no Omnistar on this flight.	2147- 2257	1.2	A Bandani B Glover <a href="#">L Oolman</a>
Flight Hours	As of Mar 03, 58.7 out of 100 research hours were flown, 41.3 remain.			Test: 7.4	

## ASCII Forecast Links

- [NCAR RAP RT-FDDA model run](#)
- Time Height Forecasts
  - [NAM GFS](#): Dixon
  - [NAM GFS](#): Battle
  - [NAM GFS](#): Laramie
- [Binod's forecast page](#)

ASCII 2012 Flight Hours



**3/3/2012 ASCII Pilot notes (Flight 18)**

Crew: Drew, Miao, French, Ward

Flight Time: 4.1

Objective: Single RSE/ASCII Case

Planned: 4 Ladder patterns and along-wind between 2-3

Actual: Departed LAR 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000. Flew five rung ladder at 13,000 from East to West alternating starting points four times. Between ladders 2 and 3 flew along-wind leg. After ladder 4 flew another along-wind leg on return to LAR.

## **Battle Town site report 3/3/2012 (Geerts)**

IOP duration: 1730-2220Z – single flight (1750-2220Z), a joint RSE case. UWKA flew 4 ladders plus 1 long along-wind leg (250°). It completed ladder 2 at 1931Z (just as seeding started), and started ladder 3 at 2001Z.

weather: post-frontal, rather strong westerly flow behind a deep trough. Strong NW jet aloft, and a 500 m deep inversion above 620 mb (about 4.0 km MSL), clearly a subsidence inversion. No chance for seeding from aloft. Cold, BTS temperature -12.5 to -9°C (warming during the IOP). Significant veering of the wind, esp across the deep stable layer. 700 mb wind according to the DOW from 240°, clear S-shaped zero isodop. DOW anemometer shows winds at 17-18 m/s during the IOP, with a period between 1845-1945 with stronger winds, 21-22 m/s. MRR echo layer very shallow at first, only about 600 m, deepening gradually to 1000 m. Snowfall at about 10 dBZ (MRR) at the start, quite light, gradually becoming more intense during IOP (up to 17-18 dBZ). No shower structure in the MRR. DOW reports rather uniform precip, up to 12 dB at first, then increasing up to 20 dBZ in the 2<sup>nd</sup> half of the IOP. The BTS Radiometer shows a steady increase in water vapor, and virtually no LW in the first half (until 1940Z). Between 1940-2220, several LW spikes appear, up to 0.1 mm (vertically integrated), all of it at low levels. A brief LW spike of 0.2 mm at 2022Z. A mixed layer forms over Dixon during the day, and cloud base rises from the 1<sup>st</sup> to the 3<sup>rd</sup> Dixon sounding, raising the cloud base, but still well below Battle Pass level, and cloud depth increases. No riming on obstacles around Battle Pass before 1930Z (not verified afterwards). The sun was visible through the snowfall during the first half of the IOP. In fact in the first hour (1750-1850) it was bright enough to cast shadows. After 1930Z the sun was obscured by cloud. BTS measurements clearly were affected by blowing snow, both widespread blowing snow advected from the open area near the pass, and snow occasionally falling from surrounding trees. particles show little riming, except some riming in 2<sup>nd</sup> half.

synopsis: an excellent case. All instruments except hotplate worked. Good UWKA, DOW, BTS, and upwind data. Relatively shallow echoes, fairly steady wind, but increasing temperature, mixing ratio, LW, echo depth, and radar reflectivity. Interesting orographic flow, downwind acceleration and sinking on leg 5.

BTS instruments: all instruments turned off at the end of IOP

- CPI, Parsivel, WXT520, radiometer, and MRR worked well. Continuous data since previous day
- hotplate down
- Snow chemistry sampling: 2 samples before seeding, 5 samples after Ggen ignition
- Snow photography: worked well (all daytime).

Yang Yang's snow photo summary: mostly rimed small snow particles.

- 17:34 : Hexagonal plates (less than 1 mm), crystals with sectorlike branches (about 1 mm) and needles (about 1 mm).
- 19:15 : rimed crystals (2 mm) and rimed needles appear.
- 19:22 : dendrites with diameter greater than 2 mm appear with the small crystals, plates and needles. Some of the dendrites are rimmed.

AgI generators: 4 hours of seeding starting at 1930Z, ending at 2330 – all 8 Ggens over the SM/MB. Another RSE case ended at 1530Z, 2 hrs before the start of the IOP.

DOW: performed well, between 1730-2230Z, except for 1735-1813Z (problem with power generator). Frequencies were manually stabilized in the beginning. RHI angle centered at 250°.

upwind data:

- Dixon: 3 soundings. Saratoga soundings at 19Z and also at 11Z (well before the IOP) and 06Z the next day (well after the IOP).
- Savery radiometer and O'Toole MRR and ceilometer were up.
- Savery GPS station was up!

## ASCII-12

### RF18 Flight Notes (French)

03 March, 2012

#### Crew

T Drew

Q Miao

J French

S Ward

#### Preflight

RSE case, planned generator turn on time of 1230 local, planning 1050 local take off time. Forecast clear in Laramie so should be able to complete 4 ladders and along wind with some additional loiter if necessary.

No issues at startup.

#### Flight

1750 wheels up

1800 everything up and running, no issues, all looks good

1813 CIP computer rebooted

#### *Ladder Pattern 1*

1816 begin leg 1

1820 end leg 1

1822 beg leg 2

1829 end leg 2

1831 beg leg 3

1835 end leg 3

1838 beg leg 4

1844 end leg 4

1846 beg leg 5

1850 end leg 5

#### *Ladder Pattern 2*

1855 beg leg 1

1902 end leg 1

1904 beg leg 2

1908 end leg 2

1910 beg leg 3

1916 end leg 3

1918 beg leg 4

1923 end leg 4  
1925 beg leg 5  
1931 end leg 5

*Along Wind*

1937 on line, 070 degree true ground track  
1946 end line  
Loiter for another ~15 minutes

*Ladder Pattern 3*

2001 begin leg 1  
2005 end leg 1  
2007 beg leg 2  
2013 end leg 2  
2015 beg leg 3  
2020 end leg 3  
2022 beg leg 4  
2028 end leg 4  
2030 beg leg 5  
2034 end leg 5

*Ladder Pattern 4*

2039 beg leg 1  
2046 end leg 1  
2048 beg leg 2  
2053 end leg 2  
2054 beg leg 3  
???? end leg 3 – lost LWC100  
2103 beg leg 4  
2107 end leg 4 – 2DP iced over  
2109 beg leg 5  
2115 end leg 5

*Along wind leg*

2122 on line at 070 deg True ground trk  
2131 end line

Done for the day, returning to Laramie

2153 wheels down

**Debrief**

Applanix omnistar was intermittent. Never went into XP mode, flipped back and forth between VBS and C/A

2DP iced over near end of last ladder.

LWC100 iced over in last ladder

CIP computer crashed early in flight.

No other instrument problems

## ASCII Research Flight (RF17) 2012-03-01

*Crew: Brett Wadsworth, Terry Deshler, Larry Oolman, Jayson Stemmler*

### Summary:

0135 Take off  
0150 CIP computer rebooted  
0159 Start first ladder, in and out of cloud tops  
0206 2<sup>nd</sup> leg, T/TD = -15/-18 C, winds=44 knots@230  
0213 3<sup>rd</sup> leg, T=-15 in cloud, -13 out  
0220 4<sup>th</sup> leg  
0227 5<sup>th</sup> leg, lights seen to NW  
0232 Finished with first ladder  
0236 Start second ladder, some downdrafts to -5 m/sec  
0244 2<sup>nd</sup> leg  
0252 3<sup>rd</sup> leg  
0257 4<sup>th</sup> leg, cloud layer above us 7-15,000 ft on south end of track, lights to NW.  
0305 Last leg  
0307 2D-P blocked  
0309 Done with second ladder,  
0315 Along wind leg toward 030 magnetic.  
0323 Done with research, climb to 15,000 ft  
0340 Land

Instrument issues: one crash of CIP, 2D-P iced up on last leg.

## **Battle Town site report 2/29/2012, 2<sup>nd</sup> IOP (Geerts) SEED then NOSEED**

IOP duration: 22-04Z – double back-to-back flight (2230Z-0030Z and 0134-0400Z), an ASCII case. UWKA flew 2 ladders in both flights, plus 1 along-wind leg (220°) on the 2<sup>nd</sup> flight. First flight with SEED, 2<sup>nd</sup> flight NOSEED.

weather: prefrontal SW flow, LL wind direction about 220°, yet cold, T steady around -7.7°C at BTS. Steady light to moderate snowfall, MRR tops around 1.5 km AGL between 2200-2345Z, decreasing to 1.0 km around 0000Z. Snowfall is very light between 1:10-3:45Z, and DOW reports at 0115Z that they can see the lights of Dixon to the SW. Snowfall is not showery, except maybe at the end (2:45-3:45Z), but even those showers are shallow (up to ~1.5 km AGL). Winds at 700 mb over Dixon were rather strong (~25 m/s in the first flight, ~18 m/s in the second flight) from the SSW (220-210°). There was an inversion at 650 mb and drier air aloft, consistent with the shallow precip. Slight veering of winds with height, esp across the inversion. The inversion persisted but lifted to ~600 mb in later soundings, close to the UWKA flight level. Winds at Battle Pass were rather weak, 8 m/s from about 250° between 22-01Z, and 10-11 m/s between 01-04Z. Clouds seemed rather shallow with a bit of blue sky showing early in the IOP (later on it was dark). On both flights the UWKA spends much time in clear air (maybe 1/3 of the time). Fairly little riming, many aggregates. BTS radiometer records integrated LW averaging around 0.05 mm, between 22-01Z. Savery radiometer also reports high LW (~0.15 mm on average) between 22-01Z. Well-marked cold front passed Battle after the IOP (~08Z).

synopsis: a good ASCII case. All instruments except hotplate worked. Good UWKA, DOW, BTS, and upwind data. Relatively shallow echoes. Another good orographic precip study also as we captured the entire storm at BTS over a period of some 36 hours (2/29 12 Z to 3/2 00Z ), including 2 UWKA flights and nearly 8 hrs of DOW data.

### BTS instruments:

- CPI up, Parsivel, MRR, radiometer operated fine, all day
- WXT520 collected data starting around 00Z.
- hotplate down
- Snow chemistry sampling: 3 sample during seeding, 3 samples after Ggen end
- Snow photography: worked well (all daytime).

Xia's snow photo summary: mostly rimed small snow particles.

- 22:18 : large dendrites (2 mm), dendrite branches and needles. Some dendrites are rimed.
- 00:21 : dendrites sizes grew smaller.  
00:39 : heavily rimed graupel and rimed small dendrites.
- 01:11 : large dendrites with diameter larger than 2 mm appear again. Rimed small dendrites occasionally show up.

AgI generators: 2.5 hours of seeding:

SM03 - Mill Creek      2126-2355Z  
SM04 - Sandstone      2128-2358Z  
SM06 - Cottonwood    2130-0000Z

DOW: performed well, continuously between 2200-0400Z, stable frequencies. Disk swap dead period between 0235-0243Z. RHI angle centered at 235° early in the IOP and 220° from 2330Z.

upwind data:

- Dixon: 4 soundings. one Saratoga sounding, at 03Z

- Savery radiometer and O'Toole MRR and ceilometer were up.
- Savery GPS station was up as well!

**2/29/2012 ASCII Pilot notes (Flight 16A)**

Crew: Wadsworth, French, Miao, Deschler

Flight Time: 2.1

Objective: Single Ascii Case.

Planned: 2 Ladder patterns. Planned to fly entire profile at 13,000 ft.

Actual: Departed LAR, climbed to 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. in a block of 13,000 – 15,000. Flew entire pattern at 13,000' as planned. Fairly light icing experienced. Fairly bumpy. On average had the throttles at 1750 ft-lbs with 1600 RPM props. Couple of times, early in flight had to use 2000 ft-lbs when in a bit of a downdraft along leg 5 for first ladder. Saratoga was clear all day as a divert if necessary. No issues.

## **ASCII-12**

### **RF15 Flight Notes (French)**

**29 February, 2012 second flight**

#### **Crew**

B Wadsworth

T Deshler

Q Miao

J French

#### **Preflight**

ASCII only case, but because of limitations working with WMI and start time for follow-on RSE case, we plan on conducting ops with 2 ladders and generators turned on. Then, return to LAR, refuel and come back out (flight 3) and conduct 2 ladders with generators off.

No issues at startup.

#### **Flight**

2230 wheels up

2239 everything up and running, no issues, all looks good

#### *Ladder Pattern 1*

2255 begin leg 1

2259 end leg 1

2302 beg leg 2

2307 end leg 2

2309 beg leg 3

2314 end leg 3

2316 beg leg 4

2321 end leg 4

2323 beg leg 5

2328 end leg 5

#### *Ladder Pattern 2*

2332 beg leg 1

2338 end leg 1

2340 beg leg 2

2345 end leg 2

2347 beg leg 3

2352 end leg 3

2354 beg leg 4

2359 end leg 4

0001 beg leg 5

0006 end leg 5

Done for the day, returning to Laramie

0028 wheels down

**Debrief**

Applanix omnistar was intermittent. 2DP lost at end of last leg.

No other instrument problems

**Battle Town site report 2/29/2012 (Geerts) MORNING IOP – Blowing snow**

IOP duration: 8:07am-11:35 am (15-19 Z) in support of a blowing snow flight

weather: quite windy, at Battle Pass the wind is estimated at 20 m/s before the IOP (6:15 am), wind from 230-250°, temp around -12°C, warming slowly. Winds weakened a bit during IOP at Battle Pass. The visibility was poor (<100 m) at 6:15 am at Battle Pass. Low clouds obscured the sky during most of the IOP at Battle Town site. It snowed lightly but steadily during the IOP, with a spell of very light snow centered at 1700 Z. During that spell the sun was visible, but it hardly cast a shadow – too faint b/o low (maybe also high) clouds. Snow did not fall in showers, instead, it was steady, with MRR tops around 1.0 km initially, lowering to 0.7 km. The snow crystals showed little riming, some dendrites and needles. The CPI also recorded numerous tiny, amorphous particles, presumably blowing snow. Yang Yang took some camera photos of the snow crystals. At Dixon, 8 m/s winds from the south, temp remained below freezing, and RH around 65%.

BTS instruments: CPI, MRR, Parsivel, and radiometer plus WXT520 weather station.

AgI generators: none

DOW: did not record data.

Soundings: two at Dixon near the start and the end of the UWKA flight

Savery radiometer and GPS, and O'Toole ceilometer & MRR were up as well!

**2/21/2012 ASCII Pilot notes (Flight 15)**

Crew: Drew, Miao, French

Flight Time: 3.6

Objective: Blowing Snow Case

Planned: Two Blowing Snow patterns.

Actual: Departed LAR VFR to area. Conditions were marginal for VFR, so picked up the IFR clearance to complete rest of the legs under IFR at 13,000.

Did two complete BS patterns and the first 3 legs of a third. Turned northwest bound parallel to line 4-5 and completed sounding. Returned to Laramie.

**ASCII2012 Flight Scientist Report  
Qun Miao**

**Wednesday, 29 Feb. 2012**

**Flight one**

**IOP 15**

**Crew:** Tom Drew, Qun Miao, Jeff French

**Objective:** Blowing snow

**Flight Details:** Takeoff and landing times were 1506 and 1834 UTC. Designed blowing snow case patterns were conducted. Various flight levels were tried to get optimal results and good visibility.

**Weather notes:**

Winds at Laramie was not high, around 30 knots and the visibility was not very good as well. At the target area, the clouds were thick and it was snowing over the mountains. The conditions were better on the upwind side legs and northern legs.

**Legs (local time):**

Leg1, 0827 -0838      BL01-BL02

Flight level 12.5 kft, hard to tell if we are above clouds. Can't see the ground.

Near cloud top, WCR showed thin clouds. No radar returns near ground.

Leg2, 0842-0846      BL02-BL03

Flight level 9 kft

Waited for traffic

Fly up to 13 kft to stay above clouds

Leg3, 0900-0906      BL03-BL04

Ground can be seen at places.

Leg4, 0910-0918      BL04-BL05

Can see ground. Around 0914, may have good signals of blowing snow.

Leg5, 0922-0935      BL05-BL06

At the N end, no radar returns near ground.

Around 0928, interesting double-layer. Lower one touching ground.

Repeat the pattern

Leg1, 0938-0952      BL01-BL02

West part cleared up

Leg2, 0954-0958      BL02-BL03

Leg3, 1001-1007      BL03-BL04

Leg4, 1009-1018      BL04-BL05

Clouds were not dense, but with higher Z to the ground. Some interesting features.

Leg5, 1020-1033      BL05-BL06

At N end, Lower Cu, looking dense, with lower Z. Not much sign of blowing snow

Still had some time, did leg1-3

Leg1, 1037-1050      BL01-BL02

Leg2, 1053-1057      BL02-BL03

Leg3, 1059-1105      BL03-BL04

Sounding flight

Landing at Laramie    1134 MST

## ASCII-12

### RF15 Flight Notes (French)

29 February, 2012 first flight

#### Crew

T Drew

Q Miao

J French

#### Preflight

Plan for blowing snow case, working around clouds may prove problematic. Will try to conduct ops VFR, but if clouds get in the way may end up doing everything IFR at FL130

No issues at startup.

#### Flight

1507 wheels up

1520 everything up and running, no issues, all looks good

There are definitely clouds over the mountains, will try to conduct ops VFR, but leg over the mountains will need to be at least FL125

#### *Blowing Snow Pattern 1*

1527 begin leg 1

1538 end leg 1 first leg showed echo to the ground over almost entire leg

1542 beg leg 2 at FL090

1546 end leg 2 this leg was beneath cloud with no cloud/precip echo...

No way to complete these legs VFR, orbit while we pick up IFR clearance and setup to complete patterns at FL130

1600 beg leg 3

1606 end leg 3

1610 beg leg 4

1618 end leg 4 some blowing snow evident on WCR

1622 beg leg 5

1635 end leg 5

#### *Blowing Snow Pattern 2*

1639 beg leg 1

1652 end leg 1

1654 beg leg 2

1659 end leg 2

???? beg leg 3

1707 end leg 3

1709 beg leg 4  
1718 end leg 4  
1720 beg leg 5  
1733 end leg 5

*Blowing Snow Pattern 3*

1737 beg leg 1  
1751 end leg 1  
1753 beg leg 2  
1757 end leg 2  
1759 beg leg 3  
1805 end leg 3

Only enough fuel to complete 3 legs on this 3<sup>rd</sup> pattern, setup for sounding then RTB.

*Sounding on north end of pattern*

1806 beg sounding  
1811 end sounding

Done for the day, returning to Laramie

1833 wheels down

**Debrief**

Applanix omnistar was intermittent. CIP computer rebooted once. No other instrument problems

## **Battle Town site report 2/28/2012, 2<sup>nd</sup> IOP (Geerts)**

IOP duration: 19-00Z – single flight (1925-2300Z), an ASCII case. UWKA flew 4 ladders plus 1 along-wind leg (270°).

weather: post-frontal, strong westerly flow behind a deep closed 700 mb low that had moved just north of the SM around 15Z, pressure gradually rising during IOP. Deep trough aloft, little westward tilt with height. Dixon sounding 700 mb winds 17-18 m/s from 265° early in the IOP, veering to 290° late in the IOP. Wind at Battle Pass about 20 m/s also slowly veering during IOP. The wind at the level of the generators (750 mb) was a little backed relative to the 700 mb wind, so I think the northernmost Ggen did affect Battle Pass.

Early in the IOP, DOW reports a shallow precip layer (1.4 km deep) up to 15-20 dBZ separated from a snow layer at 3-5 km AGL. WCR captures this layer aloft as well. Dixon soundings confirm dry layer between 4.4-6.0 km AGL, as well as some drying aloft and near surface during IOP. Late in the IOP, reflectivity weakens to 0-5 dBZ, but showers continue across the area well after the IOP end (more snowfall 2-4Z). Cloudy during the IOP, except for some blue sky towards the end. Radiometer LW rather high throughout IOP, from 1630Z till 03Z, with spikes over 0.2 mm, and some dry periods.

synopsis: a good ASCII case. All instruments except hotplate worked. Good UWKA, DOW, BTS, and upwind data. Relatively shallow echoes, with more riming than the morning IOP. This is a good orographic precip study also as we captured the entire storm at BTS over a period of some 36 hours (2/28 00 Z to 2/29 12 Z), including 10 hrs of DOW data.

### BTS instruments:

- CPI up.
- Parsivel, WXT520, radiometer operated fine, all day
- MRR faulted at 2042 Z and was restarted about 1 hour later (2145 Z)
- hotplate down
- Snow chemistry sampling: 3 sample before seeding, 3 samples after Ggen ignition
- Snow photography: worked well (all daytime).

Yang Yang's snow photo summary: mostly rimed small snow particles.

- 1917: densely rimed stellar crystals, rimed plates, rimed needles, graupel particles and rimed broken branches
- 2058: No graupel anymore. Slightly rimed dendrites (about 2 mm diameter).
- 2125: smaller dendrites and needles, some plates; they were clearly rimed.
- 2208: some graupel larger than 1 mm.
- 2219-2300: Slightly rimed dendrites sizes larger than 2 mm and broken branches. No graupel particles.

AgI generators: two hours of seeding:

SM03 - Mill Creek	2053 to 2255Z
SM04 - Sandstone	2055 to 2258Z
SM06 - Cottonwood	2056 to 2300Z

DOW: performed well, continuously between 1905-2350Z, stable frequencies. RHI angle centered at 265° early in the IOP and 285° late in the IOP.

upwind data:

- Dixon: 3 soundings. No Saratoga soundings
- Savery radiometer and O'Toole MRR and ceilometer were up.

**2/28/2012 ASCII Pilot notes (Flight 14)**

Crew: Wadsworth, Miao, French, Sever

Flight Time: 3.5

Objective: Single ASCII Case

Planned: 4 Ladder patterns, 1 Along-wind leg. Planned to fly entire profile at 13,000 ft.

Actual: Departed LAR, climbed to 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. in a block of 13,000 – 16,000. Flew entire pattern at 13,000' as planned. Fairly light icing experienced. Kept props at 1600 RPM throughout flight. Never had to exceed 1600 ft-lbs. Landed back at KLAR with 1085 lbs fuel.

**ASCI2012 Flight Scientist Report  
Qun Miao**

**Tuesday, 28 Feb. 2012**

**Second flight**

**IOP 14**

**Crew:** Brett Wadsworth, Qun Miao, Jeff French, Gokhan Sever

**Objective:** Single IOP (ASCI only)

**Flight Details:** Takeoff and landing times were 1926 and 2254 UTC. Four "ladder" patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the second ladder around 2109 UTC. The icing was minor. All legs were at 13 kft.

**Weather notes:**

700 mb wind direction was set at 270°. On the way to the target area, we flew between two layers of clouds. The upper one's cloud top was 3.5 -4 km above flight level. In the target area, convective cumulus-like clouds were observed. Some heavy snow was observed with large snow crystals. LW was mostly low, with some higher values at bumpy occasions.

**Ladders (local time):**

Ladder1

L5, 1251-1256 from north end, at top of lower clouds, snow crystals, some LW  
L4, 1258-1303 sun seen through higher clouds, strong plumes (for L5 too), LW up to 0.7  
L3, 1305-1310 200+ concentration, 15um, LW0.3, wind 30 knots  
L2, 1311-1317 LW up to 1.0, snow crystals  
L1, 1319-1323 N end upper clouds clear up, middle part – snow and bumpy, all legs have convective clouds.

Ladder2

L5, 1328-1333 from S end, convective, hi reflectivity seen  
L4, 1335-1340 bumpy over BPK, heavy snow, hi reflectivity  
L3, 1342-1347 large particles, LW up to 0.7  
L2, 1349-1354 hi clouds thin, lower reflectivity  
L1, 1356-1402 higher reflectivity, low LW

Along-wind leg 1409-1417, 270 degrees

The seeding generators were turned on at 13:53 MST.

Ladder3

L5, 1421-1427 from S end, cloud shallower  
L4, 1429-1433 wind 42-43 knots, LW0.3 when bumpy  
L3, 1435-1441 LW 0.6 at bumpy places  
L2, 1443-1447 Low reflectivity

L1, 1450-1456

Ladder4

L5, 1500-1505 from N end, lower Z, higher Z towards the south

L4, 1507-1513 300+ concentration, LW 1.0, small droplets

L3, 1515-1519 400+ conc, 6-7um, low LW, higher LW at places

L2, 1521-1527 Z not high, N end low clouds clear up

L1, 1529-1533

Seeding generators on 13:53 MST.

Landing at Laramie 1554.

## **ASCII-12**

### **RF14 Flight Notes (French)**

**28 February, 2012 second flight**

#### **Crew**

B Wadsworth

Q Miao

G Sever

J French

#### **Preflight**

Plan for RSE case, but shortly after takeoff was informed that WMI released case for ASCII. Forecast for LAR improved over earlier flight, does not require an alternate, expect that we should be able to conduct along wind leg.

No issues at startup.

#### **Flight**

1926 wheels up

1935 everything up and running, no issues, all looks good

Do not expect to find much liquid today, should be able to complete entire pattern at FL130

#### *Ladder 1*

1951 begin leg 1

1956 end leg 1

1958 beg leg 2

2003 end leg 2

2005 beg leg 3

2009 end leg 3

2011 beg leg 4

2017 end leg 4

2019 beg leg 5

2023 end leg 5

#### *Ladder 2*

2028 beg leg 1

2033 end leg 1

2035 beg leg 2

2040 end leg 2

2041 beg leg 3

2047 end leg 3  
2049 beg leg 4  
2054 end leg 4  
2056 beg leg 5  
2102 end leg 5

*Along wind leg*

2109 beg along wind 090 true  
2117 end along wind

*Ladder #3*

2121 beg leg 1  
2127 end leg 1  
2129 beg leg 2  
2133 end leg 2  
2135 beg leg 3  
2141 end leg 3  
2143 beg leg 4  
2147 end leg 4  
2150 beg leg 5  
2156 end leg 5

*Ladder #4*

2200 beg leg 1  
2205 end leg 1  
2207 beg leg 2  
2213 end leg 2  
2214 beg leg 3  
2219 end leg 3  
2221 beg leg 4  
2227 end leg 4  
2229 beg leg 5  
2233 end leg 5

Done for the day, returning to Laramie

2253 wheels down

**Debrief**

Applanix omnistar was intermittent. No other instrument problems

## **Battle Town site report 2/28/2012, 1<sup>st</sup> IOP (Geerts)**

IOP duration: 13-18Z – single flight (1333-1655Z), an ASCII case. UWKA flew 4 ladders, no along-wind leg.

weather: a deep closed 700 mb low moved just north of the SM during the IOP (lowest pressure at 15Z, pressure change very gradual). Deep trough aloft, little westward tilt with height. Dixon sounding 700 mb winds 15 m/s from 245° early in the IOP, strengthening somewhat during IOP. Temperature at Battle Pass about -5.5°C at 13°Z, cooling steadily to -8.5°C at 18Z. Wind at Battle Pass about 15 m/s from 245 at 13 Z, increasing to 18 m/s on average between 14-16Z, and decreasing to 15 m/s between 16-18Z. Wind direction stayed steady, backing slightly during the IOP. Excellent advection of IN towards Battle Pass.

Deep clouds, tops near the tropopause at about 10 km (-47°C), according to WCR and DOW7. Dixon soundings lapse rate is near moist-adiabatic to the tropopause. Strong, deep echoes from the IOP start, with reflectivity up to 25 dBZ below 2 km AGL. DOW reports some SSW-NNE oriented snowbands at 13-14Z. Storm tops decreased during the IOP, esp after 15 Z. Reflectivity decreased esp between 16-17Z. Rather little integrated LW (from BTS radiometer), less than 0.1 mm (average 0.01 mm), except between 1630-1800Z, when integrated LW peaks at 0,3 mm (average 0.1 mm). Cloudy throughout IOP, rather dark b/o deep cloud. UWKA records LW in Ladder 1 on legs 1,2, but no liquid water on legs 3,4,5, and very little LW on the remaining 3 ladders.

synopsis: an excellent ASCII case. All instruments except hotplate worked. Good UWKA, DOW, BTS, and upwind data. Heavy snowfall from a deep storm. Generally very little riming, except between 17-18Z. This is a good orographic precip study also as we captured the entire storm at BTS, starting with the first elevated echoes (snow sublimating before reaching ground), to a series of deep showers overnight, and then more continues mod/heavy snow during the IOP.

### BTS instruments:

- CPI up starting the evening before (01Z), before the precip developed.
- Parsivel, WXT520, MRR, radiometer operated fine, all day
- hotplate down
- Snow chemistry sampling: 3 sample before seeding, 3 samples after Ggen ignition
- Snow photography: worked well (all daytime).

Yang Yang's snow photo summary: little riming at first, more riming around 1700, with graupel. Many blowing snow particles

- 1307: needles, irregular, broken branches and small ice particles
- 1422: few densely rimed stellar crystals and small rimed particles
- 1445: small amount of lump graupel particles and large amount of small rimed particles
- 1456: aggregates
- 1513: small rimed broken branches, rimed minute columns, many irregular shapes
- 1535: small amount of graupel particles, plates and dendrites. Some of the dendrites were rimed.
- 1714: lump graupel particles with size larger than 2 mm and highly rimed dendrites. Other particles were all small rimed particles. This is consistent with the radiometer-observed LW increase at this time.

AgI generators: two hours of seeding:

SM03 - Mill Creek	1500 to 1656Z
SM04 - Sandstone	1504 to 1658Z
SM06 - Cottonwood	1506 to 1700Z

DOW: performed well, continuously between 1300-1748Z, stable frequencies. RHI angle centered at 245 degrees the entire IOP.

upwind data:

- Dixon: 3 soundings. No Saratoga soundings
- Savery radiometer and O'Toole MRR and ceilometer were up, but Savery radiometer went down 14:15-18:15Z.

**2/28/2012 ASCII Pilot notes (Flight 13)**

Crew: Drew, Miao, French, Wurman

Flight Time: 3.4

Objective: Single Ascii Case

Planned: 4 Ladder patterns

Actual: Departed LAR 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000. Flew five rung ladder at 13,000 from East to West alternating starting points four times. Returned to LAR.

**ASCII2012 Flight Scientist Report  
Qun Miao**

**Tuesday, 28 Feb. 2012**

**Flight one**

**IOP 13**

**Crew:** Tom Drew, Qun Miao, Jeff French, Josh Wurman

**Objective:** Single IOP (ASCII only)

**Flight Details:** Takeoff and landing times were 1333 and 1650 UTC. Four "ladder" patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the last ladder around 1626 UTC. The icing was minor. All legs were at 13 kft

**Weather notes:**

It was snowing at Laramie. 700 mb wind direction was set at 250°. Wind was variable from 30 to 50 knots at the flight level. There were plenty of clouds and they were quite deep, 4 to 5 km above the flight level. Some heavy snow was observed with large snow crystals. LW was mostly low, with some higher values at the upwind side legs.

**Ladders (local time):**

Ladder1

L5, 0659-0704      deep clouds, smooth flight, very low LW  
L4, 0706-0711      some WCR Z plumes seen from the ground  
L3, 0713-0718      some LW up to 0.4, high Z above flight-level  
L2, 0720-0725      some LW  
L1, 0727-0731

Ladder2

L5, 0736-0741      stronger wind compared to upwind side (50 vs 30 knots)  
L4, 0743-0748      large snow crystals, 6 mm  
L3, 0751-0756      large particles, LW up to 0.7  
L2, 0758-0803      L4,3,2 southern ends snow heavier  
L1, 0805-0810

No along-wind leg

The seeding generators were turned on at 8:00 MST.

Ladder3

L5, 0814-0819  
L4, 0821-0826  
L3, 0828-0833  
L2, 0835-0840  
L1, 0842-0847

Ladder4

L5, 0851-0856      clouds above flight level thinner

L4, 0858-0903

L3, 0905-0910 lots of LW, icing, many instruments out, mission aborted

L2, 0912-0917

L1, 0919-0924

Along wind leg, 0926-0932

Landing at Laramie 0950

**ASCII-12**

**RF13 Flight Notes (French)**

**28 February, 2012**

**Crew**

T Drew

Q Miao

J Wurman

J French

**Preflight**

ASCII only case. Forecast at LAR requires an alternate, this will preclude our ability to fly an along wind leg, will plan on four ladder patterns. Snow started falling at LAR just before pullout, decided to pullout under power right before takeoff.

No other issues at startup.

**Flight**

1333 wheels up

1345 everything up and running, no issues, all looks good

Very deep clouds with snow, do not expect to find much liquid today, should be able to complete entire pattern at FL130

*Ladder 1*

1348 begin leg 1

1404 end leg 1

1406 beg leg 2

1411 end leg 2

1413 beg leg 3

1418 end leg 3

1420 beg leg 4

1426 end leg 4

1427 beg leg 5

1431 end leg 5

*Ladder 2*

1436 beg leg 1

1441 end leg 1

1443 beg leg 2

1449 end leg 2

1451 beg leg 3  
1456 end leg 3  
1458 beg leg 4  
1502 end leg 4  
1504 beg leg 5  
1510 end leg 5

*No Along wind leg*

*Ladder #3*

1514 beg leg 1  
1519 end leg 1  
1521 beg leg 2  
1526 end leg 2  
1528 beg leg 3  
1533 end leg 3  
1535 beg leg 4  
1540 end leg 4  
1542 beg leg 5  
1547 end leg 5

*Ladder #4*

1551 beg leg 1  
1556 end leg 1  
1558 beg leg 2  
1603 end leg 2  
1605 beg leg 3  
1610 end leg 3  
1612 beg leg 4  
1617 end leg 4  
1619 beg leg 5  
1624 end leg 5

Done for the day, returning to Laramie

1648 wheels down

**Debrief**

Six WCR "port scrambles, unually large number; Applanix omnistar was intermittent. No other instrument problems

## **Battle Town site report 2/22/2012 (Geerts)**

IOP duration: 13-18Z – single flight (1336-1700Z), an ASCII case.

weather: very strong winds associated with a strong 700 mb W\_E height gradient and a strong jet aloft . DOW anemometer recorded winds averaging 20 m/s, strengthening during the IOP. There was a lot of blowing snow. The particles are so fine and numerous that they reduce the visibility (while on a snowmobile for instance) to just tens of meters, and one can see billows going up above tree canopy, probably much higher in PBL turbulence, because they are so small and have negligible fallspeed. The CPI recorded a lot of tiny (20-30 micron) non-spherical particles today, probably blowing snow. It was fairly warm, Dixon 700 mb temperatures were -5.1, -4.4, -4.2C, for the 3 soundings during the IOP. It was cloudy throughout the IOP at BTS.

synopsis: an excellent ASCII case. First time all instruments worked. Good UWKA, DOW, BTS, and upwind data. The high temperatures and the extensive blowing snow may diminish the seed effect.

### BTS instruments:

- CPI up starting 1445Z. The CPI continued to work into the next day. A strong cold front passed around 6Z (11 pm 2/22), with some brief deep shower with 30 dBZ. Might make an interesting study, since all BTS data are available (no DOW).
- Parsivel, WXT520, MRR, radiometer operated fine, all day
- hotplate down
- Snow chemistry sampling: 1 sample before seeding, 2 samples with seed
- Snow photography: worked well (all daytime).

Yang Yang's snow photo summary: Small graupel particles with diameter about 1 mm were continuously observed.

- 13:08 : small graupel particles with diameter about 1 mm.
- 14:03 : graupel particles with size up to about 2 mm diameter. Corn like graupel particles with diameter about 2 mm.
- 15:02 : Rimed columns and needles. Graupel particles with diameter up to 2 mm.
- 16:28 : Rimed stellar crystals.
- 16:37 : Corn like graupel particles with 2 mm diameter.
- 17: 00-17:10: graupel particles larger than 2.5 mm.
- 17:11 : Heavily rimed dendrites with diameter up to 3 mm.
- 17:40 : Cornlike graupel particles with diameter up to about 1.5 mm.

AgI generators: two hours of seeding:

SM03 - Mill Creek	1507 to 1705Z
SM04 - Sandstone	1509 to 1708Z
SM06 - Cottonwood	1510 to 1710Z

DOW: performed well, continuously between 13-18Z. RHI angle centered at 270 degrees the entire IOP.

### upwind data:

- Dixon: 3 soundings, plus two soundings collected after the end of the IOP. These were “case-calling” soundings, for a possible second afternoon IOP. It became too warm for another IOP.
- Savery radiometer and O'Toole MRR and ceilometer were up.

**2/22/2012 ASCII Pilot notes (Flight 12)**

Crew: Wadsworth, Miao, French, Zhorov

Flight Time: 3.4

Objective: Single Ascii Case

Planned: 4 Ladder patterns, 1 Along-wind leg. Lots of moisture in the forecast & models. Even Bart suggested we proceed with caution. Planned to fly first ladder or two at 16,000 if necessary.

Actual: Departed LAR, climbed to 17,000 direct to CKW 135@37. Requested 20 nm radius of pt. in a block of 13,000 – 16,000. Tops of clouds over the ladder were visible and were estimated around 14,000'. Flew 5 rung ladder, first time started at 14,500 from East to West alternating starting points. On leg 3, climbed to 15,000 as there was heavier icing on that leg. Remained at 15,000 for remainder for the first 3 ladders and the along-wind leg. Descended to 14,000 for last ladder. On leg 3, aircraft performance was degrading so elected to abort the flight. Crosswinds component at KLAR was greater than 25 kts., with a contaminated runway. Landing wasn't my best

**ASCII2012 Flight Scientist Report  
Qun Miao**

**Wednesday, 22 Feb. 2012**

**Crew:** Brett Wadsworth, Irina Zhorov, Jeff French, Qun Miao

**Objective:** Single IOP (ASCII only)

**Flight Details:** Takeoff and landing times were 1336 and 1657 UTC. Four "ladder" patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the second ladder around 1525 UTC. The forecasted LW was very high in the target area. To avoid aborting the mission due to the icing, the flight level was set at 14.5 kft. Large LW drops (30 um) were observed in the first ladder. Ground observation confirmed high LW content. Many KA instruments did not function due to the icing when KA descended to 14 kft in the last ladder.

**Weather notes:**

700 mb wind direction was set at 270°. Wind was very strong up 50 to 60 knots at the flight level. The flight to the target area was bumpy at the lee side of the mountains. At the target area, KA was mostly flying right above the low clouds and some high level clouds were present. Clouds were deeper at the southern sides. LW was observed by the WCL at most of the time.

**Ladders (local time, pm):**

Ladder1 14.5 kft level

L5, 0706-0709

L4, 0712-0718 cloud top of low clouds is 200-300 meters below flight level

L3, 0720-0724 30 micro drops observed, 2 radiometers show hi LW, KA up to 15 kft

L2, 0727-0733

L1, 0735-0739 1<sup>st</sup> ladder fast, 23 min

Ladder2

L5, 0743-0750

L4, 0752-0758

L3, 0800-0805

L2, 0806-0810

L1, 0812-0819

Along-wind leg 0825-0833

Loitering for a while to let the Agl disperse

The seeding generators were turned on at 8:10 MST.

Ladder3 Condition remained very steady. Clouds above KA are thin and high.

L5, 0838-0845

L4, 0846-0850

L3, 0852-0859

L2, 0901-0905

L1, 0907-0913

Ladder4 try 14 kft

L5, 0918-0922 still above the cloud top

L4, 0924-0931 in the clouds, hi LW

L3, 0933-0937 lots of LW, icing, many instruments out, mission aborted

L2,

L1,

Landing at Laramie 0951 pm

Landing was very rough due to the strong cross wind and ice/snow on the runway.

The seeding generators were turned on at 8:10 MST. The timing is great.

## ASCII-12

### RF12 Flight Notes (French)

22 February, 2012

#### Crew

B Wadsworth

I Zhorov

Q Miao

J French

#### Preflight

ASCII-only case, early AM takeoff. Expect 4 hour flight with four full ladder patterns. RT model is showing lots of liquid water, radiometer is also showing large LWP—battle reports icing with drops to 30 micron on CPI. Plan to be conservative flying in the clouds—maybe try to do most work on top of the clouds. No issues at startup.

#### Flight

1336 wheel up

1355 everything up and running, no issues, all looks good

Picked up some ice crossing the Snowies at FL170—based on visual, decided to conduct first ladder at FL145 which will be above the tops of the clouds most of the time.

#### *Ladder 1 begin at FL145*

1406 begin leg 1

1409 end leg 1

1412 beg leg 2

1418 end leg 2

1420 beg leg 3

Got into 1 g/m<sup>3</sup> of 30+ micron drops—ice built up quick—decided to climb to FL150 to get above

1424 end leg 3

1427 beg leg 4

1433 end leg 4

1435 beg leg 5

1438 end leg 5

FL150 kept above clouds almost entirely, trimming the tops on the middle and upwind legs

#### *Ladder 2 @ FL150*

1443 beg leg 1

1451 end leg 1

1452 beg leg 2  
1456 end leg 2  
1458 beg leg 3  
1505 end leg 3  
1506 beg leg 4  
1510 end leg 4  
1512 beg leg 5  
151? end leg 5

*Along wind leg @ FL150*

1525 begin along wind leg with ground track 080 deg True  
1533 end along wind leg, setting up for next set of ladders

*Ladder #3 @ FL150*

1537 beg leg 1  
1545 end leg 1  
1546 beg leg 2  
1550 end leg 2  
1552 beg leg 3  
1559 end leg 3  
1601 beg leg 4  
1604 end leg 4  
1607 beg leg 5  
end leg 5

Clouds seem to be thickening (tops getting a bit higher) on legs 3 & 4, particularly south end. We're going to try to get into the clouds more on ladder 4, so at least start at FL140 and see where that puts us.

*Ladder #4 @ FL140*

1618 beg leg 1 above/skimming tops on this leg  
1621 end leg 1  
1624 beg leg 2 into the clouds on this leg, CLWCs to ~0.8 g/m<sup>3</sup>, 30 micron drops,  
1631 end leg 2  
1632 beg leg 3  
1636 decide that we need to start climbing, picking up too much ice  
1637 end leg 3  
Poor climb performance, decide to abort mission and return to laramie

1656 wheels down

**Debrief**



## **Battle Town site report 2/21/2012 (Geerts)**

IOP duration: 1910-0010Z – single flight (1935-2325Z), an RSE case.

weather: This was the day with 3 back-to-back RSE cases, a record. The reasons are: persistent high LW, winds in the right sector (about 240 near Dixon, 260 at Battle Pass), and cold enough. Each RSE case is 4 hrs long, and followed by a 4 hr buffer. The ASCII IOP was a piggyback on the third RSE case. Some effect of the 2<sup>nd</sup> RSE case is possible at the beginning of the IOP: the 2<sup>nd</sup> RSE ended at 1718Z. Although this is unlikely, given the strong winds. These winds are associated with a strong 700 mb gradient and a strong jet aloft, from the WNW. The DOW measured average winds of 20-22 m/s during the IOP, with gusts over 30 m/s. The 3 Dixon soundings had winds 15-18 m/s at 700 mb. Temperature increased slightly from -9 to -8C at BTS during the IOP, the Dixon sounding 700 mb temps were -9.1, -8.4, and -8.3C. It was cloudy throughout the IOP, no sun at BTS. It snowed steadily, lightly at first and then heavier starting at 2100Z, about 20 min before the GGen were fired. Snow particles were generally small and rimed. Sometimes graupel or small hail fell.

synopsis: a good case. Good UWKA, DOW, BTS, and upwind data. All instruments but the hotplate worked. The UWKA did 4 ladders, but ladders #2, #3, and the last part of #4, and the long along-wind leg after ladder #2 were at 16 kft.

### BTS instruments:

- CPI up!! starting at 1830Z
- hotplate down – taken back to Laramie for repair/replacement.
- Parsivel, WXT520, radiometer operated fine, starting the previous day, continuing to the next day
- MRR ran fine and then quit at 2210Z. Restarted after the IOP, 0020Z
- Snow chemistry sampling: 1 sample before seeding, 2 samples with seed
- Snow photography: worked well (all daytime); most particles are rimed.

Yang Yang's snow photo summary: heavily rimed dendrites were common

19:22: Graupel-like dendrites with diameter about 2 mm were continuously observed. Small graupel particles with diameter less than 1 mm. Rimed columns and needles about 1mm.

19:08: Aggregated snow flakes. Densely rimed stellar crystals, densely rimed plates and rimed needles.

19:48-00:10: Corn-like graupel particles with about 1.5 mm diameter, rimed dendrites with about 3 mm diameter and small graupel particles with diameter less than 1.5 mm.

AgI generators: Four hours of seeding using 8 Ggens over either the SM or the MB starting between 2110-2120Z

DOW: performed well, continuously between 1800-0010Z. RHI angle centered at 260 degrees the entire IOP.

### upwind data:

- Dixon: 3 soundings, 20:10, 21:20, and 22:30 UTC. Plus 3 Saratoga soundings, 13, 21, and 01Z. All soundings OK.
- Savery radiometer and O'Toole MRR and ceilometer were up.

**2/21/2012 ASCII Pilot notes (Flight 11)**

Crew: Drew, Miao, French, Baker

Flight Time: 3.9

Objective: Single Ascii Case

Planned: 4 Ladder patterns, 1 Along-wind leg.

Actual: Departed LAR 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000. Flew 5 rung ladder, one time at 13,000 from East to West alternating starting points. At the end of the last leg decided to climb to 16,000 due to icing of aircraft. Did next two ladders and crosswind at 16,000. Repeated a shortened cross-wind to delay a little more. On last ladder decided to descend again to 13000. However, after the 3<sup>rd</sup> leg decided to go back to 16000 due to ice. Returned to LAR.

**ASCII2012 Flight Scientist Report  
Qun Miao**

**Tuesday, 21 Feb. 2012**

**Crew:** Tom Drew, Qun Miao, Jeff French, Scott Baker

**Objective:** Single IOP (ASCII RSE joint case)

**Flight Details:** Takeoff and landing times were 1932 and 2321 UTC. Four "ladder" patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the second ladder around 2117 UTC. The icing was severe after the first ladder. Some legs were conducted at 16 kft level to avoid icing. Many KA instruments did not function due to the icing.

**Weather notes:**

700 mb wind direction was set at 260°. The flight to the target area was bumpy at the lee side of the mountains. At the target area, a great deal of clouds was present, both above and below the flight level. The cloud top was about 1.5 km above the flight level. Clouds were deeper at the southern sides. LW was pretty high throughout the flight.

**Ladders (local time, pm):**

Ladder1 13 kft level

L5, 1257-0101      Cloud top 1.5 km above flight level

L4, 0103-0110      Cloud top lower at the northwest end

L3, 0112-0117

L2, 0119-0124      KA instruments on and off

L1, 0126-0130

Ladder2              too much ice, fly at 16 kft level. Many KA instruments not working well.

L5, 0136-0142      2" of ice on everything

L4, 0144-0148

L3, 0150-0156

L2, 0158-0202

L1, 0205-0210      cloud abv KA clears up

Along-wind leg    0217-0226

Loitering for a while to let the Agl disperse

The seeding generators were turned on at 2:20 pm MST.

Ladder3

L5, 0243-0247

L4, 0249-0257

L3, 0259-0303

L2, 0305-0312

L1, 0314-0317

Ladder4 try 13 kft

L5, 0321-0328

L4, 0330-0334

L3, 0336-0342    lots of LW, icing  
L2, 0347-0350    back to 16 kft to avoid icing  
L1, 0353-0359

Landing at Laramie    0421 pm

## ASCII-12

### RF11 Flight Notes (French)

21 February, 2012

#### Crew

T Drew

Q Miao

S Baker

J French

#### Preflight

RSE case. Early-afternoon takeoff. Expect 4 hour flight with four full ladder patterns.

No issues at startup.

#### Flight

1932 wheels up

1948 everything up and running, no issues, all looks good

#### *Ladder 1*

1957 begin leg 1

2001 end leg 1

2003 beg leg 2

2010 end leg 2

2012 beg leg 3

2016 end leg 3

???? beg leg 4

2024 end leg 4

???? beg leg 5

2034 end leg 5

Collected lots of ice during pattern, at times during pattern lost CDP, LWC100, 2DP, & FSSP. Liquid water contents to 1 g/m<sup>3</sup>, drops to 25 micron. Decided we could not complete flight if we continued to collect so much ice, so decided to go up to FL160 for next few ladders

#### *Ladder 2 @ FL160—above tops of clouds*

2035 beg leg 1

2042 end leg 1

???? beg leg 2

2048 end leg 2

2050 beg leg 3

2056 end leg 3

2058 beg leg 4  
2102 end leg 4  
2105 beg leg 5  
2111 end leg 5

During ladder, fssp came back, looks like LWC100 came back (although clear air values look a little screwy), 2DP came back near end of ladder

#### *Along wind leg*

2117 begin along wind leg with ground track ??? deg True  
2126 end along wind leg, setting up for next set of ladders  
Loitered some additional time to give seeding material time to spread across range

#### *Ladder #3*

2143 beg leg 1  
2147 end leg 1  
2149 beg leg 2  
2157 end leg 2  
2159 beg leg 3  
2202 end leg 3  
2205 beg leg 4  
2211 end leg 4  
2213 beg leg 5  
2217 end leg 5

Decide to go back down to FL130 to see if we can complete ladder in situ...

#### *Ladder #4*

2221 beg leg 1  
2228 end leg 1  
2230 beg leg 2  
2234 end leg 2  
2236 beg leg 3  
2242 end leg 3

At some point FSSP went out to lunch, collecting lots of ice, decide to climb back to FL160 to complete pattern

2247 beg leg 4  
2250 end leg 4  
2252 beg leg 5  
2258 end leg 5

Done for the day, returning to Laramie

2321 wheels down

## **Debrief**

Picking up lots of ice at FL130 through the first ladder—it was clear that we could not complete the flight if we were to stay in the icing—both because of fuel concerns and that instruments were dropping off line. Following first ladder we went to FL160—to complete ladders 2 & 3. This turned out to be a good compromise to allow us to collect the remote sensing data without needing to abort the flight. On beginning of last ladder, we decided to try FL130 to get back into the clouds. By 3<sup>rd</sup> leg we were collecting too much ice and climbed for last two legs.

**2/14/2012 ASCII Pilot notes (Flight 10)**

Crew: Drew, Miao, French, Ward

Flight Time: 3.8

Objective: Single Ascii Case

Planned: 4 Ladder patterns, 1 Along-wind leg.

Actual: Departed LAR 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000. Flew 5 rung ladder, 4 times at 13,000 from East to West alternating starting points. Did along wind leg over Bridger Peak Site at 13,000 between Ladder 2 and 3 and again after ladder 4. Returned to LAR.

**ASCII2012 Flight Scientist Report  
Qun Miao**

**Tuesday, 14 Feb. 2012**

**Crew:** Tom Drew, Qun Miao, Jeff French, S Ward

**Objective:** Single IOP (ASCII only)

**Flight Details:** Takeoff and landing times were 2230 and 0210 UTC. Four "ladder" patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the second ladder around 0016 UTC. Another along-wind leg was conducted after the fourth ladder around 0147 UTC. All flight legs were conducted at a height of 13,000' msl. The icing was minor.

**Weather notes:**

700 mb wind direction was set at 270°. A great deal of clouds was present, both above and below the flight level in the target area. The cloud top was about 1.5 km above the flight level. Cloud top seemed to be lowered with time. Clouds above the flight level are mostly ice cloud. To the southeast end of the ladder, the clouds were deeper. LW was low for the most of the time at flight level. Below flight level, there might be LW. This can be checked by looking at WCL data. Icing is not a problem.

**Ladders (local time):**

Ladder1

L5, 1558-1603      Cloud top 1.5 km above flight level  
L4, 1605-1611      Cloud top lower at the northwest end  
L3, 1613-1617  
L2, 1619-1625  
L1, 1627-1632      The KA flying between two layers of clouds at the north half of the leg.

Ladder2

L5, 1637-1642      Cloud top lower. When no cld abv, WCR Z drops a lot.  
L4, 1644-1649      When passing Bridger Peak, lots of LW, mean size 20um.  
L3, 1651-1657  
L2, 1658-1703  
L1, 1705-1710

Along-wind leg    1716-1724

Ladder3

L5, 1729-1734  
L4, 1736-1741      cloud top lower  
L3, 1742-1748  
L2, 1750-1754      clouds clear up at places  
L1, 1756-1802      low WCR Z

Ladder4

L5, 1806-1811      clouds shallower  
L4, 1813-1818

L3, 1820-1824 cloud top 2,300 meters lower than flight level. Low WCR Z  
L2, 1826-1832 WCR Z not reaching ground  
L1, 1834-1838

Along-wind leg 1847-1853

Landing at Laramie 1910

WMI turned on three generators at 1705. The timing was right on.

## **Battle Town site report 2/14/2014 (Geerts)**

IOP duration: 2200-0300Z – single flight (2230-0215Z), ASCII only. Two hours of seeding by the ASCII Ggens.

weather: Synoptic situation: weak trof aloft, passing overhead during the IOP, drying (subsidence) aloft during IOP, evident by comparing the three Dixon soundings. Weak trof at 700 mb, moving through at 21Z, resulting in gradual wind shift from 260-290 degrees during IOP. Rather cold air: BTS temperature cooling from -7.4C to -9.7C, anemometer wind at Battle Pass around 8 m/s from 260 degrees (veering a little during IOP). Steady snowfall first 1.5 hrs of the IOP, up to 15-20 dBZ, until 2330Z, *before seeding started*. Then snow tapered off, in depth and intensity, to 0030Z. Then it mostly quit till the end of the IOP.

Low-level clouds during the IOP, obscuring the sun. The droplets were tiny: road poles on Battle Pass show hardly any riming (at most 1 mm in 24 hrs to the next morning, tiny white particles). By 0200Z the cloud layer lifted above Battle Pass, only ~50 m above the pass, but still dense enough to obscure the stars. By 0300Z it was clear. The last sounding clearly shows drying aloft and near the surface.

synopsis: a good ASCII case. Too bad the weather changed. Good UWKA, DOW, BTS, and upwind data, but CPI was dead.

### BTS instruments:

- CPI down
- Parsivel, WXT520, radiometer operated fine, starting the previous day, continuing till 03 Z
- hotplate dubious (?)
- MRR ran fine and then quit at 0102Z
- Snow chemistry sampling: 3 samples before seeding, 1 sample with seed
- Snow photography: worked well (all daytime); many dendrites, small aggregates. Not much riming.

Yang Yang's snow photo summary: riming most intense between 22:20 and 00:20

- 22:08: Hexagonal plates (0.5 mm to 1.5 mm), needles, plates with sectorlike extensions (about 2 mm)
- 22:17: Aggregated ice crystals.
- 22:27: Small graupel particles and rimed hexagonal plates (about 1 mm) and densely rimed stellar crystals and rimed needles and rimed broken branches and rimed small particles.
- 23:53: Large rimed hexagonal plates with diameter about 3 mm along with graupel particles with size around 1mm and rimed dendrites with size around 2 mm.
- 00:23: Densely rimed stellar crystals with diameter about 2 mm and rimed needles and stellar crystals with rimed spatial branches about 2 mm. No more graupel.
- 02:14: stellar crystals with plates at ends (2 mm) and stellar crystals (2 mm) and dendritic crystals (larger than 2 mm). No riming was observed between 02:10-03:00.

AgI generators: 3 Ggens active for 2 hours, specifically:

SM03 – Mill:	00:02- 02:04
SM04 - Sandstone	00:04- 02:06
SM06 – Cottonwood	00:05- 02:08

DOW: performed well, continuously between 2200-0300Z. The first 15 minutes one of the two magnetrons was not yet fully warmed up, affecting dual-pol measurements. The frequency was tuned manually. RHI angle centered at 270 degrees the entire IOP.

upwind data:

- Dixon: 3 soundings, 22:30, 00:00, and 01:30 UTC. All soundings OK.
- Savery radiometer and O'Toole MRR and ceilometer were up.

**ASCII-12**

**RF10 Flight Notes (French)**

**14 February, 2012**

**Crew**

T Drew

Q Miao

S Ward

J French

**Preflight**

ASCII only flight. Mid-afternoon takeoff, following an RSE case in the morning. Expect 4 hour flight with four full ladder patterns.

No issues at startup.

**Flight**

2230 wheels up

2250 everything up and running, no issues, all looks good

*Ladder 1*

2258 begin leg 1

2303 end leg 1

2305 beg leg 2

2311 end leg 2

2313 beg leg 3

2317 end leg 3

2319 beg leg 4

2325 end leg 4

2327 beg leg 5

2332 end leg 5

*Ladder 2*

2337 beg leg 1

2342 end leg 1

2344 beg leg 2

2349 end leg 2

2351 beg leg 3

2357 end leg 3

2359 beg leg 4

0003 end leg 4

???? beg leg 5  
0010 end leg 5

*Along wind leg*

0016 begin along wind leg with ground track 090 deg True  
0025 end along wind leg, setting up for next set of ladders

*Ladder #3*

0028 beg leg 1  
0034 end leg 1  
0036 beg leg 2  
0040 end leg 2  
0042 beg leg 3  
0048 end leg 3  
0050 beg leg 4  
0054 end leg 4  
0056 beg leg 5  
0102 end leg 5

*Ladder #4*

0106 beg leg 1  
0110 end leg 1  
0112 beg leg 2  
0118 end leg 2  
0120 beg leg 3  
0124 end leg 3  
0126 beg leg 4  
0132 end leg 4  
0134 beg leg 5  
0138 end leg 5

*Along wind leg*

0147 begin along wind leg with ground track ~090 deg True  
0154 end along wind leg, setting up for next set of ladders

Done for the day, returning to Laramie

0210 wheels down

## **Battle Town site report 2/13/2012 (Geerts)**

IOP duration: 1830-2330Z – single flight (19:00-22:30Z), ASCII only. Two hours of seeding by the ASCII Ggens.

weather: Synoptic situation: postfrontal. Rather cold air. BTS temperature cooling from -5.3C to -7.7C, wind at Battle Pass around 5 m/s from 260 degrees, increasing to 10 m/s around 1900Z to the end, direction steady. Continuous light snowfall, with several heavier showers in between, esp. after seeding started. Snow shower between 1840-1910 UTC, tops around 1.2 km, up to 20 dBZ, sun not visible during this shower. Then very light snow between 1910-2100Z, mostly sunny with some very low clouds moving by rapidly. 2100-2330Z: a series of snow showers (~ 15 dBZ, 1.0 km deep), and lower temps, around -7C. Savery radiometer indicates high LW, with a spike over 0.1 mm around 2215Z. The droplets were very small all day (and night). Road poles on Battle Pass hardly show any riming (at most 1 mm in 24 hrs to the next morning, tiny white particles).

synopsis: the first successful ASCII case. Weather persistent, and good DOW, BTS, and upwind data, but CPI was dead.

### BTS instruments:

- CPI down
- Parsivel, hotplate, radiometer and MRR operated fine, starting the previous day, continuing till 00 Z
- weather station WXT520: down
- Snow chemistry sampling: 2 samples before seeding, 2 samples with seed
- Snow photography: worked well (all daytime); mostly dendrites, rimed particles and aggregates during snow showers. Some large aggregates.

### Yang Yang's snow photography summary:

- 1830-1900Z: dendrites (2 mm), plates (1 mm) and needles (1.5 mm)
- 1908-1912: highly rimed dendrites (3 mm) and rimed needles
- 1915: large dendrites (2-3 mm) without riming and small plates
- 1941: small rimed dendrites and plates (1-2 mm)
- 2014: highly rimed dendrites (2 mm)
- 2024: dendrites and plates
- 2125-2140: aggregates
- 2158: small rimed dendrites (1 mm)
- 2203-2207: small graupel particles
- 2210-2215: aggregates
- 2242: rimed dendrites
- 2256-2259: aggregates
- 2300: small rimed dendrites (1 mm)
- 2319: dendrites (2 mm) and plates (1 mm)

AgI generators: GGens started 15 min too early, so certainly leg #2 and possibly leg#3 on ladder #2 were affected by seeding. All legs on ladder #4 were completed when the GGens were switched off.

SM03 – Mill: 20:12- 22:12Z  
SM04 - Sandstone: 20:14- 22:14  
SM06 – Cottonwood: 20:15- 22:16

DOW: performed well, continuously between 1830-2330Z. RHI angles centered at 260 degrees the entire IOP.

upwind data:

- Dixon: 3 soundings, 19:30, 20:45, and 22:00 UTC. All soundings OK.
- Savery radiometer and O'Toole MRR and ceilometer were up.

**2/13/2012 ASCII Pilot notes (Flight 9)**

Crew: Drew, Miao, French

Flight Time: 3.7

Objective: Single Ascii Case

Planned: 4 Ladder patterns, 1 Along-wind leg.

Actual: Departed LAR 16,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000. Flew 5 rung ladder, 4 times at 13,000 from East to West alternating starting points. Did along wind leg over Bridger Peak Site at 13,000 between Ladder 2 and 3 and again after ladder 4. Returned to LAR.

**ASCII2012 Flight Scientist Report**  
**Qun Miao**

**Monday, 13 Feb. 2012**

**Crew:** Tom Drew, Qun Miao, Jeff French

**Objective:** Single IOP (ASCII only)

**Flight Details:** Takeoff and landing times were 1901 and 2235 UTC. Four "ladder" patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the second ladder around 2042 UTC. Another along-wind leg was conducted after the fourth ladder around 2210 UTC. All flight legs were conducted at a height of 13,000' msl. The flight was quite smooth. The icing was minor.

**Weather notes:**

700 mb wind direction was set at 260°. A great deal of SC clouds was present, mostly below the flight level in the target area. We were flying close to the cloud top. Cloud top seems to be lowered with time. Isolated clouds with high cloud top were encountered later in the mission. LW was low for the most of the flight, higher LWC were measured from time to time. Icing is not a problem.

**Ladders (local time):**

Ladder1

L5, 1222-1228      some Cumulus clouds with high cloud top are seen.

L4, 1230-1235      low clouds indicate quite turbulence in BL.

L3, 1237-1243

L2, 1245-1250

L1, 1242-1257      cloud top lower

Ladder2              700 mb wind direction from sounding is 241 degrees

L5, 1302-1307

L4, 1309-1314

L3, 1316-1321

L2, 1323-1328

L1, 1330-1335

Along-wind leg      1342-1348

Ladder3

L5, 1354-1359

L4, 1401-1406      cloud top seems lower

L3, 1408-1413      large snowflakes encountered

L2, 1415-1420      clouds clear up at places

L1, 1422-1427

Ladder4

L5, 1431-1437      clouds shallower

L4, 1439-1444

L3, 1446-1451    isolated deeper clouds

L2, 1453-1458

L1, 1459-1505

Along-wind leg    1510-1517

Landing at Laramie    1535

WMI turned on three generators at 1315, which is about 12-15 min too early.

## **ASCII-12**

### **RF09 Flight Notes (French)**

**13 February, 2012**

#### **Crew**

T Drew

Q Miao

EMPTY

J French

#### **Preflight**

ASCII only flight. First flight after repair to tail. Aircraft returned to Laramie early this AM, plan on noon local departure for 4 hour flight.

No issues at startup.

#### **Flight**

1900 wheels up

1908 everything up and running, no issues, all looks good

1910 noticed no housekeeping on 2DP

1921 at FL130, setting up for ladder #1; skimming tops of clouds with some embedded, scattered cu with small pockets of liquid

#### *Ladder 1*

1922 begin leg 1

1928 end leg 1

1930 beg leg 2

1935 end leg 2

1937 beg leg 3

1942 end leg 3

1945 beg leg 4

1949 end leg 4

1952 beg leg 5

1957 end leg 5

#### *Ladder 2*

2001 beg leg 1

2006 end leg 1

2008 beg leg 2

2014 end leg 2

2016 beg leg 3

2021 end leg 3  
2023 beg leg 4  
2028 end leg 4  
2029 beg leg 5  
2034 end leg 5

*Along wind leg*

2040 begin along wind leg with ground track ~61 deg True  
2047 end along wind leg, setting up for next set of ladders

*Ladder #3*

2053 beg leg 1  
2058 end leg 1  
2100 beg leg 2  
2105 end leg 2  
2107 beg leg 3  
2112 end leg 3  
2114 beg leg 4  
2119 end leg 4  
2121 beg leg 5  
2126 end leg 5

*Ladder #4*

2130 beg leg 1  
2136 end leg 1  
2138 beg leg 2  
2143 end leg 2  
2145 beg leg 3  
2150 end leg 3  
2152 beg leg 4  
2157 end leg 4  
2158 beg leg 5  
2204 end leg 4

*Along wind leg*

2209 begin along wind leg with ground track ~66 deg True  
2217 end along wind leg, setting up for next set of ladders

Done for the day, returning to Laramie

2233 wheels down

## **Battle Town site report 2/12/2012 (Geerts)**

IOP duration: 2300-0900Z – no UWKA, ASCII only. Seeding first, then 2 hr buffer, then no-seed.

weather: Synoptic situation: deep trough aloft, SM range is at the northern end of this almost-cut-off system. Very weak winds aloft, sharp tropopause just above 300 mb. GOES IR suggests we are in the center of a weak circulation. Cloud tops quite cold, down to -50C early in the IOP, warming after 3-4 UTC. It started snowing at 18Z, light snow, fairly steady, the sun can mostly be seen thru until about 21Z. Widespread cirrus (cirrostratus) clouds aloft, as seen from the ground, around 18Z). BTS temperature: about -4.7°C at the start of the IOP, winds at Battle Pass weak (8 m/s) from about 270-280°. The temperature dropped steadily, reaching -5.4C at 01Z.

23Z: several heavy snow showers, DOW up to 30 dBZ, aggregates, MRR tops up to 3.6 km AGL (6.6 km MSL). Dendrites, aggregates, sometimes small graupel

00Z:DOW reports winds in lowest elevation angle from 250. Heavy snowfall continues, in showers, less deep on MRR (up to 2.5 km AGL). Showers are consistent with the near-neutral temperature profile from the ground to the tropopause (Dixon sounding at 00:15Z)

01Z: DOW winds closer to 269, maybe 280 at higher elevations. Still showers, less heavy (20 dBZ on DOW)

02Z: DOW wind close to 270 degrees, weak echoes (0-5 dBZ), MRR tops lowering to around 0.5 km AGL

03Z: DOW wind close to 265 degrees, stronger echoes (5-10 dBZ) moving in from the west.

04Z: DOW wind close to 245 degrees, mini-squall line approaching from the west with up to 30 dBZ. Near Battle some showers, up to 15 dBZ, MRR tops around 1.5 km AGL. Squall line passed over Battle at 0410Z, it was quite weak, 20 dB max, and shallow (up to 2 km on MRR), and no T-drop.

05Z: winds post-squall line shifted to about 270 degrees, and weakened down to ~5 m/s. T at BTS -6.1C.

Moderately weak echoes (10-15 dB on DOW) continue, mostly aligned N-S.

synopsis: good case with continuous precip and weather persistence, and good DOW, BTS, and upwind data, but CPI was dead. Weak wind shift around 430Z, in the buffer period, and weaker winds, that implies that if the Ggens had been on in the 2<sup>nd</sup> period, seed material probably would not reach Battle.

### BTS instruments:

- CPI down
- Parsivel, hotplate, radiometer and MRR operated fine, starting the previous evening (about 23Z for the hotplate, 2Z for the CU probes), continuing well past 0900Z
- weather station WXT520: down
- Snow chemistry sampling: 4 samples before seeding, 4 samples with seed
- Snow photography: OK:

### Yang Yang's snow photo summary:

- 23:12: A lot of plane crystals with sectorlike extensions and stellar crystals with plates at ends. Hexagonal plates, needles and column with plates.
- 00:00-00:10: Aggregates.
- 00:15-04:00: No aggregates. Densely rimed stellar crystals, rimed columns, rimed needles, small rimed particles and rimed broken branches prevailed.
- 04:00-04:10: Aggregates.
- 04:19-06:00: Large rimed hexagonal plates and hexagonal graupel particles, smaller rimed plates and needles and small rimed particles.
- 06:08-08:00: Densely rimed stellar crystals, rimed needles and plates. Large dendrites up to about 5 mm.

- 08:06: Mostly rimed broken branches and small rimed plates. A few 1 mm plates with sectorlike extensions.
- 08:43: Mostly small hexagonal plates and a few of them were rimed.

AgI generators:

fired up at 23Z, specifically:

SM03 - Mill - 22:57

SM04 - Sandstone - 22:59

SM06 - Cottonwood- 23:00

extinguished by 03 Z

SM03 - Mill - 2:57

SM04 - Sandstone - 2:59

SM06 - Cottonwood- 3:00

DOW: performed well, continuously between 2230-0900Z. RHI angles around 260 degrees 23-05Z, then 280 degrees between 05-09Z.

upwind data:

- Dixon: 4 soundings, 00:15, 2:30, 4:45, and 7:00 UTC. All soundings OK.
- Savery radiometer and O'Toole MRR and ceilometer were up.

## **Battle Town site report 2/10/2012 (Geerts)**

IOP duration: 0030-830Z – no UWKA, ASCII only

weather: BTS temperature: about -6°C, weak winds from about 270-280°. Mostly small snow flakes (many dendrites), sometimes pellets or graupel. Many brief showers with graupel occurred after 0400 Z. Conditions were fairly steady throughout the IOP, with a break of very weak precip between 120-210Z. Between 0220-0340 the MRR sees echoes to 2250 m AGL, and DOW echoes are up to 30 dBZ. Early on the precip was most shallow, <1000 m till 0210Z (MRR estimate).

synopsis: good case with excellent precip and weather persistence, and good DOW, BTS, and upwind data, but hot plate and CPI were dead.

### BTS instruments:

- CPI down
- Parsivel, radiometer and MRR operated fine, starting at 0100Z, continuing well past 0830Z
- hotplate: started fine at 0120Z, stopped around 0420Z. Some data were collected.
- weather station WXT520: down
- Snow chemistry sampling: 4 samples before seeding, 4 samples with seed
- Snow photography: OK

### Yang Yang's snow photo summary:

- 01:38 - 02:30: Hexagonal graupel (D ~1.5 mm), lump graupel (D ~2 mm), conelike graupel (D ~2mm)
- 03:04: Rimed column and small graupel particles (D less than 1 mm).
- 05:15: Rimed stellar crystals, needles. The size of lump graupel and conelike graupel grew to larger than 2 mm
- 05:34: highly rimed stellar crystals.
- 05:50-06:25: Large lump graupel particles (some larger than 3 mm) and large conelike graupel particles (D ~2 mm).
- 06: 26: smaller graupel particles (about 1~2 mm). Densely rimed stellar crystals
- 07:09: Small rimed particles and rimed needles.
- 07:45: Hexagonal graupel particles and rimed columns

### AgI generators: 3 hrs of seeding

fired up at:

SM02 - Deep - 4:34Z

SM03 - Mill - 4:35

SM04 - Sandstone - 4:37

SM06 - Cottonwood- 4:38

SM07 - Rasmussen - 4: 39

SM09 - North Battle - 4:40

SM10 - West Tullis - 4:45

SM11 - High Savery - 4: 44

extinguished between 7:30-7:50 Z

DOW: performed well, continuously between 00:30-8:30Z. RHI angles 270, 280, 290 degrees.

### upwind data:

- Dixon: 3 soundings, 0230, 0430, and 0630Z. All soundings OK.
- Savery radiometer and O'Toole MRR and ceilometer were up.

## **Battle Town site report 1/20/2012 (Geerts)**

IOP duration: 12:30-17:30Z – single flight, UWKA flew 4 ladders. Upon return damage was found on the leading edge of the tail wing, resulting in several hard-down days.

weather: BTS temperature: -5.1C at the start, cooling to -5.5C, then warming to -4.5C at the end. Wind at the DOW averaged 13 m/s from 270-280, less than the last 2 days. Deep system initially, tops about 6 km MSL, MRR and DOW reflectivity up to 25 dBZ. Graupel occurred several times. Precip became more shallow and lighter between 1430-15:30 UTC at BTS, and then stopped altogether. Shallow showers with graupel present between 18-21Z. It remained foggy at BTS the entire IOP.

synopsis: good orographic precip study. No seeding.

### BTS instruments:

- CPI down
- Parsivel, hotplate and MRR operated continuously for over 48 hrs, ending around 21 Z.
- radiometer: no data stoppages: no need to deice radome.
- weather station WXT520: down
- Snow chemistry sampling: initially 30 min intervals, later 1-2 hrs interval.
- Snow photography: OK: some graupel balls between 13-15Z and 18-20Z, “bouncing off the photo platform”

AgI generators: none

DOW: performed well, continuously between 12:30-20:00Z except for a 10 min break. RHI angles 260, 270, 280 degrees.

Soundings:

- Dixon: 3 soundings, one early in the flight, one in the middle, and one near the end, All soundings OK.
- note: Savery radiometer was up.

## ASCII Post Mission Report

Jan 20, 2012

1. Crew: Bandani, Qun Miao, Larry Oolman, Jacklyn Ritzman.
  2. Pre-Flight Brief: 0515
  3. Planned T/O time: 0630
  4. Flight Time: 4.0 Hrs
  5. Weather: VMC for T/O, Layered deck between 13000'- FL 190, VMC for Landing.
  6. Lowest cloud deck: 13000'.
- A. Brief:

Briefed mission for the ASCII ladder.

B. Execution:

Filed for CKW 135/37 fix 16000'. Took Off at 0645, received clearance to work w/in 20 nm of the fix 13000' block 16000'. Started the ladder at L5N and 13000'. Completed 4 ladder pattern and a BPK cross pattern. Once complete returned to KLAR via Lymps for RNAV 12 circle to land 30.

Discussion:

It would have been a great day except that the switch was off!

-

## ASCII2012 Flight Scientist Report

### Qun Miao

**Friday, 20 January 2012**

**Crew:** [Ahmad Bandani](#), Qun Miao, Larry Oolman, and Jacklyn Ritzman

**Objective:** Single IOP (ASCII only)

**Flight Details:** Takeoff and landing times were 1347 and 1739 UTC. Four “ladder” patterns were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. An along-wind leg was conducted after the second ladder around 1543 UTC. There was no time for another along-wind leg after all four ladders. All flight legs were conducted at a height of 13,000’ msl. The flight was quite smooth throughout except some gust when landing. The icing was visible.

#### **Weather notes:**

Forecast wind direction at 700 mb was 275°. A great deal of clouds was present, both above and below the aircraft on the way to the target area. In the target area, clearings were seen at the northern ends of ladders. More clearings for both below and above the KA were seen with time (blue skies or sun visible through clouds). LW was low right at the beginning of ladders, but stayed rather high throughout the mission.

#### **Ladders (local time):**

Ladder1

L5, 0710-0716

L4, 0719-0724

L3, 0727-0732

L2, 0735-0740

L1, 0743-0748

Ladder2

L5, 0754-0758

L4, 0801-0807

L3, 0810-0815

L2, 0817-0823

L1, 0826-0831

Along-wind leg

Ladder3

L5, 0855-0901

L4, 0904-0909

L3, 0912-0919

L2, 0921-0926

L1, 0929-0935

Ladder4

L5, 0940-0944

L4, 0947-0953

L3, 0955-1000

L2, 1002-1007

L1, 1010-1014

WMI forgot to turn on the generators after the second ladder.

## ASCII Research Flight (RF08) 2012-01-20

*Crew: Tom Drew, Qun Miao, Larry Oolman, Jaclyn Ritzman*

**Summary:** Standard ASCII flight. Applanix required a restart. It came up with an IMU Sensor Error the first time. On the ground the navigation was degraded initially.

1347 Take off, 700 mb temperature about -3C on climb out

1404 Both MAIN120 and AUX120 values are suspect

1410 Start first ladder, T/TD=-10/-15 C, Wind=270@49 kt, cloud glaciated

1415 0.2 g/m<sup>3</sup> of 20 micron drops – near cloud top?

1419 Leg 2, between cloud layers. From radar there is probably seeding from above. T/TD=-12/-14, winds=280@40

1420 Some 30+ micron drops up to 0.4 g/m<sup>3</sup>

1427 Leg 3, -12/-14, 290@33, broke out of cloud at end of the line

1435 Leg 4, -11/-13, 280@34

Lidar disk filled. There may be a corrupt file

1449 CIP computer rebooted.

1453 Start second ladder, -11/15, 280@43

1501 Leg 2, -12/-14, 270@36

1509 Leg 3, -12/-13, 280@35

1517 Leg 4, -11/-14, 280@33, LWC100 baseline has had step jumps, ice or slave coil?

1525 Leg 5, -11/-14, 270@33

1530 Finished second ladder

1532 Lost CDP

1534 Lost 2D-P

1542 Along 080 magnetic from Bridger Peak

1546 2D-P back

1554 Third ladder, -10/-16, 270/39, Out of cloud this line

1558 Stall indicator iced

1604 Leg 2, -12/-14, 280@42

1611 Leg 3, -12/-14, 270@34, CDP still down, LWC100 baseline appears to be floating.

1620 Leg 4, -12/-15, 280@35, Ice on FSSP extends beyond the front of the shroud.

1628 Leg 5, -12/-14, 280@31, mostly in clear air

1634 Done with ladder 3, Swapped out WCL nitrogen, Applanix mostly at 'Nav: Aligned' rather than 'Nav: Full'

1639 Final ladder, -11/-19, 280@42, no cloud on this pass

1646 Leg 2, -11/-16, 280@37

1655 Leg 3, -12/-17, 280@34

1701 Leg 4, -12/-15, 280@38, CIP crashed in a small bump – no .dmp files

1709 Leg 5, -12/-17, 290@36, clouds have dissipated significantly since the start of the flight.

1713 Done with mission, heading to Laramie, not enough time for second along wind leg.  
Up beam was probably messed up on last ladder.

### **Postflight**

WMI failed start generators, so we will try again.

## Battle Town site report 1/19/2012 (Geerts)

IOP duration: 15:00-20:40Z – single flight, UWKA flew one ladder. Icing too severe. Flight aborted at 17:15Z.

weather: too warm for ASCII standards, but still an interesting case. T steadily increased from -5.1 to -3.1C between 15:00-20:40Z at BTS, pressure 697 mb. It was windy again, persistently from about 250 degrees at Battle, not as windy as yesterday (maybe 15 m/s on average). The IOP started with large droplets in a rather shallow orographic cloud, some drops as large as 200 micron, and many over 100 micron diameter. The drizzle resulted in a rainbow visible for several hours, at Bottle Creek (photo 1716Z), at Battle Pass (photo 1904Z), and even at the north end of the Medicine Bow Range on I-80. Drizzle reached the valley floor. Josh Wurman reported seeing a piece of a rainbow on the lee side most of the morning between 9-12am (16-19Z). Objects on Battle Pass had over an inch of riming by 17 Z. We saw drizzle drops on the CPI until at least 18Z in the CPI probe on Battle. The drizzle caked the snow with a layer of ice about 0.5 cm thick, blocking any blowing snow. This was the main motivation for continuing the IOP (which was aborted for 30 min), since now we could exclude the blowing snow effect. Attached another picture of a rainbow on the lee side of the Sierra Madre. (photo attached). It had stopped precipitating by 18:00 Z, as the cloud base lifted above Battle Pass (10 kft). But then, following seed generator start at 18:11 Z, both the DOW and the MRR recorded light snow (echoes up to 15 dBZ) till 1940 Z. By then the cloud base had risen to Bridger Peak (11 kft), and the temperature at the pass went up to -3.5C. The last half hour of seeding saw no more precip. The Dixon sounding shows that the stable cloud layer was decoupled from the surface. Weak drizzle and snow (echo tops about 1200 AGL) between 15:00-18:00 UTC, and light graupel/snow between 18:30-19:40 Z.

synopsis: poor case due to lack of UWKA. Freezing drizzle made for a very interesting case.

BTS instruments:

- CPI, Parsivel, hotplate and MRR operated continuously 24 hrs.
- Parsivel accumulated some ice on window, and was de-iced once (10 min data stoppage)
- radiometer: several data stoppages ~ 10 min long to deice radome.
- MRR: worked OK
- Hotplate: OK
- weather station WXT520: down
- Snow chemistry sampling: none – snowfall too light. ice accumulated on intake funnel.
- Snow photography: OK: some supercooled droplets and some small graupel

AgI generators: SM03 - Mill Creek, SM04 - Sandstone Overlook, and SM06 - Cottonwood Park, on at 18:11Z and extinguished at 20:15 to 20:20Z

DOW: performed well, between 15:00-20:40Z. RHI angles 235, 245, 255 degrees. We called the case off at 17:25 Z and the DOW stopped recording. Then we requested a restart at 17:55 Z. DOW normally requires 3 hours of warm up for stable magnetron frequencies. Since the DOW did a "quick start", the frequencies are off. Reflectivity Z is good. ZDR is not, initially. Good ZDR's can be recovered, but there will be some post-facto work by the PI's and/or students, working with CSWR, to get these to be good. By 18:52 Z, one of the frequencies was locked in, but the other was 2.5 MHz off. So, there should be good data in one frequency which can be used as ground truth for the 2nd. The 2nd frequency converged by 19:30 Z.

Soundings:

- Dixon at 18:18 UTC: complete (1 sounding only)
- note: Savery radiometer was up.

**1/19/2012 ASCII Pilot notes**

Crew: Drew, Miao, Oolman, Emery

Flight Time: 1.1

Objective: Ascii Ladder Flight

Planned: 4 Ladder patterns 2 along wind legs.

Actual: Departed LAR to Center point 16,000 ft. Over the Medicine Bow Range, encountered a brief period of moderate icing conditions. Over Saratoga valley requested 13,000 and the work area. Turned toward point 1 and descended to 13,000. Encountered "severe" Icing as demonstrated by the high power settings required, and decided to divert to Saratoga. Flew to IAF for Saratoga and broke out VMC upon reaching. Flew VFR back to Laramie.

## ASCII2012 Flight Scientist Report

Qun Miao

**Thursday, 19 January 2012**

**Crew:** Tom Drew, Qun Miao, Larry Oolman, and Brittni Emery

**Objective:** Single IOP (ASCII only)

**Flight Details:** Takeoff and landing times were 1644 and 1748 UTC. Four “ladder” patterns were planned. Severe icing happened on the way to the target area in relatively short time. Many large ice crystals ( $>25 \mu\text{m}$ ) were observed. At about 1710 UTC, the icing was too much for the KA to continue the mission. At first, the KA was flying to Saratoga. Then Tom managed to fly the KA back to Laramie.

**Weather notes:**

Forecast wind direction was 240-245°. A great deal of clouds was present, both above and below the aircraft.

## ASCII Research Flight (RF07) 2012-01-19

*Crew: Tom Drew, Qun Miao, Larry Oolman, Brittni Emery*

**Summary:** Standard ASCII flight. Temperatures are marginal with Battle being at -4.5 C.

1645 Take off

1647 700 mb temperature around -2.5 C.

1651 +6 m/s wave coming over the Snowy Range

1702 0.5 g/m<sup>3</sup> of 30 micron droplets

Icing too severe. Aborting mission.

Headed first to Saratoga, after descending below clouds, decided to go the long way to the north to Laramie. Torque was at max: 2230, as soon as we aborted.

1738 Ice slid down over front of Rosemount temperature. Shed a couple minutes later.

1746 Land

## Battle Town site report 1/18/2012 (Geerts)

IOP duration: 21:00-4:00Z – single flight, UWKA flew 3 ladders plus along-wind leg, between about 00:00Z-3:30Z (entire flight in the dark)

weather: very windy, persistently from 240-250 degrees. DOW reports a peak gust at 5 m AGL of 47.2 m/s at 23:25Z, and several gusts over 40 m/s, with averages close to 30 m/s; several trees snapped in the area in the afternoon. It remained rather dry during the IOP, mostly clear at first, with a cloud layer around 5-6 km MSL. The Dixon soundings reveal a deep well-mixed layer below ~ 3.8 km MSL, and a stable layer ~1 km deep above that, becoming increasingly moist. At 00:15 UTC DOW reports a possible blowing snow band about 500 m above radar level in the RHIs, mainly to the east, later also to the west, with another echo layer near 4.5 km AGL. Temperature steady between -6 and -7C at BTS throughout the IOP. Weak snowfall (echo tops about 1200 AGL) between 1:30-4:00 UTC, strongest at 2:50 UTC.

synopsis: probably too dry in the BL for effective seeding. Very little snowfall reaching the ground. May be a good blowing snow case, with all instruments in operation

BTS instruments:

- CPI: started at 02 Z – performed well. Initially rounded particles, probably abraded blowing snow particles, later on some small rimed dendrites, but mostly rounded particles.
- Parsivel: OK (one only)
- MRR: worked OK
- radiometer: OK – recorded no SLW at all
- Hotplate: OK
- weather station WXT520: down
- note: Parsivel, hotplate and MRR started data collection at 15 Z (evening before) and continued data collection into next day.
- Snow chemistry sampling: two samples, one before seeding (23:30-1:30Z), one after Ggen switch-on (1:30-4:00Z).
- Snow photography: some – not much snowfall. Most images around 3Z when some shallow snow cell passes overhead..

AgI generators: SM03 - Mill Creek, SM04 - Sandstone Overlook, and SM06 - Cottonwood Park on at 01:30Z and extinguished at 03:31Z

DOW: performed well, between 21:00-4:00 UTC. RHI angles 230, 240, 250 degrees early. DOW Down for ~10 min at 23:45Z.

Soundings:

- Dixon at 00:15, 01:40, and 03:05: all complete
- note: Savery radiometer was dead.

## ASCII Post Mission Report

Jan 18, 2012

1. Crew: Bandani, Kristovich, French, Stemmler.
  2. Pre-Flight Brief: 1400
  3. Planned T/O time: 1530 (actual 1700)
  4. Flight Time: 3.4Hrs
  5. Weather: VMC for T/O, Layered deck between 13000'- 16000', VMC for Landing.
  6. Lowest cloud deck: 13000'.
- A. Brief:

Briefed mission for the ASCII ladder.

B. Execution:

Filed for CKW 135/37 fix 16000'. T/O delayed as per PI's request. Took Off at 1700, received clearance to work w/in 20 nm of the fix 13000' block 16000'. Started the ladder at L5N at 13000'. Strong winds (~80 Knots) and icing resulted in only 3 ladder patterns and a BPK cross pattern. Once complete returned to KLAR via Lymps for RNAV 12 circle to land 21.

Discussion:

Another satisfied customer! PI was extremely happy regarding tonight's flight.

Flexibility was the word of the Day.

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# Flight Report

RF06

Wednesday, 18 January 2012

## ***Flight Scientist Report (Kristovich)***

**Crew:** Bandani, Kristovich, French, and Stemmler

**Objective:** Take observations of an upslope flow event. \*\* NOTE: This was the second flight on this day. See RF05 notes. \*\*

**Flight Details:** Approximate takeoff time was 2356 UTC. Three full “ladder” patterns, each having five “steps”, were conducted, using the same waypoints as used in RF01. Before returning to Laramie, an along-wind leg (using the 700 hPa wind direction) was conducted across the steps with a pivot point at Battle Peak. All flight legs were conducted at a height of 13,000’ msl.

Approximate start and end times (UTC) for each of the ladder patterns are below. Each of the five steps in the ladders took approximately 5-6 min.

Ladder #1	0023-0103
Ladder #2	0110-0147
Ladder #3	0206-0246

Landed at approximately 0315

### **Weather notes:**

Mostly overcast skies were observed throughout the mission. Some tendency for the clouds to be more prevalent, with greater LW at aircraft altitude, on the north side tracks during Ladder 2 and 3.

Winds were strong throughout the flight up to  $>45 \text{ m s}^{-1}$  at times with some tendency for decreasing winds in the latter half of the flight.

Comparison of skew-T diagrams using data just after takeoff and just before landing: Warming and increasing dew point below 600 mb. The mixed layer appeared shallower near landing.

## **ASCII-12**

### **RF06 Flight Notes (French)**

**18 January, 2012 (2<sup>nd</sup> flight)**

#### **Crew**

A Bandani

D Kristovich

J Stemmler

J French

#### **Preflight**

Plan for ASCII only flight; conditions marginal for seeding at takeoff time, but can't delay anymore due to crew duty limitations. Plan to have generators turned on 1 hr 30 min after takeoff.

No issues at startup.

#### **Flight**

2357 wheels up

On ferry over, thought WCR may have scrambled beams, difficult to tell because of lack of clouds above us. Tried a few different things, then decided WCR was OK.

Setup for pattern 1, starting on southeast end of lines.

0023 begin leg 1

Applanix went out to lunch, gps fix bad

0031 end leg 1

0034 begin leg 2

0039 end leg 2

0041 begin leg 3

0047 end leg 3

0049 begin leg 4

0054 end leg 4

0057 begin leg 5

0103 end leg 5

End pattern 1, setup for ladder pattern 2

0110 begin leg 1

0114 end leg 1

0115 WCR beams scrambled, start new file

0117 begin leg 2

0123 end leg 2

???? begin leg 3

0131 end leg 3

0134 begin leg 4  
0140 end leg 4  
0142 begin leg 5  
0147 end leg 5

End pattern 2, setup for along wind leg

???? begin along wind leg  
0200 end along wind leg

Setup for pattern 3

0206 begin leg 1  
0214 end leg 1  
0217 begin leg 2  
0221 end leg 2  
0224 begin leg 3  
0230 end leg 3  
0233 begin leg 4  
0238 end leg 4  
0240 begin leg 5  
0246 end leg 5

LWC100 iced up at end of flight

Done for the day, returning to Laramie

0314 wheels down

## **Battle Town site report 1/18/2012 (Geerts)**

IOP duration: 8:00am-12 noon (15-19 Z) in support of a blowing snow flight

weather: quite windy, DOW reports 7 m AGL sustained wind at 20-23 m/s, and wind gusts to 32 m/s. wind from 230-250, T around -12C, warming slowly. Winds increased towards 12 noon. Took photos of blowing snow at Battle Pass, and some photos of ice crystals at BTS. Persistent high cloud, maybe altostratus (sun sometimes visible).

BTS instruments:

Hotplate, MRR, Parsivel, and radiometer working fine since 8:00 am. CPI and WXT520 away for service.

AgI generators: none

DOW: did not record data. Warmed up 8:15-10 am, collected data 10-11 am, could not see anything at low elevation, so decided not to record.

Soundings: one at Dixon at 16:15Z: complete

**1/18/2012 ASCII Pilot notes**

Crew: Drew, Kristovich, French, Emery

Flight Time: 3.5

Objective: Ascii Blowing Snow

Planned: 2 Blowing Snow patterns.

Actual: Departed LAR VFR direct to BL1, contacted Center on 132.1 but we were too low for radar coverage or flight following. Relayed our intentions for the flight.

Did legs BL1-2 at 11,000; BL2-3 at 9000; BL3-4 at 10,000; BL4-5 at 10,000; BL5-6 at 12,000; BL6-1 at 12,000. Did a vertical profile on BL4-5 12,000 down, on first pattern. Decided to do the first three legs on a third pattern and return to LAR.

# Flight Report

RF05

Monday, 18 January 2012

## ***Flight Scientist Report (Kristovich)***

**Crew:** Drew, Kristovich, Oolman, and Emery

**Objective:** Take observations of blowing snow over various terrain. \*\* NOTE: This was the first flight on this day. See RF06 notes. \*\*

**Flight Details:** Approximate takeoff time was 1453 UTC. Two and a half blowing snow flight patterns were conducted at altitudes from 9,000'-12,000' msl. A sounding was conducted along flight leg BL4-BL5 during the first flight pattern; the sounding was from approximately 8300' to 12,000' msl.

Approximate start and end times (UTC) for each of the blowing snow flight patterns, and the along-wind legs, are below. Each of the five steps in the ladders took approximately 5-6 min.

Blowing snow pattern #1	1516-1619 (sounding from BL4-BL5)
Blowing snow pattern #2	1625-1728
Blowing snow pattern #3	1731-1801 (Stopped at BL4)

### **Weather notes:**

Strong winds were evident throughout the flight. The greatest magnitudes, nearly  $40 \text{ m s}^{-1}$ , were observed along the peaks. Lower magnitude wind speeds,  $15\text{-}20 \text{ m s}^{-1}$ , were seen along the western passes. Areas of blowing snow were clearly visible, particularly downwind of peaks. Blowing snow was not visible, however, in more flat terrain.

Skies were clear at and below the aircraft throughout the flight. Some higher-level wave clouds could be seen, particularly toward the end of the flight.

## **ASCII-12**

### **RF05 Flight Notes (French)**

**18 January, 2012**

#### **Crew**

T Drew

D Kristovich

B Emery

J French

#### **Preflight**

Plan for blowing snow flight. At takeoff time, winds were howling at Laramie. Report from Battle Pass indicated strong winds, Rawlins was reporting winds 20 gusting to 25 kts. High clouds evident from radar, but looks to be clear of low clouds.

No issues with startup

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#### **Flight**

1453 wheels up

1505 everything up and running, looks good....ferry across Snowies at FL110, stay VMC below higher clouds.

1516 beg leg 1 at FL110, good VMC, weak radar return right at our level

1527 CIP computer dropped connection. Unable to reconnect, tried rebooting...not responding to PING or VNC—lights indicate computer is working....network issue??

1530 end leg 1, descend to FL090 for next leg

???? beg leg 2

???? end leg 2

Trying everything on CIP computer—unable to reconnect

Climb to FL100

1540 beg leg 3 at FL100

1546 end leg 3

1550 beg leg 4, first half of leg do a sawtooth sounding beginning at FL120 going down

1553 hit bottom at FL083, climb back to FL100

1559 end leg 4, climb to FL120

1602 beg leg 5

1614 end leg 5

1617 beg leg 6

1620 end leg 6

End pattern 1, setup for repeat of pattern

1624 beg leg 1 at FL110

1639 end leg 1

1641 beg leg 2

1646 end leg 2, climb to FL100  
1648 beg leg 3  
1654 end leg 3  
1657 beg leg 4  
1707 end leg 4, climb to FL120  
1711 beg leg 5  
1723 end leg 5  
1725 beg leg 6  
1728 end leg 6, descend to FL110  
End pattern 2, Setup for repeat pattern for first 3 legs  
1731 beg leg 1, FL110  
1746 end leg 1, descend to FL090  
1748 beg leg 2  
1752 end leg 2, climb to FL100  
1755 beg leg 3  
1801 end leg 3

Done for the day, returning to Laramie

1821 wheels down

## Battle Town site report 1/16/2012 (Geerts)

IOP duration: 5:00am-3:45 pm (1200-2245 UTC) – superlong – due to change in seed plans. This resulted in a double flight, neither following the Ops Plan. The UWKA did fly any aerosol legs on either flight

weather: rather windy in the morning, wind from 240-250, T=-8 at the start of the IOP, cooling steadily. Cold front passage at 17:30 in Dixon, wind shift sudden cooling and start of snow in Dixon. At BTS it started snowing harder at 18:00 with a brief spell of large graupel balls (soft hail?) up to 1 cm diameter at 18:08. Some periods of heavy snow, large flakes, mostly small crystals later on. Wind speed decreased steadily.

BTS instruments:

- CPI: failed at about 16 Z. Hard disk appears dead – spare one available at SPEC. If replacement successful, the CPI may be back soon.
- Parsivel: OK (one only)
- MRR: started at 1750 UTC only, first 13 min vertical resolution 35 m, then from 1803 UTC vert res 200 m, to the end
- Hotplate: OK
- radiometer: OK
- weather station WXT520: OK, except records no wind
- note: CPI, Parsivel, hotplate and wxt520 started data collection at 00 Z (evening before). MRR, Parsivel, hotplate and wxt520 continued data collection thru about 02Z (evening of IOP).
- Snow chemistry sampling: hourly before 18Z, about half-hourly after that.
- Snow photography: OK, every 10 min. Sample of soft hail/graupel balls was photographed some 15 min after the graupel fell (it fell at 1808 Z). We collected some of the balls on the ground

AgI generators: type C window (joint ASCII-RSE, all 8 Ggens) SM-MB114 seeding started at 18:15 Z, ended at 22:12 Z.

DOW: performed well, between 1200-2245 UTC. RHI angles 230, 240, 250 degrees early. As the wind veers towards W and WNW, DOW RHIs follow the wind direction, close to 300 degrees. Down for ~10 min at 20Z.

Soundings:

- Dixon at 14:15, 15:45, 17:15, 18:45, and 20:15Z: complete
- Saratoga at 1545 Z and 1745 Z: complete

### **1/9/2012 ASCII Pilot notes (Flight 3)**

Crew: Drew, Kristovich, Oolman, French

Flight Time: 2.5

Objective: Ascii Case

Planned: 4 Ladder patterns, 2 Along-wind legs.

Actual: Departed LAR 14,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000.

Flew 5 rung ladder, 2 times at 13,000 from East to West alternating starting points each time. Did along wind leg over Bridger Peak Site at 13,000. Received message from ASCII Ops via Chat to return to Laramie. Returned to Laramie refueled and prepped for next flight (I.E. ate sandwich).

### **1/9/2012 ASCII Pilot notes (Flight 4 and Ferry)**

Crew: Drew, Kristovich, Oolman, French

Flight Time: 2.8 + .4 (Ferry)

Objective: Ascii Case

Planned: 2 Ladder patterns, 2 Along-wind legs.

Actual: Departed LAR 14,000 direct to CKW 135@37. Requested 20 nm radius of pt. at 13,000.

Flew 5 rung ladder, 2 times at 13,000 from East to West alternating starting points each time. Did along wind leg over Bridger Peak Site at 13,000. Headed back to Laramie, but weather was below approach minimums. Confirmed with LOD on Chat, and diverted to CYS. Refueled, checked weather and ferried to LAR with no data-system.

# Flight Report

RF04

Monday, 16 January 2012

## ***Flight Scientist Report (Kristovich)***

**Crew:** Tom Drew, David Kristovich, Larry Oolman, and Jeff French

**Objective:** Take observations of an upslope flow event. \*\* NOTE: This was the second flight on this day. See RF03 notes. \*\*

**Flight Details:** Approximate takeoff time was 1817 UTC. Two full “ladder” patterns, each having five “steps”, were conducted, using the same waypoints as used in RF01. Before returning to Laramie, two along-wind legs (using the 700 hPa wind direction) were conducted across the steps with a pivot point at Battle Peak. All flight legs were conducted at a height of 13,000’ msl.

Low visibilities in snow prevented landing in Laramie after the research flight ladders and along-wind legs. The aircraft landed at Cheyenne and returned to Laramie, landing at approximately 2055 UTC.

Approximate start and end times (UTC) for each of the ladder patterns, and the along-wind legs, are below. Each of the five steps in the ladders took approximately 5-6 min.

Ladder #1	1847-1921
Ladder #2	1925-1959

Along-wind legs	2002-2009 and 2011-2019
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### **Weather notes:**

Overcast skies and occasional snow particles were observed throughout the mission. During much of the flight, there appeared to be two cloud layers: below and above the aircraft. The ground could be seen infrequently through breaks in the lower clouds. Hazy sunshine could occasionally be seen, particularly after about 1900 UTC.

Turbulence was light to moderate in the first few flight legs of Ladder #1, with vertical motions peaking over  $5 \text{ m s}^{-1}$  at times. Vertical motions mainly  $< 5 \text{ m s}^{-1}$  were observed thereafter.

## ASCII-12

### RF04 Flight Notes (French)

16 January, 2012 (2<sup>nd</sup> flight)

#### Crew

T Drew

D Kristovich

L Oolman

J French

#### Preflight

First flight aborted about midway through because seeding generators were delayed for turn on. After landing, turned plane around in about 1 -1/2 hour for a second flight to fly pattern with seeding generators on. Plan on 2 full ladder patterns.

No issues with startup.

#### Flight

1818 wheels up

1828 everythin up and running, noted that up beam (H1) and downslant (H2) looked “funny”.

Confirmed that phase from both were not correct. Tried the following:

- Restarted a file—did not fix problem
- Restarted wcrserv –did not fix problem
- Soft reboot of ferret –did not fix problem
- Hard powered down everything, restarted, WCR was fine after that

1845 everything back up and running OK

Setting up for Ladder 1 at FL130

1847 beg leg 1

1852 end leg 1

1854 beg leg 2

1854 Note—CIP computer rebooted

1859 end leg 2

1901 beg leg 3

1906 end leg 3

1909 beg leg 4

1914 end leg 4

1916 beg leg 5

1921 end leg 5

Setup for Ladder 2 at FL130

1925 beg leg 1

1930 end leg 1  
1932 beg leg 2  
1937 end leg 2  
1939 beg leg 3  
1944 end leg 3  
1946 beg leg 4  
1951 end leg 4  
1953 beg leg 5  
1959 end leg 5

Setup for along wind leg

2002 beg along wind leg 1 (tailwind)  
2009 end leg 1  
2011 beg along wind leg 2 (headwind)  
2020 end leg 2

Done for the day, returning to Laramie

2040 Wx at Laramie is below mins, decided to head to Cheyenne

2055 wheels down, CYS

## Flight Report

ASCI103, RF03

Saturday, 7 January 2012

### ***Flight Scientist Report (Kristovich)***

**Crew:** Tom Drew, David Kristovich, Larry Oolman, and Jeff French

**Objective:** Take observations of an upslope flow event. \*\* NOTE: A second flight was conducted on this day. See RF04 notes. \*\*

**Flight Details:** Approximate takeoff and landing times are 1414 and 1645 UTC. Two full “ladder” patterns, each having five “steps”, were conducted, using the same waypoints as used in RF01. Before returning to Laramie, an along-wind leg (using the 700 hPa wind direction) was conducted across the steps with a pivot point at Battle Peak. All flight legs were conducted at a height of 13,000’ msl.

Approximate start and end times (UTC) for each of the ladder patterns, the along-wind leg, and the beginning of Ladder #3, are below. Each of the five steps in the ladders took approximately 5-6 min.

Ladder #1      1444-1518

Ladder #2      1522-1556

Along-wind leg 1601-1608

First leg, Ladder #3 1616-1620; Aborted mission as per Deshler; Generators were scheduled to start at 1815.

### **Weather notes:**

Overcast skies and snow were observed throughout the mission. Occasional breaks in the clouds below aircraft level allowed for short periods of observing the ground. The sun could occasionally be seen through the clouds above the aircraft, particularly in the southwestern-most flight legs.

Predominant snow particle sizes varied considerably along the flight legs. Locations with the largest snow particles varied from flight leg to flight leg. No consistent pattern could be discerned.

Turbulence was light to moderate, with vertical motions peaking over  $5 \text{ m s}^{-1}$  at times. The lower clouds had the appearance of having some convective elements (cumuliform) during the second ladder.

## **ASCII-12**

### **RF03 Flight Notes (French)**

**16 January, 2012**

#### **Crew**

T Drew

D Kristovich

L Oolman

J French

#### **Preflight**

No issues, plan on 4 hour flight, conduct 4 ladder patterns. WMI using this as a seeding case, seeders set to turn on at 1600 MST, midway through flight. Take off time at 1420 MST.

#### **Flight**

1415 wheels up  
1425 everything up and running, 2 cloud layers over the Medicine Bow, at FL140 just at top of clouds, lots of liquid water.  
1440 setting up for first ladder pattern, first leg will be NW to SE, winds are strong out of the west, at FL130  
1445 beg leg 1  
1449 end leg 1  
1451 beg leg 2  
1457 end leg 2  
1459 beg leg 3  
1503 LWC100 out to lunch, iced over  
1504 end leg 3  
1506 beg leg 4  
1511 end leg 4  
1513 beg leg 5  
1518 end leg 5

Return to starting point to repeat ladder

Ladder 2→

1524 beg leg 1  
1528 end leg 1  
1530 beg leg 2  
1532 2DP out to lunch, iced over  
???? end leg 2  
1537 beg leg 3  
1542 end leg 3  
1544 beg leg 4

1549 end leg 4  
1551 beg leg 5  
1556 end leg 5

Setup for along wind pass

1601 beg along wind leg  
1606 ice shattering on CDP  
1609 end along wind leg

Setup for ladder #3

1616 beg leg 1  
1620 found out that they delayed seeders, need to return to Laramie and do a fast turn around to  
come back out  
1625 RTB  
  
1641 wheels down

## ASCII Research Flight (RF03) 2012-01-16

Crew: Tom Drew, Dave Kristovich, Jeff French, Larry Oolman

**Summary:** Flight with RSE control of generators. Either Medicine Bow or Sierra Madre will be turned on at 1600Z. Omnistar is disabled.

1415 Take off

1427 LWC up to 1 g/m<sup>3</sup>, near top of lower cloud layer

1445 Start first ladder.

1451 Second leg. T/TD=-14/-18, wind=230@47

1459 Third leg. -14/-17, 230@47

1503 LWC100 may be iced up

1506 Fourth leg. 14/-17, 240@35

1511 LWC100 element may be completely iced over, LWCPWR=7 W

1513 Fifth leg. -15/-18, 240@44

1523 Second ladder. -14/-19, 230@43

1530 Leg 2. -14/-18, 230/50. 2D-P beam blocked

1537 Leg 3, -14/-17, 240@42

1544 Leg 4, -15/-19, 240@46

1551 Leg 5, -14/-18, 240@40

1553 Dixon winds 190@14G18

1557 Done with 2<sup>nd</sup> ladder

1602 On along wind leg at 13,000 ft.

1606 Larger ice pellets hitting windshield. Tail on CDP spectra but not FSSP

1616 Ladder 3, -14/-20, 240@48

1621 Heading home, generators not turned on.

1645 Land

**1/9/2012 ASCII Pilot notes**

Crew: Drew, Kristovich, Oolman, Bard

Flight Time: 3.7

Objective: Ascii Blowing Snow Pattern

Planned: 3 Blowing Snow patterns.

Actual: Departed LAR 12,500 direct to BL1, VFR Flight Following with 120.47. Communications with Center spotty at best, but they seemed ok with it. 132.1 is a much better frequency over work area.

Did legs BL1-2 at 11,000; BL2-3 at 9000; BL3-4 at 10,000; BL4-5 at 10,000; BL5-6 at 12,000; BL6-1 at 12,000. Did a vertical profile on BL4-5 12,000 down, on second two patterns. Center was pretty casual about the communication difficulties and only once relayed through another aircraft for a position update. After switched to 132.1 communications much better (although the wrong sector).

Monday, 9 January 2012

***Flight Scientist Report (Kristovich)*****Crew:** Tom Drew, David Kristovich, Larry Oolman, and Luke Bard**Objective:** Take WCR and other aircraft-based observations during a time period with snow on the surface, but no blowing snow or precipitation.**Flight Details:** Approximate takeoff and landing times were 1720 and about 2100 UTC. Three blowing snow flight patterns were flown, at altitudes between 9000 and 12000 ft msl. Each leg was flown at a constant height, approximately 2000 ft above the highest terrain along the leg, as listed below.

Waypoints	Altitude (ft msl)	Waypoints	Altitude (ft msl)
BL1-BL2	11,000	BL4-BL5	10,000*
BL2-BL3	9,000	BL5-BL6	12,000
BL3-BL4	10,000	BL6-BL1	12,000

\* During the second and third blowing snow pattern, a sounding was taken along this flight leg

Approximate start and end times (UTC) for each of the blowing snow patterns are below.

Blowing Snow #1	1738-1830
Blowing Snow #2	1838-1932
Blowing Snow #3	1940-2034

**Weather notes:**

Clear skies and light winds predominated throughout the flight. Thin cirrus clouds slowly increased in coverage during the flight. At the flight altitudes, observed wind speeds generally ranged from 0 to 6 m s<sup>-1</sup>. Stronger winds (to approximately 9 m s<sup>-1</sup>) and weak turbulence were observed during the soundings taken along BL4-BL5. No blowing snow was visible on the surface.

Most areas along the flight track had snow on the surface. Regions of snow/no snow were observed generally along track BL2-BL3.

**Recommendation:** If possible, this same flight pattern, including the soundings, should be flown during a blowing snow event.***Ggen/BTS/DOW/sounding reports***

Ggen, BTS, DOW and soundings were not operational during this flight.

## ASCII Research Flight (RF02) 2012-01-09

*Crew: Tom Drew, Dave Kristovich, Larry Oolman, Luke Bard*

**Summary:** Control case for blowing snow study.

**Pre-mission:** Replaced LWC100 element. Tightened mounting screws. CIP computer rebooted prior to startup. CIP probe would not come up. Omnistar was XP until engines started, then it went to VBS.

1721 Take off, Omnistar: DGPS VBS, Continued after takeoff. CIP was able to connect after takeoff.

1738 At BL1; 11,000 ft.

1751 BL2; 9,000 ft; Winds 280/05 knots

1758 BL3; 10,000 ft; Winds 300/09; T/TD=-3/-10

1806 BL4; 10,000 ft; Winds 260/07; T/TD=-2/-9

1817 BL5; 12,000 ft; Winds 350/07; T/TD=-1/-14. Nearly isothermal between 9 and 12 kft.

1832 BL6; 12,000 ft; Winds 350/10; T/TD=-1/-15

1836 Done with first pattern.

1839 Start 2<sup>nd</sup> pattern. 11,000 ft, 330/10, -2/-11

1852 BL2, 9,000 ft, 290/6, -4/-9

1859, BL3, 10,000 ft, 300/14, -3/-10

1908 BL4, Mini-sounding 12,000 (350/10,-1/-13) to 8,500 ft (calm, 0/-9)

1919 BL5, 12,000 ft, 340/6, -1/-14

1935 BL6, 12,000 ft, 350/11, -1/-14

1938 Done with second pattern.

1940 Start third pattern, 11,000, 340/7, -2/-11

1954 BL2, 9,000 ft, 300/8, -4/-9

2001 BL3, 10,000 ft, 290/8, -1/-11

2011 BL4, Mini-sounding 12,000 ft (330/13, -1/-14) to 8,500 ft (270/18, 1/-9). Higher winds near the bottom at ridge level.

2034 Done. Headed home.

2055 Land

**Post-flight debrief**

Soundings on BL4-BL5 leg were good.

Applanix worked on takeoff.

New LWC100 element, tightened mounting screws.

CIP rebooted prior to startup. Unable to talk to probe until after takeoff.

**1/7/2012 ASCII Pilot notes**

Crew: Drew, Kristovich, Oolman, Ritzman

Flight Time: 3.5

Objective: Ascii Ladder

Planned: 4 -5 rung Ascii Ladder patterns at 13,000

Actual: Departed LAR 14,000 direct to CKW 135@43. Requested 20nm radius of pt. at 13,000. Unable due to higher MIA to SE. Reduced radius to 15 nm and 13,000 was acceptable. Ladder is contained in 15nm radius.

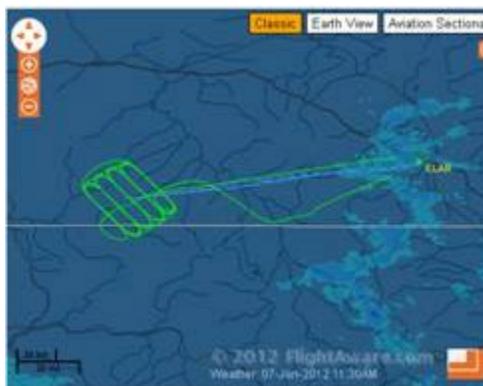
Flew 5 rung ladder 4 times at 13,000 from East to West alternating starting points each time. Crossed back over Battle Peak Site at 13,000 prior to departing area. Returned to Laramie at 14,000.

***Flight Scientist Report (Kristovich)***

**Crew:** Tom Drew, David Kristovich, Larry Oolman, and Jaclyn Ritzman

**Objective:** Take observations of a weak upslope flow event.

**Flight Details:** Rough approximate takeoff and landing times are 1437 and 1758 UTC. Four “ladder” patterns, each having five “steps” (see below), were conducted. The ladders were on the southwest side of the Sierra Madre Mountains. Before returning to Laramie, an along-wind leg was conducted approximately across the center of the steps. All flight legs were conducted at a height of 13,000’ msl.



*From [flightaware.com/live/flight/N2UW](http://flightaware.com/live/flight/N2UW) (retrieved on 9 January 2012).*

Approximate start and end times (UTC) for each of the ladder patterns are below. Each of the five steps in the ladders took approximately 5-6 min.

Ladder #1	1501-1536
Ladder #2	1540-1614 (generators started at 1615)
Ladder #3	1618-1651
Ladder #4	1656-1729 (generators ended at 1815)

**Weather notes:**

A great deal of clouds was present, particularly above the aircraft. Periods of broken or thin clouds (regions of blue skies or sun visible through clouds) were observed at times, particularly in the first two flight ladders. Clouds above the aircraft appeared to thicken with time throughout the day.

Low clouds, particularly below the aircraft, also increased throughout the flight. The lower cloud deck was more evident in the northwestern halves of the cross-wind flight legs (steps). Liquid water was observed by the aircraft, but was limited. Only slight riming was seen on the wings during flight. Snow was observed throughout most of the flight, but a regular spatial variation was not evident.

Comparison of soundings derived just after takeoff and just before landing indicated some cooling and moistening below 650 hPa.

**Recommendation:** Start the generators approximately 1 hr 30 min to 1 hr 40 min after takeoff. This is approximately between the second and third ladder patterns. Bart suggests conducting the along-wind flight leg between the second and third ladder patterns, to allow time for vertical dispersion from the generators.

### ***Ggen/BTS/DOW/sounding reports (Geerts)***

#### **Agl generators:**

SM03 - Mill Creek

SM04 - Sandstone Overlook

SM06 - Cottonwood Park

All three on 16:15 Z, off 18:15 Z

#### **DOW:**

Performed well, between 14:00– 21:30 Z. RHI angles 250, 260, 270 degrees early (before ~17 Z) to capture westerly flow, and 350, 360, 10 afterwards, as the flow became northerly.

#### **BTS instruments:**

Between 17-21 Z only, or part of that period – This was considered a shake down mission

CPI: OK

Parsivel: one of them OK, the other one failed and was taken back to Boulder

MRR: OK

Hotplate and weather station: OK

Snow chemistry sampling: hourly, 5 samples in total

Snow photography: OK

#### **Soundings:**

Dixon at 15:30 am and 17:00 Z: complete

Saratoga at 21:00 Z: complete

## ASCII Research Flight (RF01) 2012-01-07

*Crew: Tom Drew, Dave Kristovich, Larry Oolman, Jaclyn Ritzman*

**Summary:** Weak case, fly latter pattern four times

1437 Take off, Omnistar: DGPS VBS  
1448 Restart real-time Applanix solution  
1458 Step jump in LWC100, broken slave coil.  
1501` Start first ladder  
1505 Started WCR recording late on first line.  
1508 Leg 2  
1513 Below cloud base, some low stratus near ground  
1516 Leg 3, winds 240/16 knots  
1522 Leg 4  
1525 Aggregates of needles on CIP  
1530 Leg 5  
1533 Blue sky above us  
1536 Done with first ladder  
1540 Start second ladder  
1547 Leg 2  
1552 Some liquid water on lidar 500 meters below us  
1554 Leg 3  
1602 Leg 4  
1606 Seeing capped columns  
1609 Leg 5  
1614 End of ladder 2  
1619 Ladder 3  
1625 Leg 2

1632 Leg 3  
1640 Leg 4  
1647 Leg 5, light frost on windshield  
1652 End of ladder 3  
1657 Start ladder 4  
1703 Leg 2  
1710 Leg 3  
1716 Leg 4  
1723 Leg 5, upwind of generators, no liquid water  
1729 End of ladder 4  
1533 Doing an along wind leg towards 050 magnetic over Battle.  
1735 Higher lidar reflectivity 200 meters below us just before reaching highest terrain.  
1739 Heading home  
1758 Land

## ASCII Test Flight (TF05) 2012-01-05

*Crew: Tom Drew, Binod Pkoral, Larry Oolman, Bo Liu*

**Summary:** Test of loaner Applanix computer. Fly BL06-BL05 and take pictures

- 1721 Take off, Omnistar: VBS
- 1741 GNSS Status mostly DGPS VBS, occasionally C/A
- 1742 BL06 12,500 ft.
- 1746 Surface shiny enough to get reflections of WCR off KA.
- 1806 Start left radar circles over the Saratoga valley
- 1810 Right circles
- 1622 Under wave cloud, not visible on H1.
- 1630 Land

## ASCII Test Flight (TF04) 2012-01-03

*Crew: Tom Drew, Adam Wettlaufer, Larry Oolman, Bo Liu*

**Summary:** Test instruments after break. Fly through clouds and do radar circles.

1754 Take off, Omnistar: VBS

1821 Up-pol, 25000 ft

1826 Higher than expected depol on WCL, turned up N2 to 7.5 psi

1828 test/Down

1630 Still occasionally see weird stuff on housekeeping WCR display.

1832 test/up-dualdown, may have noise spike.

1835 up-dualdown\_250, noise spike may still be there.

1836 Descending to do radar circles. KA-monitor, every 2 seconds: WATCHDOG failure, System is Unresponsive. Everything else looks fine to me.

1837 Odd weak signal, high depol on WCL for a few seconds. Fogged over on outside?

1842 Omnistar VBS entire flight.

1846 Left 45 degree circle, short side-mirror file prior to this.

1854 Land

## **ASCII Test Flight (TF03) 2011-12-19**

*Crew: Tom Drew, Jaclyn Ritzman, Larry Oolman, Bo Liu*

**Summary:** Fly through clouds for 30 minutes. Complete mission with radar circles.

1718 Take off

1719 Restart Applanix by hitting red 'Stand by' and then blue 'Nav' buttons.

1742 Turn off lidar for low approach into Cheyenne

1754 Zero images (cloud droplets?) concentrated in center of CIP.

1801 Lost Applanix again.

### **Post flight notes:**

Applanix lost solution on takeoff. XP solution held.

## ASCII Test Flight (TF02) 2011-12-08

*Crew: Tom Drew, George Randolph, Larry Oolman, Bo Liu*

**Summary:** Climb to 21,000 ft to check lidar and do passes through clouds if there are any.

**Start up.** CIP computer came up with “The computer has recovered from a serious error”. New Omnistar subscription. New probe tips on the CIP.

- 2133 Take off
- 2136 Lost Applanix realtime solution, restart. Came back with VBS mode.
- 2140 Late at turning on pump and LWC-100
- 2158 Slow turn back. Bo reports good alignment on lidar.
- 2208 Start descent. New radar file.
- 2213 14,000 ft, heading towards Saratoga hoping for clouds.
- 2220 Passing over clouds.
- 2224 Head back to Laramie, switch to high resolution radar down mode.
- 2228 Nice blowing snow off ridge.
- 2238 Land

## ASCII Test Flight (TF01) 2011-12-05

*Crew: Ahmad Bandani, Brent Glover, Larry Oolman*

**Summary:** Do radar circles at 30 and 45 degrees, straight legs with pitching, straight and level. Finish with clouds passes if there are any clouds available.

**Start up.** Difficulty bringing up right generator. No Omnistar on this flight.

- 2148 Take off
- 2150 MABC on dew pointer.
- 2157 Left 30 degree turn, ground snow covered.
- 2201 Right 30 degree. Leakage of H1 into V2.
- 2204 Right 45 degree. Leakage gone.
- 2213 Start pitching
- 2217 Puff of smoke out right engine.
- 2219 Reverse course
- 2224 Reverse to NW, straight and level.
- 2232 Reverse course and repeat.
- 2244 No clouds so head home.
- 2257 Land, after checking data, this is the same time the CIP computer crashed.