

WEATHER MODIFICATION IN ND Dan Brothers

N O R T H **Dakota** Be Legendary.™



OUTLINE

- Brief history
- Cloud seeding in ND
- Project evaluations & benefits
- Research & development
- Weather modification in North America

HISTORY

- Pioneering discoveries at GE Research Lab, 1946
 - Dr. Vincent Schaefer Dry ice
 - Dr. Bernard Vonnegut Silver Iodide
- Project Cirrus collaborative research project began in 1947





Pl.259 Two lines cut through a deck of supercooled clouds, using dry ice fragments dispensed at rate of about 1 kg/km. Thin veils of ice crystals remain in seeded area but most have fallen.

P1.260 An extensive hole cut through cloud deck shown above. This opening developed in about 40 minutes and remained open for several hours. New clouds are starting to form in cleared area.

Pl.261 A solid deck of supercooled clouds seeded with burning pellets of charcoal containing silver iodide. The nuclei in the smoke converted mile-wide strips of cloud to ice crystals.

235

Pl.262 The same area as shown on Plate 261, from the other end of the seeded field about 10 minutes later as the ice crystals settled out of the cloud to produce lines of virga below cloud base.





WHY SEED CLOUDS?

- Rain/Snow enhancement
- Hail suppression
- Fog dispersal
- Sponsors include: counties, cities, states, irrigation districts, ski resorts, public utilities, water distributors, etc.



Cloud Seeding in North Dakota



CLOUD SEEDING IN NORTH DAKOTA

- First seeding attempts in 1948
- Project areas established, ground-based seeding in 1951
- Aircraft become preferred seeding delivery method in 1960
- In 1975, the Legislature created the ND Weather Modification Board to provide regulatory functions, operational support, conduct research and evaluations and provide State cost-share funding

NORTH DAKOTA PILOT PROJECT

- NDPP conducted from 1969-72
 - Randomized (3:1) proof of concept cloud seeding project in McKenzie County. Mountrail and Ward included in 1972
 - 67 rain gauges, radar observations
- Findings:
 - Statistically significant increases in (1) the number of rain events, (2) average rainfall per event, and (3) total rainfall in the target area (~10%). Published in AMS Journal of Applied Meteorology by Dennis *et. al*, 1975

NORTH DAKOTA PILOT PROJECT

- Findings:
 - Analysis of cloud seeding on hail indicated the ratio of average rainfall to hail energy was greater on seeded days and crop-hail insurance losses lower. Due to smaller sample size, results weren't statistically significant. Published in AMS JAM by Miller *et. al*, 1975



PROGRAM CREATION

- County participation through 51% petition or public vote
 - Creates 10-year authority
- Temporary (up to 4 year) authority created through public hearing and resolution of the county commission



PROGRAM CREATION

- Co. Comm. appoints 5 members to "Weather Modification Authority", which oversees project
 - ARB staff communicates with Authority members during the project to solicit feedback and adjust operations

NDCMP 2023



ND CLOUD MODIFICATION PROJECT

- NDCMP goals are hail suppression and rain enhancement
- Convective clouds (e.g. thunderstorms) are seeded by aircraft in the updraft below cloud base, or directly at cloud top
- Silver iodide acts as a nucleus for droplets to form and then freeze earlier than what occurs naturally
- Earlier ice formation induces competition and distributes the water in the cloud over more particles
- These particles don't grow as large and have greater ability to melt as they fall from the cloud



NDCMP AIRCRAFT



- Piper Seneca II
 - Base seeding



 Beechcraft King Air C90
 Top seeding 2020 NDCMP Flight Tracks





INTERN PROGRAMS

- ARB & UND have had an MOU to provide Intern Pilot training since 1975
 - Since then, 402 pilot interns have participated
- ARB's meteorology intern program began in 1996 and has provided training for 70 students

INDEPENDENT EVALUATIONS

- Crop insurance analysis over a 13-year period found 45% lower crop-hail losses in seeded counties vs. upwind control (JAM, Smith *et al.*, 1997)
 - Prior study of crop insurance in 1987 found 43.5% reduction
 - Nodak Insurance study found 43% lower incidence of hail claims in seeded counties versus the rest of N.D. (K. Pifer, personal comm., 1995)
- Several rainfall studies using varied datasets have indicated percentage increases from the low single digits to the low teens, with typical results in the 5-10% range (Eddy & Cooter, 1979, Johnson, 1985, Smith *et al.*, 2004, Wise, 2005, Tuftedal, 2020)

INDEPENDENT EVALUATIONS

- Wheat yields were found to be 5.9% higher on average in the seeded counties versus an adjacent control area (JAM, Smith *et al.*, 1992)
- Downwind effects show a slight *increase* in rainfall (Wise, 2005), which is consistent with findings from other programs in the U.S. and around the world (DeFelice *et al.*, 2014)

ECONOMIC EVALUATIONS

- Several economic studies have been done, the most recent by NDSU this year (Bangsund and Hodur, 2019)
 - Economics were evaluated for rainfall increases of 5 and 10%, and crophail damage reductions of 45%
- Analysis included the top 8 crops by planted acreage plus alfalfa
 - In the 5% rainfall scenario, direct benefits through additional ag production are \$21.22 million annually, or \$9.12 per planted acre
 - Under the 10% scenario, benefits are estimated to be \$41.9 million annually, or \$18.15 per planted acre
 - Estimated crop savable due to hail suppression was estimated at \$6.9 million per year

ECONOMIC EFFECTS

- Total combined benefits at 5% rainfall enhancement is estimated at \$28.2 million. B/C ratio: 30:1
- Total combined benefits at 10% rainfall enhancement is estimated at \$48.8 million. B/C ratio: 53:1
- State and local government revenues from enhanced ag production are estimated to range from \$576,000-\$999,000
- Other potential benefits that may be attributed to cars, homes, businesses and other infrastructure are not included





INDEPENDENT EVALUATIONS

- UND Graduate Thesis on NDCMP rainfall evaluation (Tuftedal)
 - Compared 3 NDCMP counties (Bowman, McKenzie, and Ward) to neighboring non-NDCMP counties.
 - Found 2 of 8 comparisons to have statistically significant increases in rainfall and overall a (not statistically significant) increase of 3%.
- Michigan State Evaluation
 - Compared wheat yields and crop insurance loss ratios between NDCMP and non-NDCMP counties.
 - Found statistically significant increases in wheat yields and insurance loss ratios, and a benefit-cost ratio between 36:1 and 37:1.

CONCLUSIONS

Weather modification has a long, successful history in North Dakota
Benefits to agriculture far outweigh the costs
More than 3 dozen operational programs in the western U.S. with continuing expansion

COMMON MISCONCEPTIONS

- Fiction: Few studies have been done and they're all old
- Fact: Several independent studies have been conducted to evaluate the effectiveness of cloud seeding
- Fiction: Seeding "kills storms" or reduces rain downwind
- Fact: Studies show that seeding enhances downwind precipitation as effects persist for a time after seeding
- Fiction: Silver iodide is dangerous to people and the environment
- Fact: Dozens of studies and thousands of field samples have proven that Agl poses no human or environmental danger

QUESTIONS

Pilot Aircraft Recordkeeping System (PARS)

Daniel Brothers



General Information

- Paperwork is required by law.
- From June 1 through the end of project a flight form and map are required for every flight the plane makes.
- Solution Keep it professional. All records are open to the public.
- If/when PARS doesn't work, paper flight forms and maps will be expected, so be prepared. It will happen to someone over the course of the summer.
 - Paper forms are provided in the packets given to pilots when they pick up their iPads.

Mission Summary

- Required for every flight
- Should be a synopsis of the mission. What happened. What was seen.
- If "Other" than what was the reason for the flight?
 - Most commonly a reposition flight
- What kind of "Maintenance"? Burner check or something else?
- If "Recon" than why no seeding?
- Sommon Abbreviations are ok, but avoid less common ones.
 - BIS for Bismarck is fine, 08D for Stanley is not.

- There are 5 possible purposes on project
- Recon An operational mission where no seeding occurred.
- Rain Rain enhancement, typically characterized by only using one burner and no BIPs.
- Hail Hail suppression, typically uses two burners and possibly BIPs.
- Other Miscellaneous ARB flights, usually reposition flights after missions.
- Maintenance WMI flights, usually burner checks and test flights after repairs.



FLIGHT REPORT - CLOUD BASE AIRCRAFT NORTH DAKOTA ATMOSPHERIC RESOURCE BOARD SFN 11816 (6/2000)

		The second se		or not out the
PAGE #	OF	ENGINES OFF 21129	HOURS	
		ENGINES ON 20124	1 GEN	2 GEN
		TOTAL TIME	EJCTBL	BIP

DATE (YY/MM/	00)	DISTRICT		SEED #	PILOT				COPILOT				PURPOSE	R - Bain C - Reconnaissance
11/05/	25	2	_	4	Danie	1 Brot.	hers		Mar	K Sc	hneide	r	$\mid H$	H - Halt M - Maintenance O - Other
A	В	¢	D	E	F	G	н	1	J	к	L	M		N
TIME (HH:MM)	EVENT #	VORTAC CODE*	VOR (deg)	DME (nm)	CLD BASE (kii)	ALTITUDE (kft)	UPDRAFT (fl/min)	TEMP (°C)	WINGTIP GEN (#)	PRECIP CODE**	# BIP FLARES	BIP FLARE YIELD (g)		REMARKS
20:24		8	078	54				28	0				Engines	On Stanley
20:30		8	078	54	4			28	0				Takeoff,	Burners 100 %
20:38	1	8	042	29	8.5	8.0	500	12	t	2			Ragged B	ases; Right Burner On
20:46	2	8	035	22	9.0	8.0	100	10	0	Z			Lost inflow	, Reposition, Burner off
20:55	3	8	164	2	8.0	7.0	700	11	2	3			Shelf Clou	d, Both Burners On
21:03	4	8	166	5	8.0	75	700	9	2	4	1	75	Steady Infl	by, Green Tiat, Flare
21:12	5	8	115	11	85	75	0	9	0	Z			Lost inflow	burners off, RTB
21:25		8	173	53				25	0			-	Land W.	atford City
21:29		8	173	53				25					Engines	OFF
:													0	
1														
													1	
:					1									
*VORTAC COD 1. Bismarck 5. 2. Devis Lake 6. 3. Dickinson 7. 4. Bowman 8.	PES Stanley Jamestown Minol Williston	**PRECIPI 0 - no precipit 1 - Virga only, 2 - rain shaft vi 3 - rain shaft vi be seen the 4 - heavy rain through	FATION INT alion observed precip not to g o surface, light vell establishe rough shalt, cannot i	TENSITY pround d, but can be seen	MISSION SUN Launched burger. The sto storm	IMARY I to devi Inflow w rm deviel died we	elop ment ras quic loped a n RTBon	t NE kly la ice sk	of Wil st, and watter	lliston. we re green	Initially pesitione tint s	seeded ed to a so one	for rai storm of BEP was	n using one rer Williston. used. As the

The storm developed a nice shelf and green tint so one BIP was used. As the storm died we RTBed to Watford City.







Old PARS Equipment







FLIGHT REPORT NORTH DAKOTA ATMOSPHERIC RESOURCE BOARD SFN 50864(12/2014)

ENGINES OFF	HOURS		PAGE #	OF
02:42:15	2.02		1	2
ENGINES ON	DRY ICE RATE	1 GEN	2 GEN	
00:41:00	0	0.00	0.8	37
TOTAL TIME	DRY ICE (lbs)	EJCTBL (grams)	BIP (grams	5)
02:01:15	0.00	0	45	50

DATE		DISTRICT	SEED #	PILOT				COPILOT					PURPOSE	R - Rain H - Hail O - Other
June 2, 2	2005	1	1		Jason A	kina							н	M - Maintenance C - Reconnaissance
Time (HH:MM)	EVENT #	LATITUDE (deg)	LONGITUDE (deg)	CLD BASE (kft)	ALTITUDE (KFT)	UPDRAFT (FT/MIN)	TEMP (°C)	PRECIP CODE**	DRY ICE (sec)	FL/ EJC	BIP	WINTIP GEN (#)		REMARKS
00:41:00		46.18383	-103.4268		2.8					0	0	0	Engines on in	Bowman.
00:51:15		46.17180	-103.3990		3.3					0	0	0		
00:58:10		46.17375	-103.3086	8	7.2	0				0	0	0		
01:05:00	1	46.36952	-103.1195		8.8	500	10	1		0	0	2	Two burners c	n.
01:13:13	2	46.39356	-103.0816		8.3	0				0	0	0	Two burners c	ff.
01:21:52		46.09642	-103.2415		8.0	0				0	0	0		
01:24:28	3	46.00716	-103.2847		8.1					0	0	2	Two burners o	n.
01:26:07	4	45.96891	-103.3281		8.3	400		2		0	1	2	BIP lit.	
01:32:30	5	46.00535	-103.3277		8.9	200				0	1	2	BIP lit.	
01:40:46	6	46.03755	-103.2380	9	9.1	700				0	1	2	BIP lit.	
01:45:56	7	46.08233	-103.1682		9.5	0				0	1	2	BIP lit.	
01:54:26	8	46.01844	-103.0616		9.6	800	10			0	1	2	BIP lit.	
02:02:17	9	46.21321	-102.9349	8	8.8	600				0	1	2	BIP lit.	

****PRECIPITATION INTENSITY**

0 - No Precipitation

1 - virga only, precip not to ground
 2 - rain shaft to surface, light
 3 - rain shaft well established, but can be seen through

4 - heavy rain shaft, cannot be seen through

MISSION SUMMARY lauched to the S part of the district to seed a line of new development moving in from the SW. this new line started to developed and run up through the N part of the district. I approached the cell by seeding in the front part of the cell flying N and S tucked up against the shelf cloud. It was probably the biggest shelf I ve seen since being with WMI. proceeded to seed in front of the cell till the end of the W buffer then RTB to the south around the storm.



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ENGINES OFF	HOURS		PAGE #	OF
02:42:15	2.02		2	2
ENGINES ON	DRY ICE RATE	1 GEN	2 GEN	
00:41:00	0	0.00	0.8	87
TOTAL TIME	DRY ICE (lbs)	EJCTBL (grams)	BIP (grams	5)
02:01:15	0.00	0	45	50

DATE		DISTRICT	SEED #	PILOT				COPILOT					PURPOSE	R - Rain H - Hail O - Other
June 2, 3	2005	1	1		Jason A	kina							н	M - Maintenance C - Reconnaissance
Time (HH:MM)	EVENT #	LATITUDE (deg)	LONGITUDE (deg)	CLD BASE (kft)	ALTITUDE (KFT)	UPDRAFT (FT/MIN)	TEMP (°C)	PRECIP CODE**	DRY ICE (sec)	FL/ EJC	BIP	WINTIP GEN (#)		REMARKS
02:12:30	10	46.19355	-102.7903		9.3	0				0	0	0	Two burners c	ff.
02:16:38		46.12243	-102.6910		9.3	0				0	0	0		
02:17:29		46.09520	-102.6750		9.3	0				0	0	0		
02:28:17		45.96544	-102.9941		7.3					0	0	0		
02:38:58		46.18854	-103.4312		2.8					0	0	0		
02:42:15		46.18464	-103.4266		2.8					0	0	0	Engines off in	Bowman.

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New PARS

iPad (3rd Gen)



iPad Mini (4th Gen)





FLIGHT REPORT NORTH DAKOTA ATMOSPHERIC RESOURCE BOARD SFN 50864(12/2014)

1	ENGINES OFF	HOURS		PAGE #	OF
	00:54:35	1.86		1	2
	ENGINES ON	DRY ICE RATE	1 GEN	2 GEN	
	23:03:01	0	0.00	1.1	19
	TOTAL TIME	DRY ICE (lbs)	EJCTBL (grams)	BIP (grams	5)
	01:51:34	0.00	0	15	50

DATE		DISTRICT	SEED #	PILOT				COPILOT					PURPOSE	R - Rain H - Hail O - Other
June 19,	2015	1	1		Vadim Ale	ekseev			Zac	h Sant	ee		н	M - Maintenance C - Reconnaissance
Time (HH:MM)	EVENT #	LATITUDE (deg)	LONGITUDE (deg)	CLD BASE (kft)	ALTITUDE (KFT)	UPDRAFT (FT/MIN)	TEMP (°C)	PRECIP CODE**	DRY ICE (sec)	FL/ EJC	BIP	WINTIP GEN (#)		REMARKS
23:04:23		46.16983	-103.3038		2.9					0	0	0	Engines on in	Bowman.
23:14:28		46.12606	-103.5557		6.6					0	0	0		
23:23:26		46.13757	-104.0315	8	7.2	400	19	4		0	0	0		
23:25:29	1	46.22966	-104.0407	8	7.0	700	19	4		0	0	2	Two burners o	on.
23:26:16	2	46.26484	-104.0426	8	6.8	700	19	4		0	1	2	BIP lit.	
23:36:18		46.16854	-103.9714		8.0					0	0	2		
23:37:13	3	46.20853	-103.9636	8.5	8.2	800	19	4		0	1	2	BIP lit.	
23:47:36		46.10335	-103.9900	8.5	8.6	800	15	3		0	0	2		
00:08:48		46.04565	-103.7454		8.8					0	0	2		
00:18:54		46.02869	-103.5730		9.5					0	0	2		
00:23:37		46.03232	-103.4734	9.5	9.2	700	10	3		0	0	2		
00:33:42		46.03102	-103.4444		8.8					0	0	2		
00:36:51	4	46.01844	-103.3630	10	9.5		15	1		0	0	0	Two burners o	off.

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MISSION SUMMARY We launched to check out a storm on the MT border. It was a well defined supercell. We had good consistent inflow of 800 ft/min. We seeded for a little over an hour and then returned to base to refuel and rechem.



FLIGHT REPORT NORTH DAKOTA ATMOSPHERIC RESOURCE BOARD SFN 50864(12/2014)

ENGINES OFF	HOURS		PAGE #	OF
00:54:35	1.86		2	2
ENGINES ON	DRY ICE RATE	1 GEN	2 GEN	
23:03:01	0	0.00	1.	19
TOTAL TIME	DRY ICE (lbs)	EJCTBL (grams)	BIP (grams	5)
01:51:34	0.00	0	15	50

DATE		DISTRICT	SEED #	PILOT				COPILOT					PURPOSE	R - Rain H - Hail O - Other
June 19,	2015	1	1		Vadim Ale	ekseev			Zac	h Sant	ee		н	M - Maintenance C - Reconnaissance
Time (HH:MM)	EVENT #	LATITUDE (deg)	LONGITUDE (deg)	CLD BASE (kft)	ALTITUDE (KFT)	UPDRAFT (FT/MIN)	TEMP (°C)	PRECIP CODE**	DRY ICE (sec)	FL/ EJC	BIP	WINTIP GEN (#)		REMARKS
00:46:55		46.12352	-103.3694		4.8					0	0	0		
00:54:35		46.17124	-103.3038		2.9					0	0	0	Engines off in	Bowman.

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- Good ReaderNDCMP Documents
- Foreflight
 - Available June 1
 - I'll send an email with log in info when setup
- Go ToMeeting
 - Video Chat service for briefings
- Other









- iPad should always be charged and ready to go.
- Bring the charging cord with you.
- Battery lasts longer with lower screen brightness.
- Location Services On for Safari
- WiFi OFF when running PARS
- On't Overheat iPad. Don't leave on dash of car or plane



- GPS Flight Tracking WILL NOT WORK if you are not in the PARS app with the screen on.
- Select PARS!
- Always allow PARS to use current location. That's the GPS!
 - PARS is a web-based application, so you ALWAYS give Safari permission to use GPS as well, if asked.
- Turn off Cellular Data in settings.

PARS Homepage

Start GPS Beta Version 0.00943

●●●○○ Verizon ᅙ

Crew Preferences may not be set the first time you open PARS, or the preferences may not be accurate.

First Select Crew Prefs to set the Security Key

> The crew preferences have not been set. You may need to Ge ARB Information from the ARB SYNC tab if the dro down lists for pilots and aircrafts are not populated.

15:02

* 87% 🗔

LIGHT AFTER CHEM CREW ARB DEBUG

CREW PREFS

The Security Key is required to Download and Upload info to the Flight Database

Should already be set, but check to make sure.

If you need the Security Key, call Dan.

Next Select ARB SYNC to download the most up-to-date info from ARB. (Must be connected to Wi-Fi)

	Jody Fischer	
t CoPilot:	Daniel Brothers	
raft Type:	Base	
Number:	Seed 1	
t Airport:	Bowman	
District:	D1	
urity Key:	960-536-731-890 Set	$\Big)$

Default Pilot:

Default

Airc

Seed

Defaul

Secu

ARB SYNC

Get ARB Information

- Downloads info such as Pilot lists, Co-Pilot lists, and Airports.

After you Get ARB Information, select CREW PREFS from the bottom menu.

$\left(\right)$	Get ARB Information	
$\left(\right)$	Send Chemical Inventory	
0	Items	
\bigcirc	Sync Selected Flights	\supset
(Send Weekly Aircraft Report	

8:04 PM

100% 🗩 🖌

iPad ᅙ

CREW PREFS

These menus let you select the basic information for your plane.

DO NOT change info for one flight or for a rotating vacation intern. These adjustments can and should be made in the Flight Info for that flight.

Once Preferences are set, select Flight from the bottom menu.

Default Pilot:	Jody Fischer	•
Default CoPilot:	Daniel Brothers	Ţ
Aircraft Type:	Base	Ţ
Seed Number:	Seed 1	v
Default Airport:	Bowman	Ţ
District:	D1	Ţ
Security Key:	960-536-731-890 Set	\bigcirc

Def

FLIGHT AFTER CHEM

ARB SYNC

Flight

Anytime you are launched, Start GPS immediately.

- Before you even get to the plane.
- This gives the GPS a few minutes to get proper accuracy.

Many buttons require a double tap to work. The first tap darkens the button. The second tap confirms the button.

- Helps prevent mistakes in bumpy airplanes.

Seed 2 Base Seeder

7:57 PM

🗏 100% 🔲

AFTER CHEM CREW ARB DEBUG FLIGHT INV PREFS SYNC

••••• Verizon 🔶

Beta Version 0.00943

Start GPS

Flight

Once GPS is turned on the map appears showing your current location.

GPS accuracy should be at least 10 before Engines On.

Press Engines On as close as possible to actual Engines On of the airplane.



FLIGHT AFTER CHEM CREW ARB DEBUG FLIGHT INV PREFS SYNC

Flight

Select/Change the necessary fields.

- Left Seat must be selected as either PIC or Intern. Who is sitting in the left seat.
- Purpose must be selected. Use Recon if not sure. Can be changed during or after flight as well.
- Engines On Date and Time must be selected. If you pushed Engines On at the correct time minimal adjustment should be needed.

When all info is correct push START.

04/02/2017 21:21:46 Δ=1 46.817219413759275,-10	Lat=46.8173 Lon=-100.77 0.77824715686677 moved	84 Acc=10 Alt=530 1=35.34298602556	within 4 Spd=0 Hd=30 144
Pilot:	Chance Faul		
CoPilot:	Daniel Brothers		
Left Seat:	PIC		
District:	D1		
Seed Number:	Seed 2		
Take Off From:	Bismarck	*	
Purpose:	Hail		
Engines On:	pr 25 0017	4.04 DM	
CANCEL	https://pars Are you sure y see	s.swc.nd.gov ou want to start ding?	
	Cancel	ок	

4:21 DM

1 * 100%

PARS will double check with you. Say OK

Base Seeder

Options for Left Burner, Right Burner, Both Burners, BIP Flares, and Add Remark.

- Push Buttons as actions actually occur in flight. This will give us the most accurate chem usage and physical position of events.
- Remarks should be entered at least once every 10 minutes, even if no event occurs.
- Any time an event occurs the iPad will automatically prompt you for Remarks.





FLIGHT AFTER CHEM CREW ARB DEBUG FLIGHT INV PREFS SYNC

Remarks

Remarks include Updraft, Temp, Cloud Base, and Precip Code.

- Updraft: Nearest 100 kft. Leave as N/A in clear skies.
- Temp: Must be entered. Air temp in degrees Celsius.
- Cloud Base: Leave as N/A if there are no clouds. Will automatically place the decimal point. (ex: Entering 65 produces a 6.5 kft cloud base height.)
- Precip Code: Use N/A for no clouds.
- SAVE!



Base Flight

Counters keep track of chem usage

- Burners are tracked in minutes
- Flares are # of flares used

Flight time is also tracked in minutes.

If purpose changes, you can change it with a drop-down menu.



FLIGHT AFTER CHEM CREW ARB DEBUG FLIGHT INV PREFS SYNC

Base Flight



Make sure all seeding equipment is off before trying to turn off Engines

Hopefully, this isn't a problem since you are entering what happens in flight, and you wouldn't be landing with burners still on.



FLIGHT AFTER CHEM CREW ARB DEBUG FLIGHT INV PREFS SYNC

Top Flight

The King Air uses Dry Ice, Ejectable Flares, and BIP Flares, but does not have burners. Does not seed at Base.

When selecting Ice or EJC you start a "Run".

- If you pressed Ice, the Ice will already be On.
- If you pressed EJC the Ice will be Off.
- Counters keep track of Ice time and flares used.



Bad GPS Issue

If GPS is working, you have a bunch of data at the top of the screen.

If GPS stops working, the data is replaced by a "Bad Accuracy" alert. (Or if Acc > 10)

The iPad will continue to reset the GPS until it regains a signal. Please let Dan know if there is a prolonged period with no GPS signal.



Map Shading

Target areas have no shading.

Buffer Zones have a light green shading (Not Shown).

Non-Operational areas have a red shading.

Red means No Seeding.



FLIGHT AFTER CHEM CREW ARB DEBUG



Select AFTER FLIGHT from the bottom Menu.

Select the appropriate flight from the list.

You can also sort flights.

The first time you select a flight you will be prompted for BIP and EJC usage.

- These should be based on a VISUAL count of the number of flares ACTUALLY used during flight.
- If you get it wrong, you don't get a second chance. Get it right the first time.
- Check the appropriate box if you had burner problems or if seeding was suspended due to flash flooding or tornado warnings.

All	Wed, 30 Apr 2014 13:25:00 GMT	
BIP Flares:		
EJC Flares:		
Burner Problems:		
Seeding Suspensions:		
	Done	
$\langle \rangle$		
1 2 3	4 5 6 7 8 9 0	×
- /	:;;()\$&@G	0
#+= undo	. , ? ! ' "	#+=
АВС 🔱	ABC	Ň

If the number of flares used doesn't match the number of flares entered during flight the count turns red.

- You will need to fix this before syncing your flight.
- Various controls allow you to move between records.
- There are also menus for adjusting flight info if necessary.
- Enter a flight summary in the space provided.



Moving through Records

- You can sort records using the menu.
- Events include EON, EOF, BON, BOF, LON, LOF, RON, ROF, BIP, EJC, and ICE.
- You can Remove a Flare if you had an erroneous entry. (ex: A dud)
- You can add a flare if you forgot to hit the button during flight.
- Don't forget to Save Summary any time you make changes.



Finding where to add a flare.

- The map can be helpful in finding where to add a flare, if you know about where it should have been.
- While in the flight records, press the FLIGHT button at the bottom of the screen.
- The map shows the planes position at the time of that record. Use the controls to go through the flight.
- Go back to AFTER FLIGHT and you'll be on the new record for editing.



Weekly Report

Only for home site.

Weekly Chemical Inventories are completed every week before 17Z Monday morning.

Make sure Date and Time are entered and accurate.

SAVE



ARB Sync

Send Chemical Inventory will send your weekly chemical to Bismarck.

d ᅙ	8:04 PM
Get ARB Information	
Send Chemical Inventory	
) Items	
Sync Selected Flights	
Send Weekly Aircraft Repor	t

iP

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ARB Sync

A menu shows any syncable flights.

Only select flights when you are
ready to send them. (Summary is
completed)

A flight is not syncable if you have not gone through After Flight yet.

A flight can not be resent unless a change is made. (Change Summary if needed)

Sync Selected Flights (May take a few minutes)

ad a		8:05 PM
	Cot APR Information Select Flight	\geq
	Wed, 26 Apr 2017 10:05:00 GMT 🗸	
0	Items	
	Sync Selected Flights	
_	Send Weekly Aircraft Repor	t

FLIGHT AFTER CHEM CREW ARB FLIGHT INV PREFS SYNC DEBUG

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ARB Sync

SEND WEEKLY FLIGHT REPORT

-Used to report the number and type of flights during the week.

iDad @

-Make sure the proper week is selected.

-Enter the total number of flights for each day, based on UTC, regardless of purpose.

-If flights occurred, list the EON, EOF, and purpose of each flight.

-List # and type of flares used, if applicable.

-Push Send. You will be automatically returned to the ARB Sync page.

Devi		4/24 - 4/30
Day Monday		No flights
Tuesday	0	No flights
Wednesday	0	No flights
Thursday	1	EON 1504 EOF 1735 Hail 2 2 BIPs
Friday	0	No Flights
Saturday	0	No Flights
Sunday	2	EON 1832 EOF 1946 Recon EON 2103 EOF 2129 MX
Cancel		Send
FLIGHT AFTER FLIGHT	CHEM CREW AR	B DEBUG

8:08 PM

100% ■

