2019 FIREX-AQ Twin Otter Teleconference
May 21, 2019

1. Met Otter updates
2. Chem Otter instrument updates
3. Integration schedule & logistics
4. Test flights
5. Shipping and transit
6. FBO in Boise (Jackson Jet Center)
7. In-field operations, night flights, campaign end dates

Met Otter N46

Current Status –
Lidar

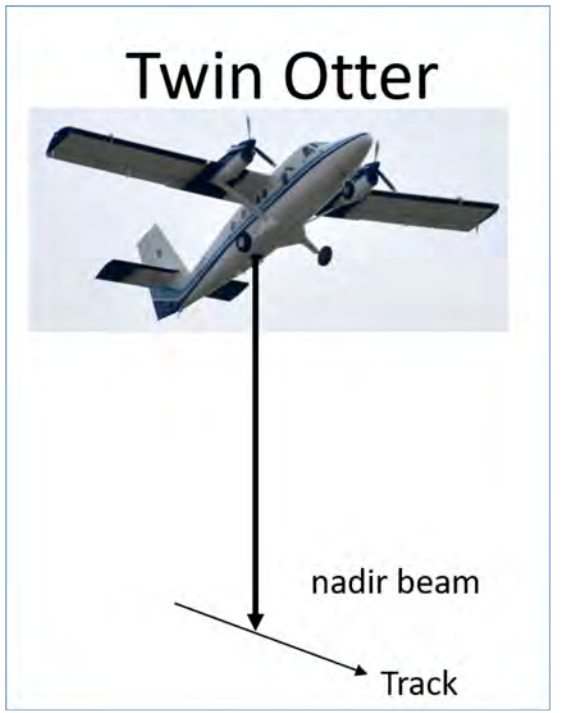
- **Processor upgrades and in-flight support software has been developed and is being tested.**
- **Direct drive scanner and control software is being tested.**
- **Flight Certification paperwork for scanner mods is in place.**

Night Fox

- **Telecon with AOC to discuss mounting in camera bay – AOC will make mounting plate send to Boulder**
- **Other mounting hardware is being manufactured locally and should be back in 7-10 days**
- **Work is being done on electronics package**
- **Software testing underway**

Scanning Mode

Vertical Staring mode

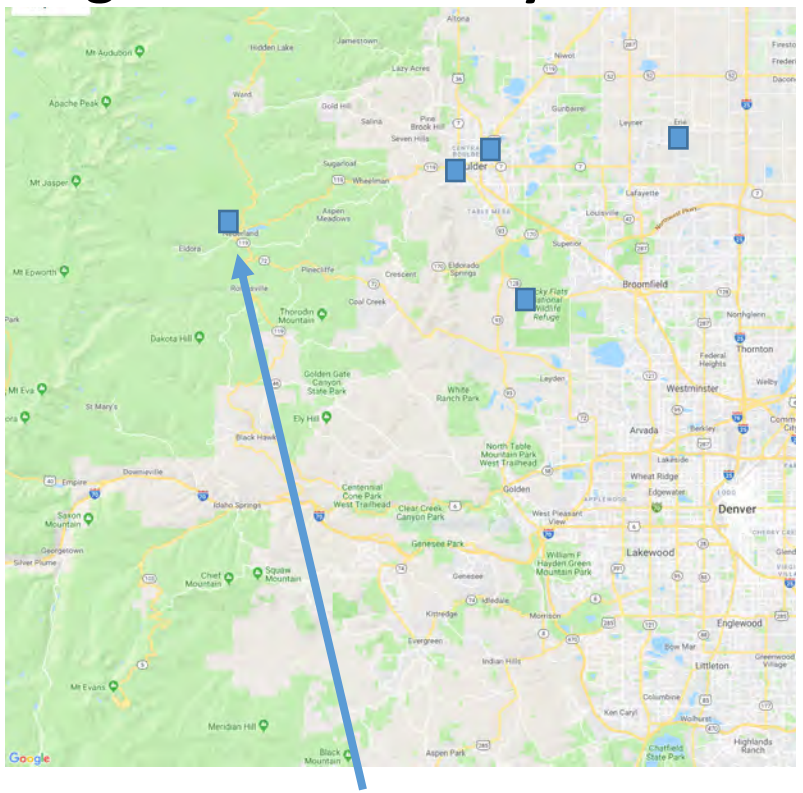


Met Otter N46

Test Flights in Boulder Area Week of July 15th

- Will deploy 4-5 Doppler Lidars for overflight comparison
  - Mountain, Transition, “Plains”
- Two flights – stable and convective conditions
- Made from a range of altitudes to evaluate optimal averaging and resulting horizontal resolution.

Met Otter Front Range Test Flights Week of July 15th



Doppler Lidars

Potential collaboration with Craig Clements from Fire Weather Research Lab San Jose State University

If the Otters fly missions in Northern California

- **Ground based, mobile scanning Doppler Lidar & Radar**
- **Transit time approx. 6 hours**
- **No direct funding, but interested in making combined measurements.**

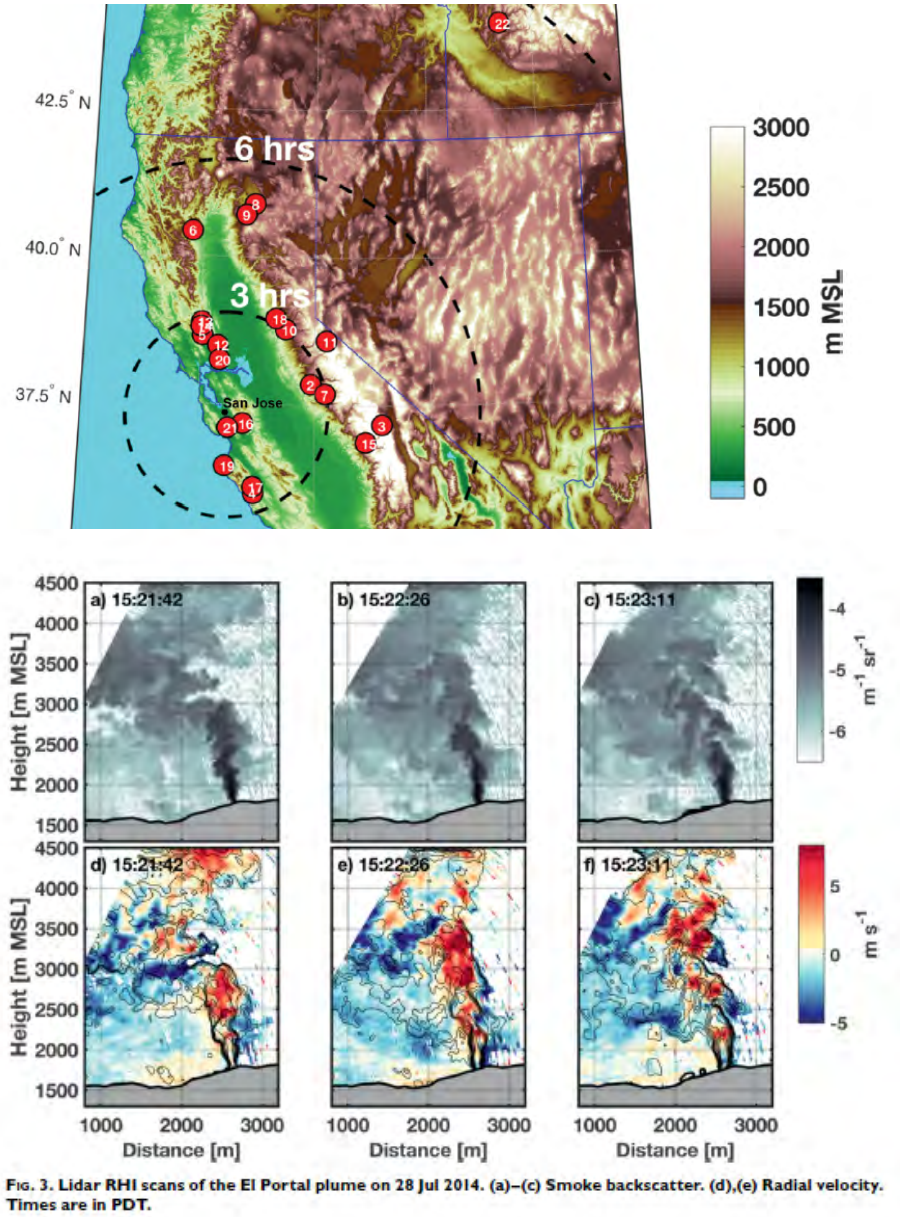


FIG. 3. Lidar RHI scans of the El Portal plume on 28 Jul 2014. (a)–(c) Smoke backscatter. (d),(e) Radial velocity. Times are in PDT.

Clemments et al. 2018, The Rapid Deployments to Wildfire Experiment

Instrument	Position	Species Measured	Investigators	Institution	Status
Picarro CRDS	1	CO, CO_2, CH_4, H_2O	Colm Sweeney	NOAA GMD	
Met Probe & Diff GPS	1	RH, Temp, Pres, Winds, GPS, flight data	Mike Robinson, Steve Brown	NOAA CSD	
Tenax cartridge autosampler	1	Speciated VOC	Kelley Barsanti, Lindsey Hatch, Avi Lavi	UC Riverside	
I^- ToF CIMS	2	Acids (HNO_3, HONO, Organics), acid gases (N_2O_5, $ClNO_2$), Oxygenated organics, Organic nitrates, Halogens	Joel Thornton, Brett Palm, Carley Fredrickson, Zach Decker	University of Washington / NOAA	
Aerosol mass spectrometer, UHSAS	3	Aerosol composition + size distributions	Ann Middlebrook, Ale Franchin, Kathy Hayden, Shao-Meng Li	NOAA CSD Environment Canada	
Brown carbon PiLS	4a	Spectrally resolved aerosol absorption	Rebecca Washenfelder, Lisa Azzarallo	NOAA CSD York University	
Chemi-luminescence	4b Floor	NO, NO_2, O_3	Andy Weinheimer, Denise Montzka, Geoff Tyndall, Frank Flocke	NCAR	
TRAC Sampler	4a	Particle composition, mixing state, morphology	Alex Laskin, Jay Tomlin, Kevin Jankowski	Purdue University	
Offline WSOC analysis	4a	Particle composition	Cora Young, Lisa Azzarallo	York University	
jNO_2 heads	Camera port	NO_2 photolysis rates	Mike Robinson	NOAA CSD	

Chem Twin Otter Payload Spreadsheet

https://docs.google.com/spreadsheets/d/1O0Tij-AY93KaB43RfqNDitCjnBwwj8q2P09koMyS8J0/edit#gid=660888805

A	B	C	D	E	F	G
Instrument	**Power (kVA)**	**Weight Estimate (lbs)**	**Deployed ? (1 = yes)**	**Target Weight (lbs**	**Deployed Power (kVA)**	**Position**
Station 1 - Met/DAQ/VOC	0.6	208.1	1	208.1	0.6	1
Station 2 - ICIMS	1.1	368.1	1	368.1	1.1	2
Station 3 - AMS	1.1	436.4	1	436.4	1.1	3
Station 4 - BrC/NOx	1.55	447.3	1	447.3	1.55	4
O3 Plate	0	76	1	76	0	4a
Station 4 Pump Plate	0	98.8	1	98.8	0	4b
Bottle Rack	0	76.3	1	76.3	0	5
Equipment Subtotal	**4.35**	**1711**	**7**	**1711**	**4.35**	
Pilots		360	1	360		
Scientists		360	1	360		
Life raft		70	0	0		
Crew Subtotal		**790**		**720**		
Total	**4.35**	**2501**		**2431**	**4.35**	
Available	4 kVA 115 VAC	**2200**		**2200**		
	~3 kVA 28 VDC					
	up to 7 kVA					

Hazardous Materials

- Lists on each tab in the spreadsheet show the hazmat information collected thus far
- Matt Roberts will be updating and organizing this information and will contact investigators

https://docs.google.com/spreadsheets/d/1O0Tij-AY93KaB43RfqNDitCjnBwwj8q2P09koMyS8J0/edit#gid=660888805

Example from AMS Tab

Hazardous Materials

Name	Unit	Quantity	UN #	CAS number	Location	SDS
Ammonium chloride	25 g	1	3077	12125-02-09	Hangar	On file
Ammonium nitrate	25 g	1	1492	6484-52-2		
Ammonium sulfate	25 g	1	NDG	7783-20-2		
Apiezon L grease	25 g	1	NDG	8012-95-1		
Compressed air	150 ft3	1		132259-10-0		
Helium	35 ft3	1		7440-59-7		
Methanol	500 ml	1	1230	67-56-1		
Mini-Buck soap solution	100 ml	1	NDG	7732-18-5		
n-Butanol	500 ml	1	1120	71-36-3		
polonium-210	740 MBq	1	2915	7740-08-06	Aircraft	
polystyrene latex spheres in water	120 ml	1	NDG	9003-53-6		
Silica gel	2 kg	1	NDG	112926-00-8 and 7646-79-9		

NDG = Not dangerous goods

Pre-Campaign Schedule

May 28 – June 24: NCAR Foothills Lab chamber experiments. I- CIMS will be participating with Brett, Carly and Zach

July 1 - 15: Integration of BrC PiLS into station 4 rack at NCAR

As of July 15:

Station 2 (I^- CIMS) and Station 4 (BrC PiLS, NO_x) racks will be at NCAR Foothills Lab

Station 1 (AOC) and Station 3 (AMS) racks will be at NOAA

July 15: Box truck from NOAA to RAF to transport Station 1 and 3 racks + equipment

July 16: Box truck from NCAR to RAF to transport Station 2 and 4 racks + equipment

Access to the NCAR Research Aviation Facility

Shipping / Contact information	NOAA Twin Otters Research Aviation Facility 10802 Airport Court Broomfield, CO 80021 Point of contact: Pavel Romashkin, 303-497-1027

- Pavel Romashkin will contact investigators on the otter list in late May / early June with procedures to obtain a badge

- Please upload a picture of yourself to the ”personnel” folder at the link below (already circulated by e-mail)

  Format = Lastname_Firstname.jpg (or other graphics format)

  https://drive.google.com/drive/folders/1YI_QzoY4dZ0QxhlyMP9AMkclzuUDn19j?usp=sharing

- Please also note that the “hazmat” folder is for SDS sheets and will be populated separately by Matt Roberts

Proposed Integration Schedule Revision

2019 JULY

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
14	15 Transit Florida to RAF Box Truck NOAA to RAF	16 Box Truck NCAR to RAF	17 Aircraft Prep	18 Sta. 1 & 2 NO_x Pump	19 Sta. 1 & 2 NO_x Pump	20 Sta. 3 AMS
21	22 Sta. 3 AMS	23 Sta. 4 BrC, NOx O_3 Shelf	24 Sta. 4 BrC, NOx O_3 Shelf	25 Instrument Tests & Cross Training	26 Test Flights & Packing	27 ??
28	29 Test Flights & Packing	30 Test Flights & Packing	31 Transit RAF to Boise		First Research Flight	

July 15-16: Transit from Lakeland, FL to Broomfield, CO (RAF)

July 17: Aircraft Prep, window plates, exhaust, inlets, etc.

July 18-19: Stations 1 & 2 (Picarro, VOC sampler, Met probe / GPS, I^- CIMS), NO_x Pump

July 20,22: Station 3 (AMS)

July 23-24: Station 4 Integration (BrC PiLS) + NO_x/O_3 Rack + O_3 shelf

July 26-30: Test flights & packing

July 31: Transit from Broomfield, CO to Boise, ID

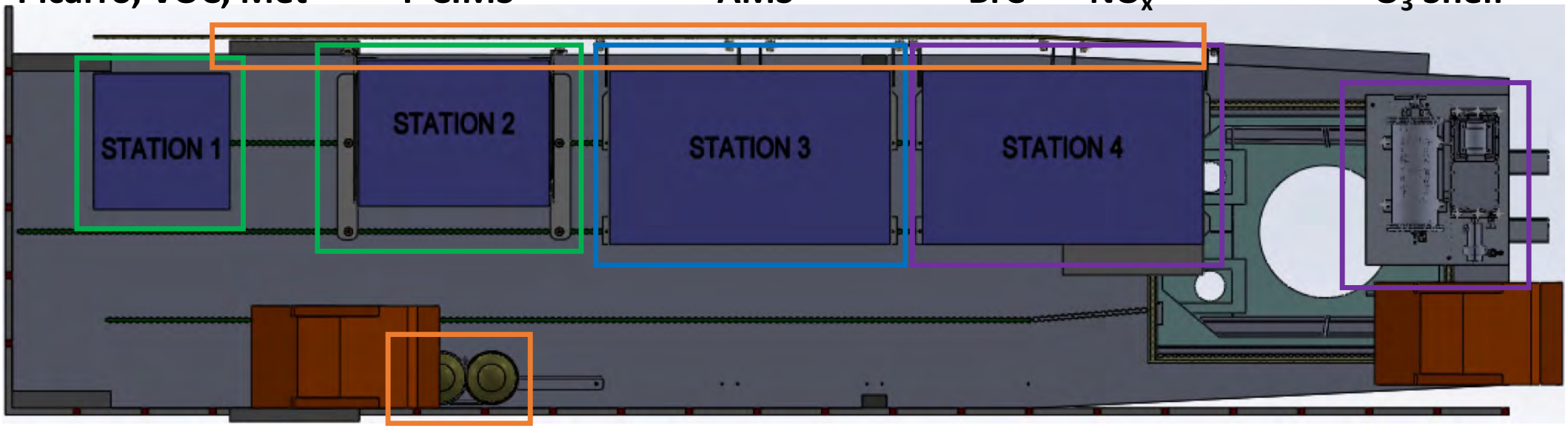
Aug 2: First research flight

Balance of two priorities:

1. Allow sufficient time for integration and test flights
2. Arrive in Boise with enough time to coordinate with other aircraft & ground instruments

Proposed Integration Schedule – Payload View

Picarro, VOC, Met | I^- CIMS | AMS | BrC | NO_x | O_3 Shelf



NOx Pump

July 15-16: Transport equipment to RAF

July 17: Windows, Inlets, Bottle Rack & Exhaust

July 18-19: Station 1, Station 2, NO_x Pump

July 20,22: Station 3

July 23-24: Station 4, O_3 shelf

July 26-29: Test flights, packing

July 31: Transit

Proposed Integration Schedule – Instrument Teams

Picarro, Met Probe, J-heads, Aerosol Inlet	July 17 – 19
VOC Autosampler	July 17 – 19
I- CIMS	July 17 – 19
AMS	July 17, July 20 – 22
BrC PiLS	July 17, July 23 – 24
TRAC Sampler (?)	July 23 – 24
NO_x, O3	July 17 – 19, July 23 – 24
All Instrument Teams	July 25 - 31

Test Flights & Instrument Cross Training

- Current plan is two test flight days, although we can consider shortening to one if priority is to get to Boise sooner

- Test flight objectives / logistics:

  - Takeoff and land twice, with refueling procedure practice in between
  - If two test flight days, then four total flights of 1 - 2 hours duration
  - Rotate through all of our flight scientists and instrument scientists (see later slides)
  - Use a fixed local source, such as a power plant, to practice plume finding and transecting
  - Use a convenient local airfield, such as Greeley, to practice missed approaches (consider using local mountain valley airfield … TBD) and vertical profiles / spirals
  - Some flight patterns specific to calibration of met probe
  - Unlikely to coordinate Chem Otter test flights with Met Otter due to schedule mismatch

- Contact Mike Robinson, Rebecca Washenfelder and Steve Brown for requests for seats and / or specific flight patterns

- All instrument teams should provide a one-page, bulleted summary of instrument startup, shutdown and operation

Transit to Boise

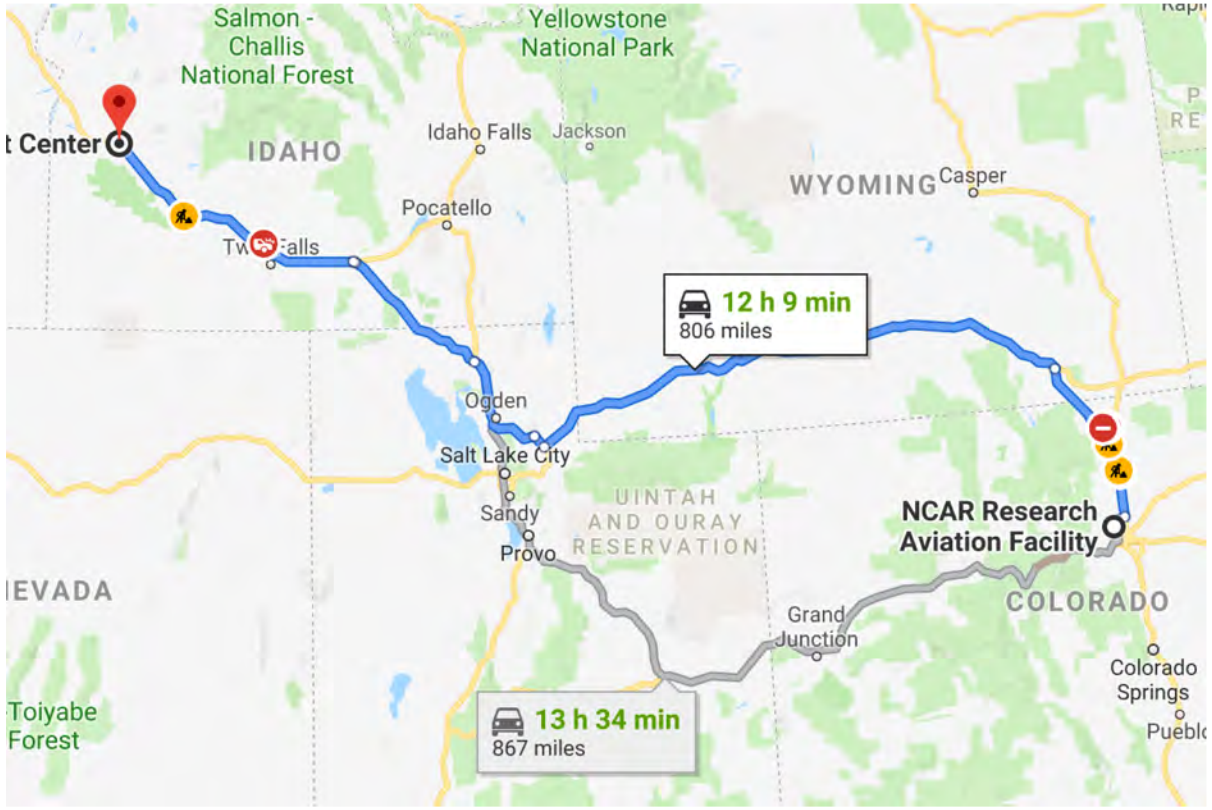
• Transport equipment from RAF to Boise on July 31 in a 24’ rental truck with a lift gate. Truck will not stop at NOAA or NCAR Foothills Lab.

• Same truck will be used to carry equipment from Boise to other FBOs as needed during the campaign.

• Support truck (NOAA CSD F450 or equivalent) will transit to Boise at the same time.

• Some (not all) hazardous material will need to be shipped separately. Ship hazmat to Boise on July 29.

• Need four truck drivers for this transit
    Matt Roberts
    Mike Robinson
    Ale Franchin
    One more lucky volunteer



Initial Base for Twin Otter: Jackson Jet Center

NASA DC-8 and its operations will be at the National Guard Base at the Boise Airport

NOAA Aircraft Operations has expressed a preference to base out of Jackson Jet Center, on the other side of the airfield

Jackson Jet Center will give us hangar space that is not available at the guard base

Meeting / office space will be at the Guard base with the rest of the project until the DC-8 departs.

Jackson Jet Center Contact Information

https://www.esrl.noaa.gov/csd/projects/firex-aq/twinotterCHEM/logistics/

NOAA Project
Jackson Jet Center
3815 Rickenbacker Street
Boise, ID 83705
Point of contact: Brent Eborn, 208-383-3300

- Please ship any hazmat that you do not need for integration (e.g., compressed gas cylinders) directly to Jackson Jet Center

- We will transport smaller quantities from Jackson to support operations at other airfields as needed

Alternate Airfields

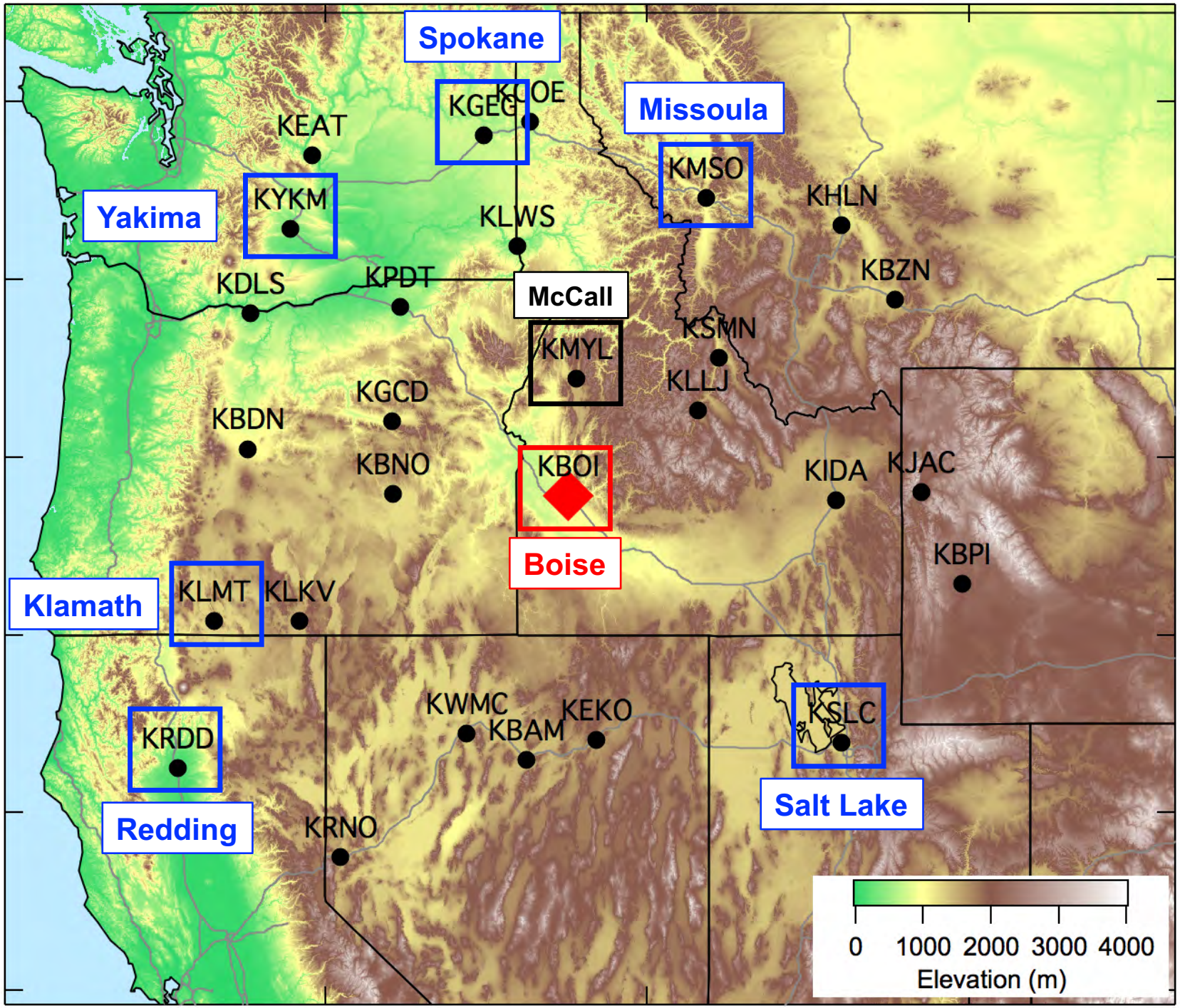
- Request is in to NOAA Aircraft Operations to identify FBOs at six alternate locations

  Missoula, MT
  Spokane, WA
  Yakima, WA
  Klamath / Crater Lake, OR
  Redding, CA
  Salt Lake City, UT

- Transits to these airfields would likely require 2-3 days on either side of a move before research flights could resume

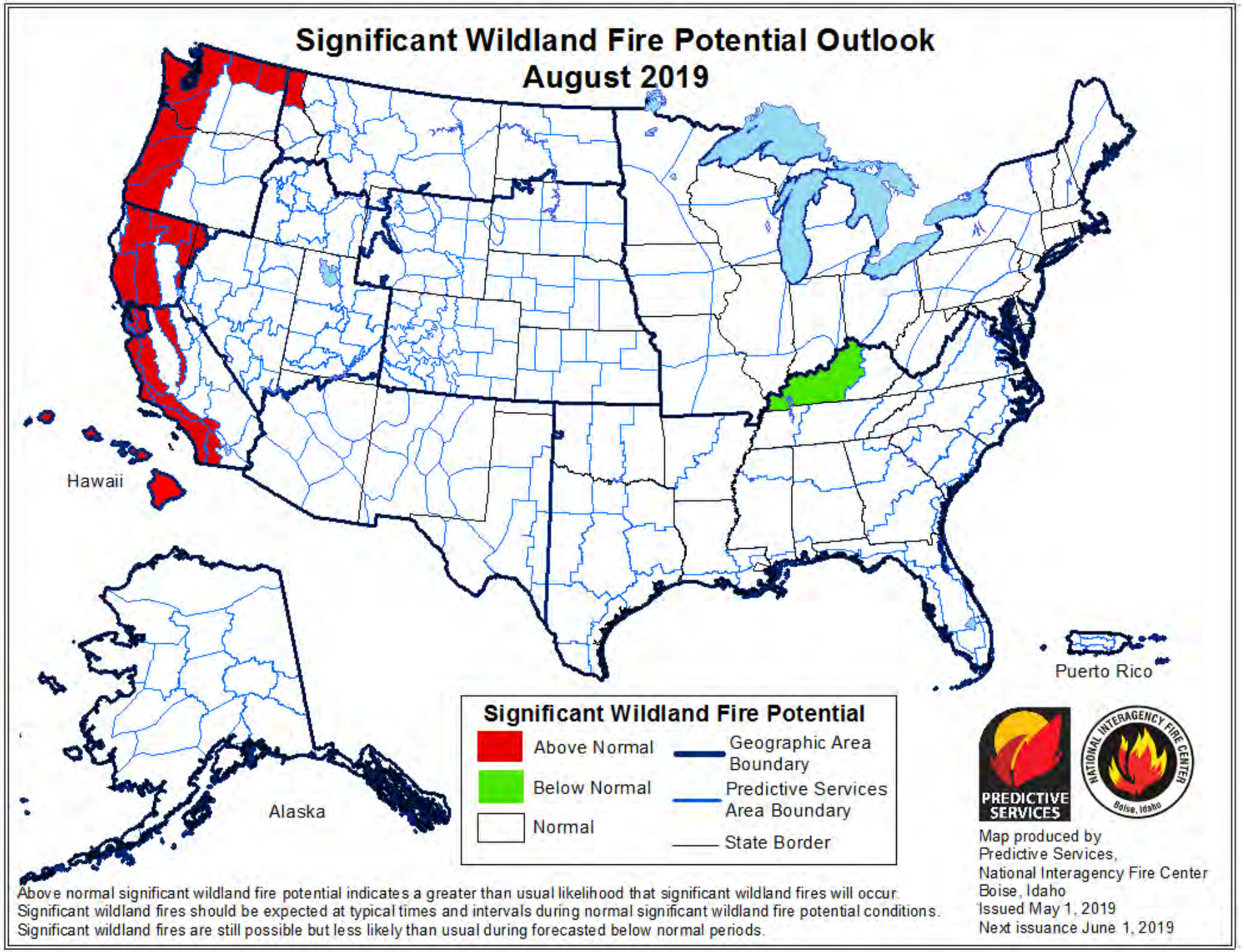
- Possibility for the chem otter to do this 1-2 times, and for the met otter to do this once

- Short ferries to smaller airfields would still be possible / likely from these bases, but no long ferries would be planned



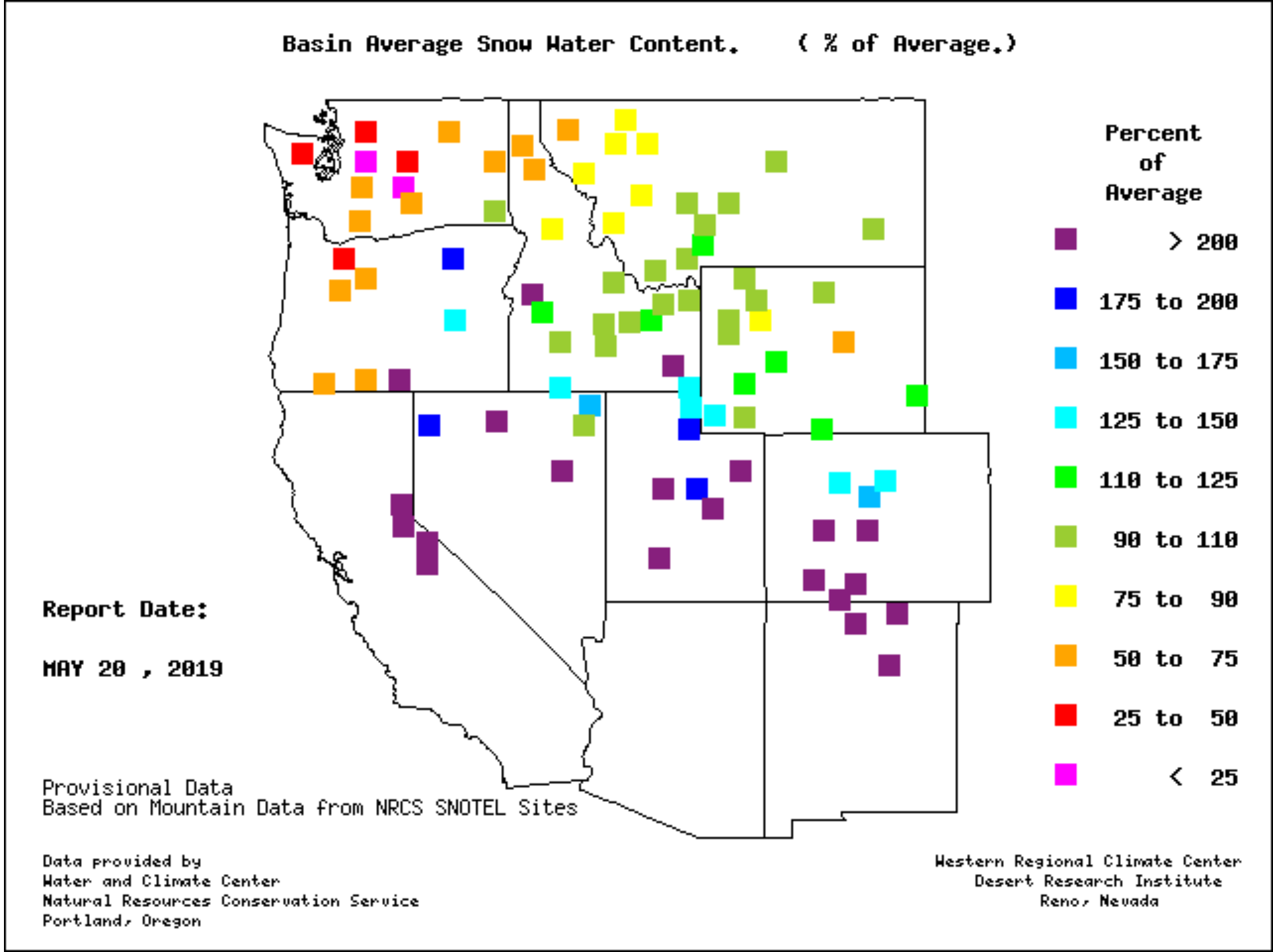
U.S. Fire Outlook for August 2019

Issued May 1, 2019



Western U.S. Snowpack

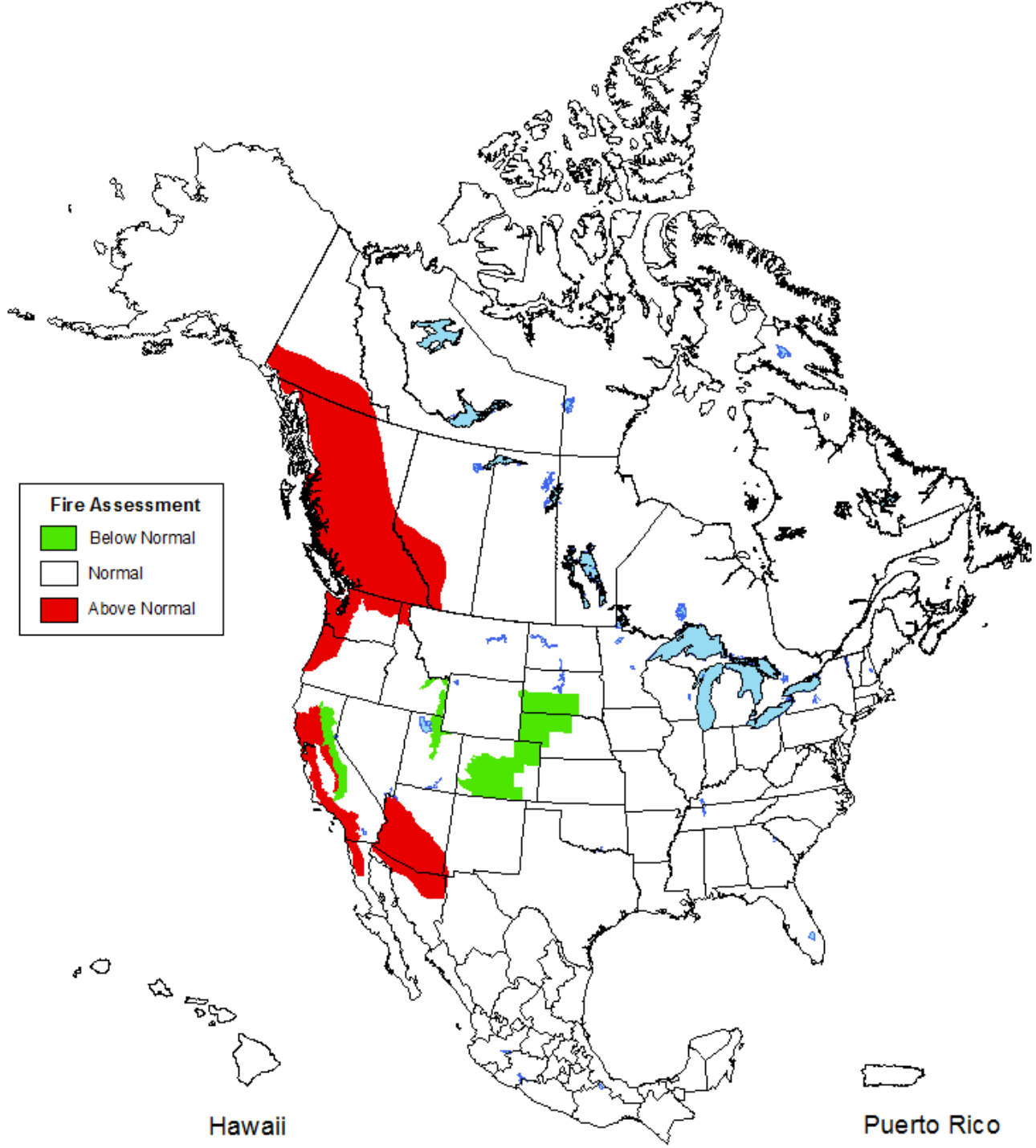
May 20, 2019



North American Fire Season Outlook for July 2019

Fires in Canada may be significant

No current plans (and almost certainly no future plans) to fly in Canadian airspace



In-Field Logistics

1. Short (< 1 hour) ferry flights from airfields in fire impacted regions followed by 1-2 research flights and return flight

2. Support truck: CSD pickup truck with an aircraft GPU, generator and air conditioning unit to support short ferry flights from whichever airfield we are based from.

   Matt Roberts, CU Mechanical Engineering Student, will work with us this summer through August 23rd and will be one of the (or the only) driver for the support truck

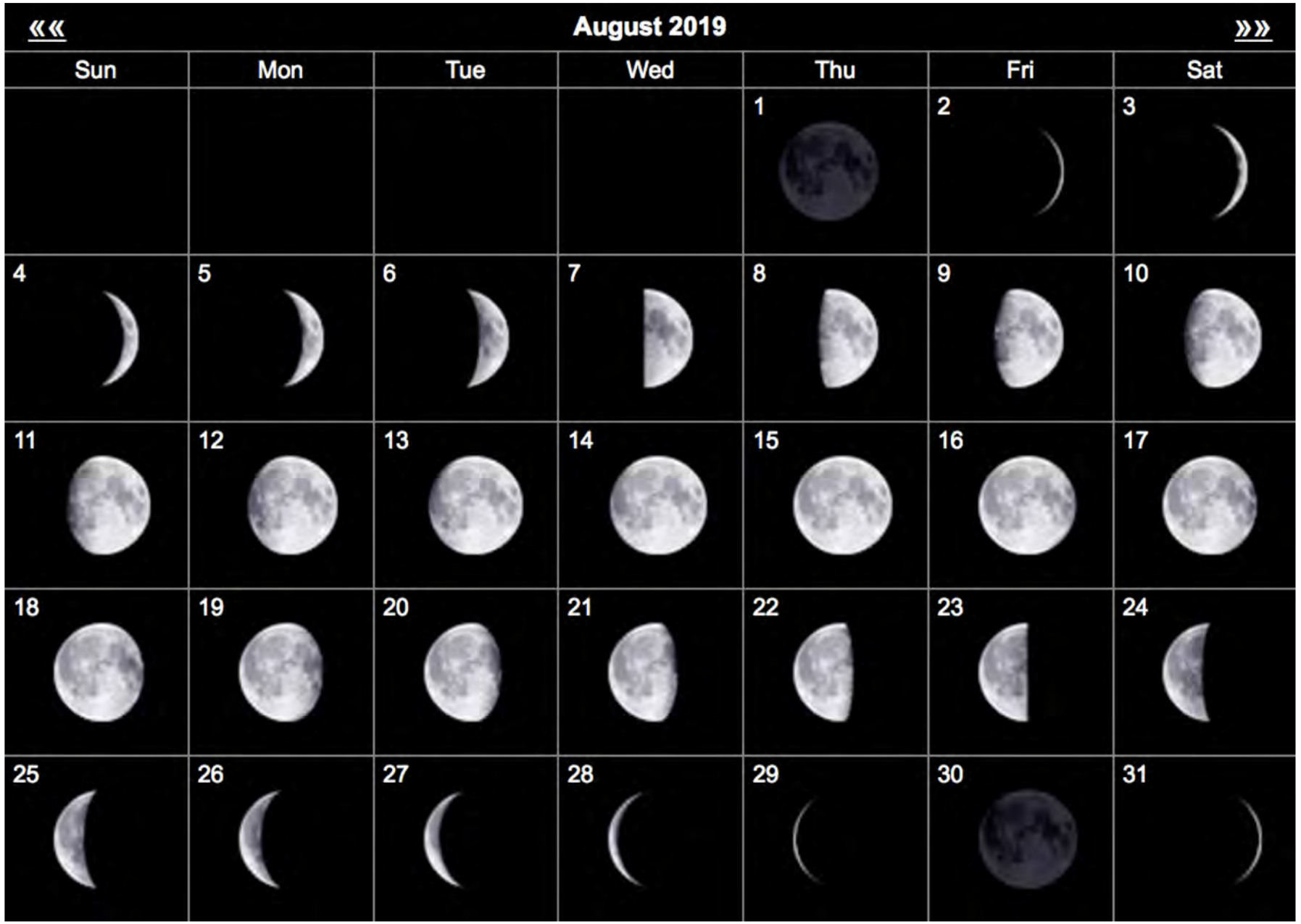
3. Front seat of aircraft = Flight Scientist

   Rotate between: Rebecca Washenfelder, Mike Robinson, Ale Franchin

4. Rear set of aircraft = Instrument Scientist

   Rotate between other project scientists

Night Flight Schedule



Night flights remain a scientific goal for the otters

Also a goal for the mobile labs if they are sampling continuously in smoke impacted valleys during nighttime drainage flow

Full moon will assist with nighttime operations

August 12 – 19 will be the best week for nighttime operations

Campaign End Dates

- DC 8
- Met Otter
- Chem Otter
- Langley Mobile Lab
- Aerodyne Mobile Lab
- McCall Ground Site

Chem Twin Otter available through September 12

Operations in Boise beyond August 30 may be less compelling due to scientific overlap

For now, assume return transit date of August 31