CFH Launches at the ARM Southern Great Plains Site (SGP) at Lamont, Oklahoma

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Howard Diamond, NOAA's National Centers for Environmental Information (NCEI)

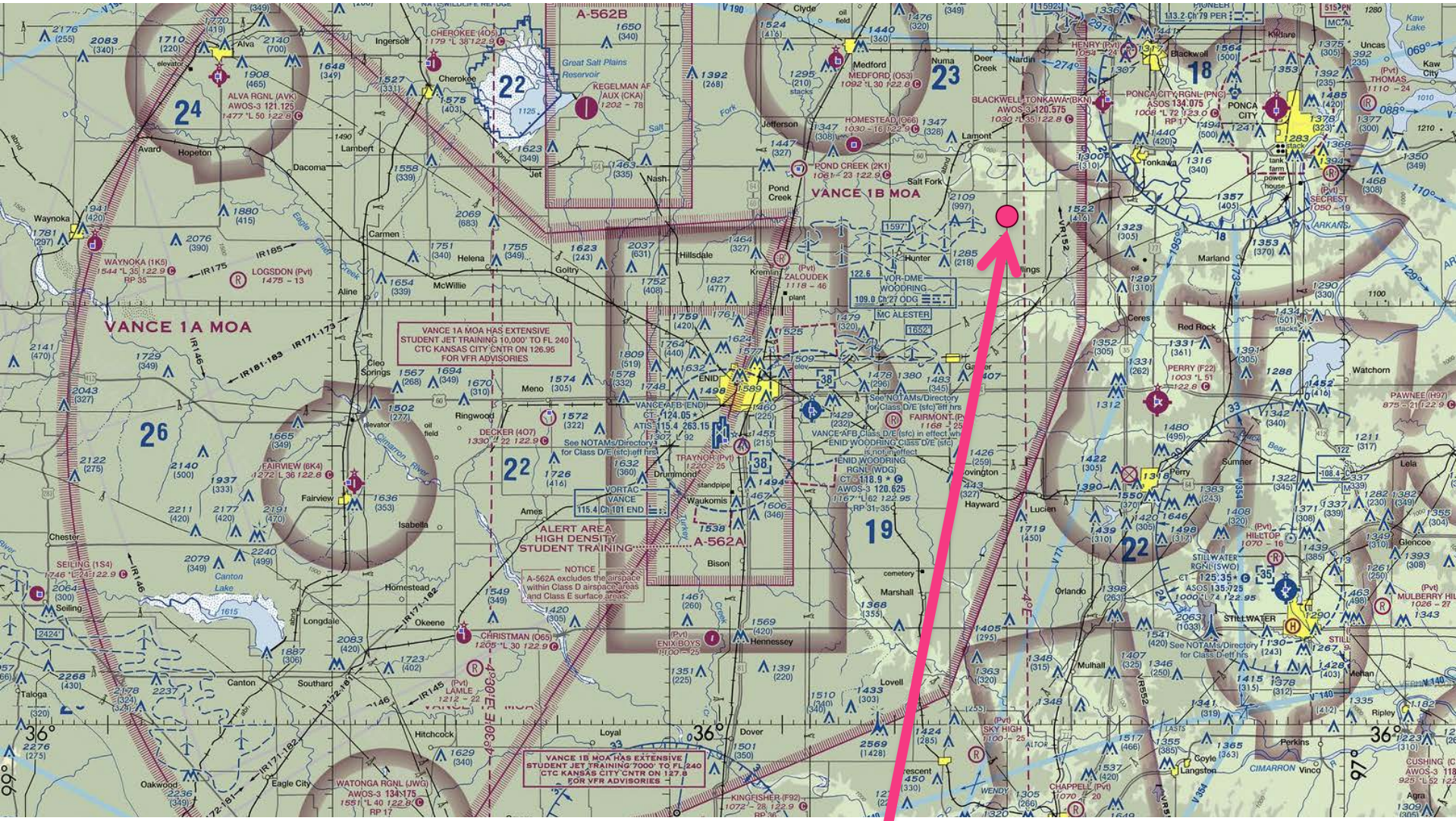
ARM CFH Mission

- **P**rovide launches of balloon-borne cryogenic frost-point hygrometer as a humidity baseline measurement.
- **H**oward Diamond, through NOAA funds CFH launch hardware.
- **A**RM provides mentorship oversight and ‘manpower’ for the efforts associated with the CFH sonde preparation and launches.
- **I**mprove and evaluate the procedures for CFH launches at the SGP facility.
- **E**valuate CFH launch logistics for use at other ARM launch sites (i.e. Barrow, Alaska) in the future.

Site location and Launch history

- Lamont, OK, 36° 36'18.0" N, 97° 29'6.0" W, 320 m a.s.l.
- Launch procedures from GRUAN Lead Center
- Eleven launches so far since
  - Sept. 11, 2014
- CFH are checked and adjusted with CFH setup
- Aim for Monthly Launches

Site Airspace Location



ARM SGP Launch Site within Military Operating Area

Airspace Access Request

Dear Vance AFB personnel,

We are planning an exempt stratospheric balloon-sonde launch for atmospheric sampling on 4/22/2016, launching at ~1330 GMT (0830 CDT). The launch location will be from the ARM Climate Research Facility near Lamont, OK (36.608, -97.488).
The sonde meets the requirements of CFR 14 Part 101. No waiver is needed.
We will telephone Vance ATC (580-213-6765) at launch, 24kft, burst, 24kft (descent) and landing.
Predictor flight path for tomorrow, 4/22/2016 shows: from the Central Facility the balloon will travel South, crossing over Highway 412, then turn east and travel north of Perry and along Highway 64, bursting near Highway 177. The package will descend by parachute, continuing SE and landing just South of the Cimarron Turnpike Spur in Payne County.

Launch Details:
- Date: 4/22/2016
- Time: 1330 GMT, 0830 CDT
- Location: 36.608, -97.488
- Balloon Type/Color: 1200g White Latex
- Maximum Altitude: 110,000 ft.
- Ascent Rate: 5 m/s
- Descent Rate: 5-10 m/s
- Payload Weight: Less than 2 pounds
- Payload Color: Red/Blue/White

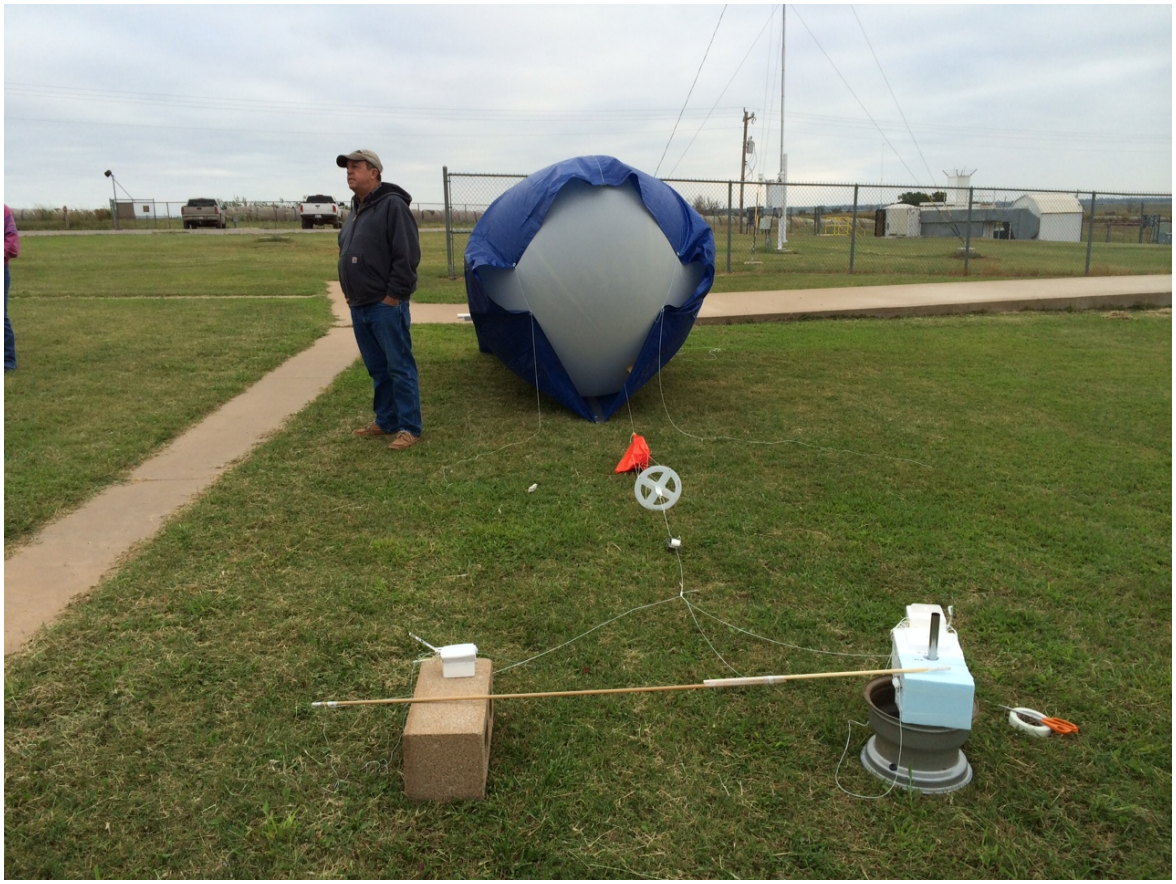
Federal Aviation Regulations

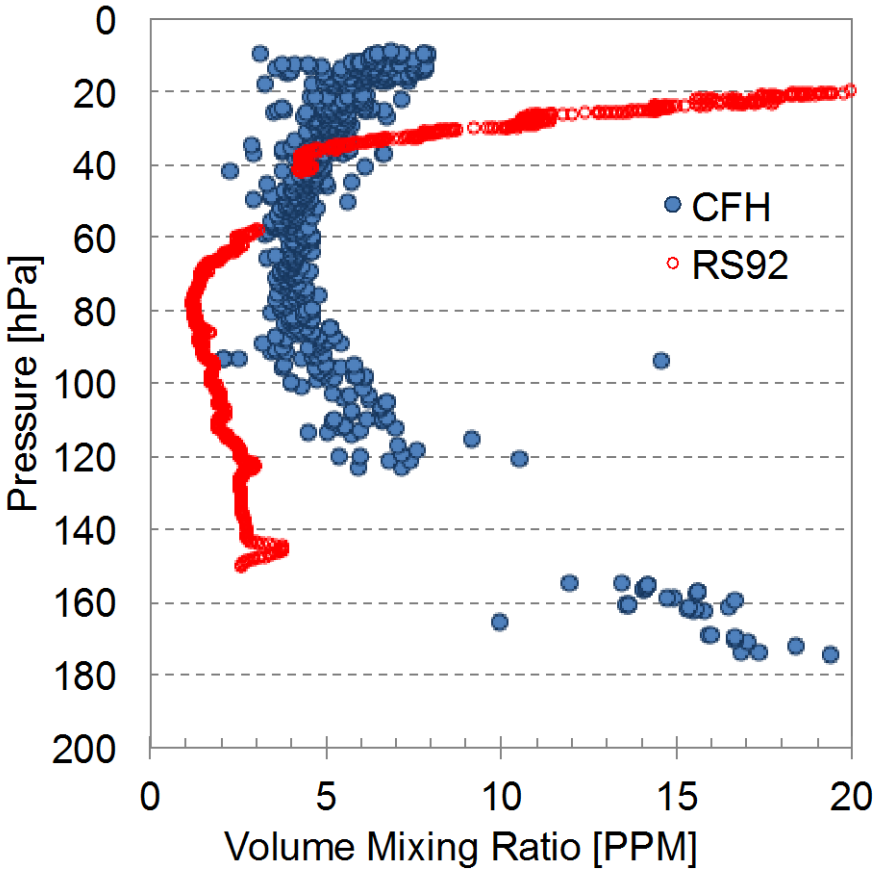
- § 101.31 — Applicability.
- § 101.33 — Operating limitations.
- § 101.35 — Equipment and marking requirements.
- § 101.37 — Notice requirements.
- § 101.39 — Balloon position reports.

Please contact me at the number below if you have questions or need additional information.
Regards,
Chris Martin
(331) 318-3354

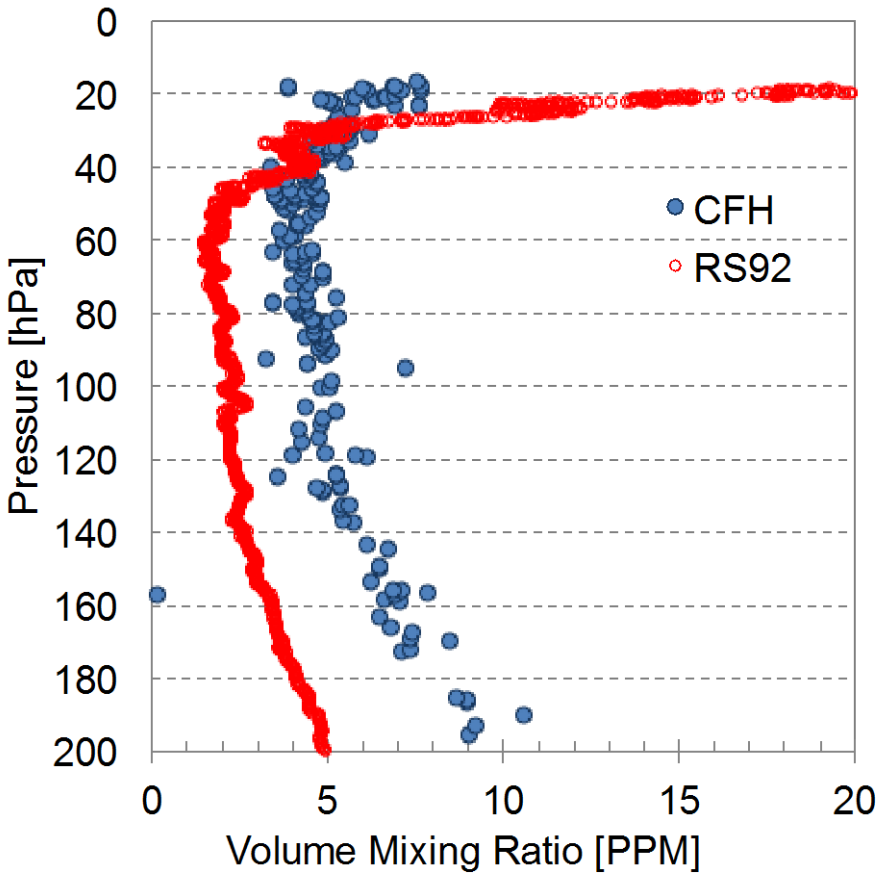
Launch package

- Cryogenic Frostpoint Hygrometer from JH Acquisition LLC
  (EnSci is in the process of becoming JH Acquisition LLC)
- InterMet IMet1 RSB
- Vaisala RS92 radiosonde, ground check with Vaisala GC25 prior to each launch





2015-09-15: CFH (blue) versus RS92 (red)



2015-10-27: CFH (blue) versus RS92 (red)

Burst altitudes typically exceed 10 hPa

Launch times in the mornings, except 10/27/15 – NPP overpass

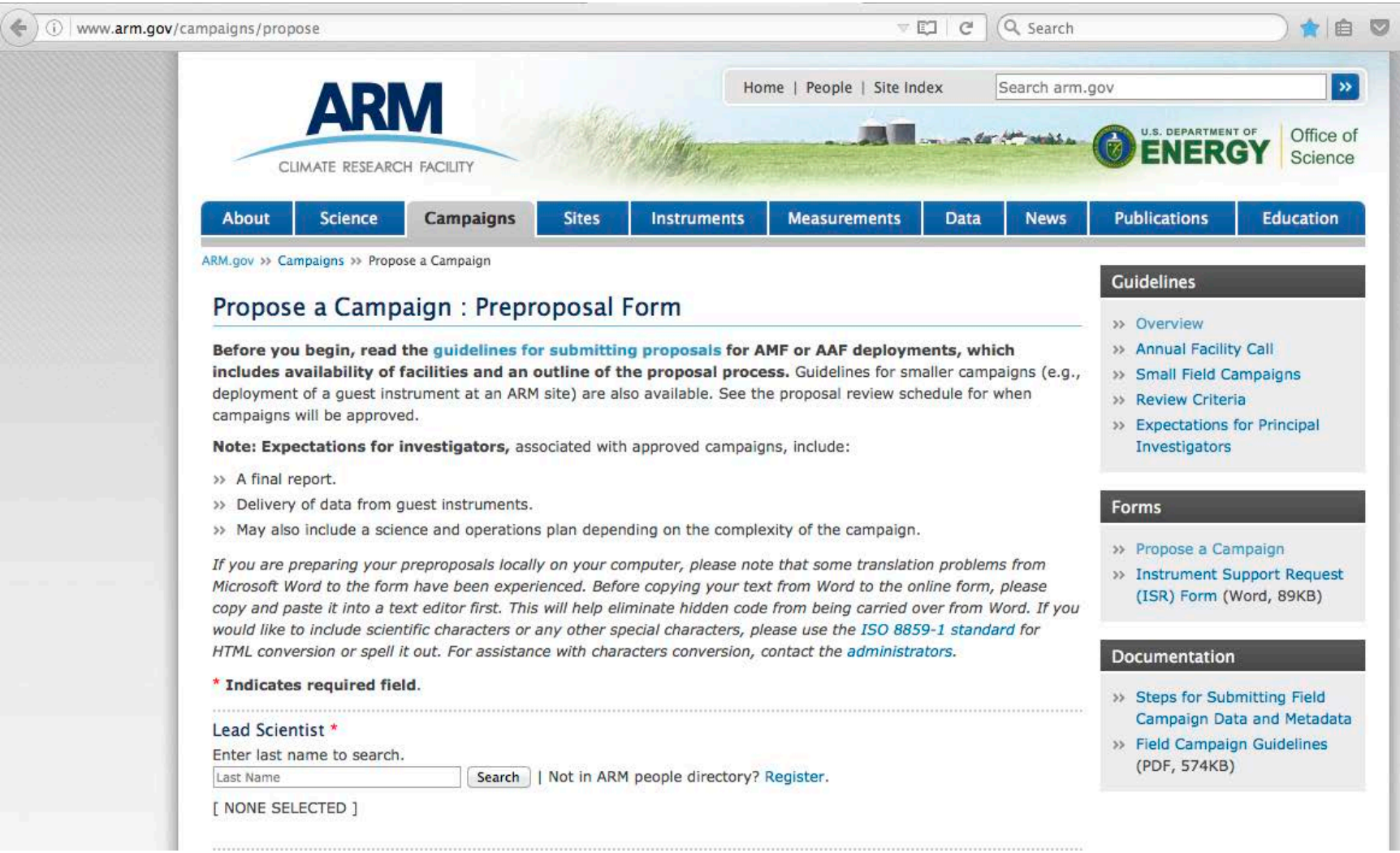
Lessons Learned

- CFH instruments are fragile. Re-Using the CFH did not work out so far.
  - small crack in cryogen compartment
  - CFH-setup impossible due to slightly loose circuit board
  - ‘wiggling’ the tube changes the settings
  - electronics are fragile causing shortcut during package release
  - removing and re-inserting the tube is tricky
  - mirror heating failed during the ascend

Next Steps

- Data ingest: ARM DMF ⇔ GRUAN RS launch client
- Data processing
- Refine launch procedures for ARM operators
- Refurbish old CFH instruments
- Move to RS41-CFH package
- Produce ARM Baseline CFH humidity measurements
- GRUAN certification

ARM Frostpoint IOP



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- George Sawyer - ARM SGP operations
- Jody Martin - ARM SGP operations

- Michael Sommer – GRUAN Lead Center