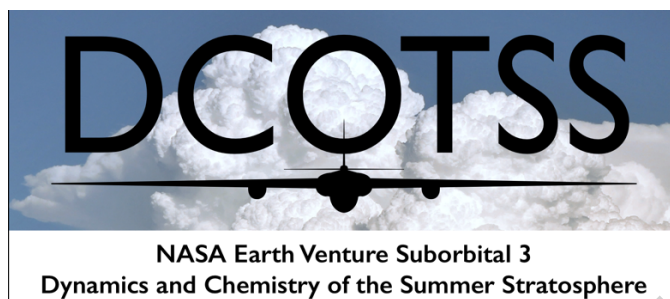


# DCOTSS ER-2 Mission Scientist Flight Summary Report



**Flight identifier:** RF17

**Science goals:** Sampling fresh convective outflow material over eastern Texas.

**Start of flight (UTC):** 2022-06-10 13:58Z

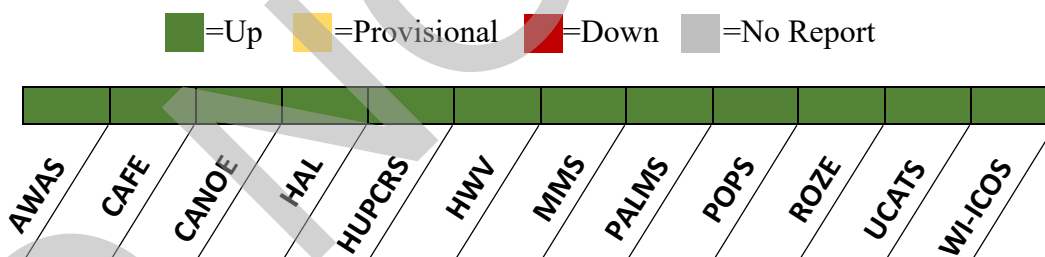
**End of flight (UTC):** 2022-06-10 21:04Z

**ER-2 Pilot:** Kurt Stallings

**Mission Scientist:** Eric Jensen

Version	Report date and time (UTC)	Author
1	2022-06-12 2000Z	Jensen, Eric
2	2022-06-13 1530Z	Frank Keutsch and Kenneth Bowman

## Instrument Performance:



**Aircraft Performance:** Good; intermittent data dropouts occurred with MTS.

## Science Objectives:

Strong convection occurred over the Texas panhandle overnight and into the morning of June 10. NEXRAD indicated convective overshoots reached up to 58 kft. Through the morning, the MCS moved into Oklahoma and further east. Trajectory forecasts indicated high altitude material from the overshoots persisting over central/eastern Texas in the 52–58 kft altitude range, and a flight plan was designed to sample the plume along an east-west leg.

The initial flight plan is shown in Figure 1. The plan included a transit at high-altitude over the forecast plume to P1, followed by a descent to 52 kft heading toward P2 just west of the plume to

obtain a background profile of atmospheric composition. Next, the plan was to execute 7 level legs back and forth between P2 and P3 at altitudes ranging from 52 to 58 kft in 1 kft increments. The forecast tropopause altitude in the region was about 46 kft. After turning back toward KSLN at P3, the plan called for an MMS maneuver to 59 kft, followed by an ascent to maximum altitude en route to KSLN. A spiral descent into the airfield was planned for comparison between aircraft measurements and balloon-borne instruments launched from the airfield.

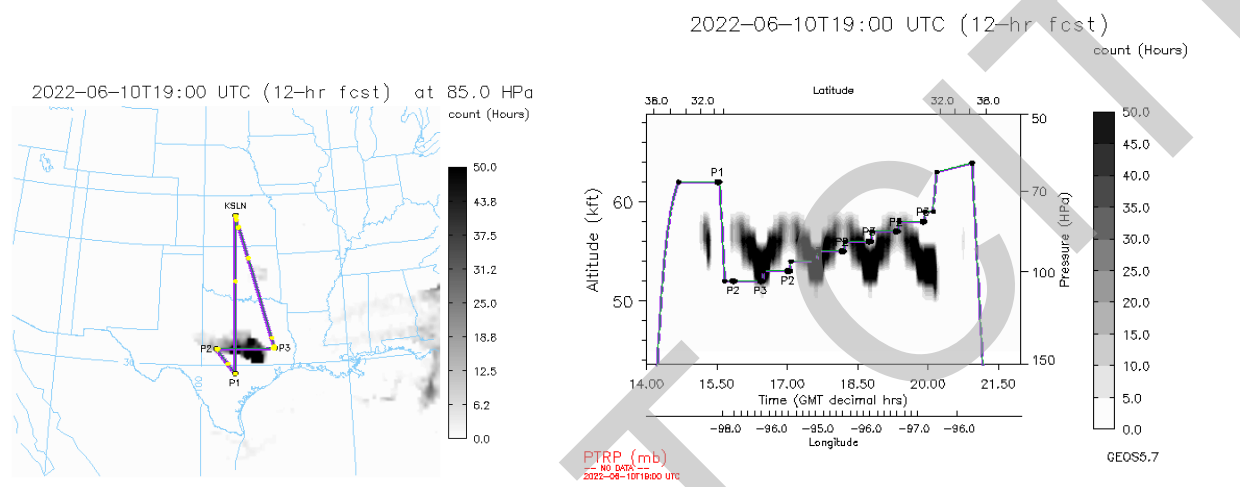


Figure 1. Left panel: flight plan overlaid on GRIDRAD overshoot trajectory parcel density at 85 hPa. Right panel: curtain of flight altitude vs time and trajectory parcel density along the flight track.

## Flight Summary:

The ER-2 departed Salina at 1348 UT, climbed to 65 kft, and headed south to P1. After closer examination of the convective plume trajectory forecasts, a decision was made to make a few flight plan changes: (1) P2 and P3 were shifted 0.25° north, (2) P3 was moved east to 93.5°W, (3) the initial plume sampling altitude was increased to 50 kft, and (4) the increment between sampling altitudes was increased to 2 kft such that we would reach 58 kft with five legs between P2 and P3. The combination of a longer P2–P3 distance and fewer sampling legs kept the total flight duration at about 8 hours.

During the first few hours of the plume sampling, we were not seeing data on MTS most of the time. Brief periods of HWV water vapor data transmission indicated that we were sampling the plume some of the time on the lower altitude legs. Water vapor mixing ratio as high as 16 ppmv was noted on the 50 kft leg. The aircraft was in the plume during parts of the 54 and 56 kft legs. The aircraft just exited the plume on the western end of the 56 kft leg, with an abrupt drop in H<sub>2</sub>O from 16 to 4 ppmv at about 1857 UT (see Figure 2). The aircraft re-entered the plume on the climb to 58 kft at about 1900 UT, which was consistent with the sheared structure predicted.

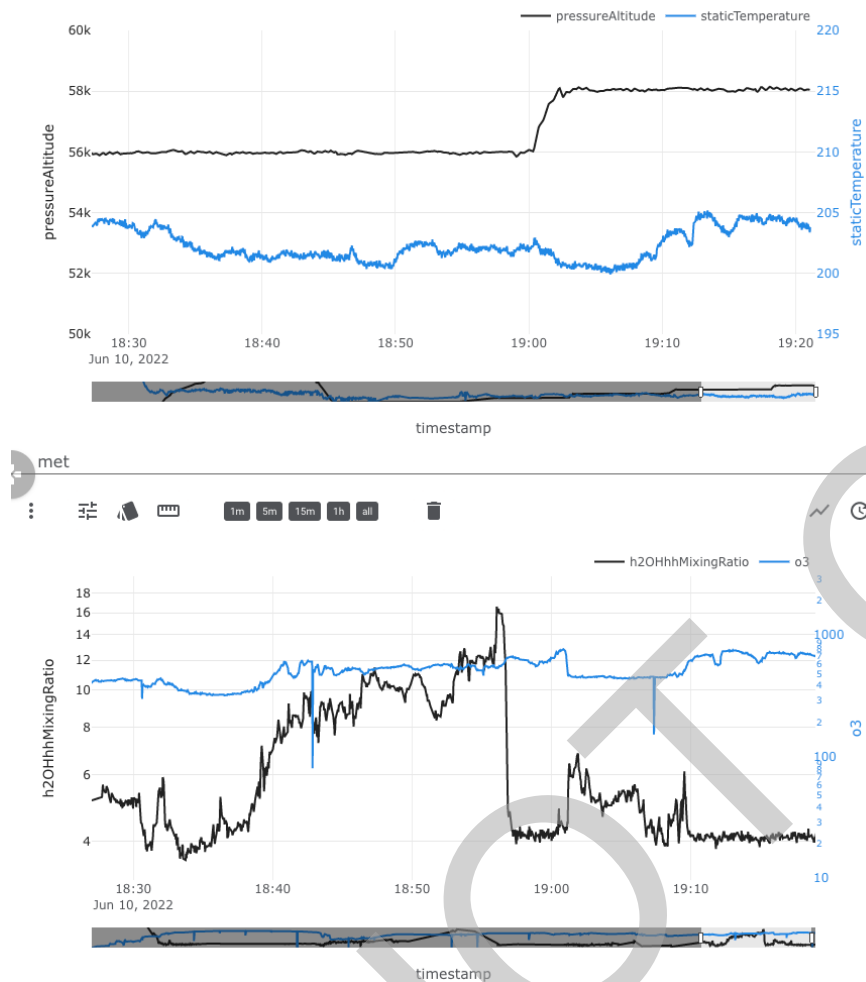


Figure 2. Time series of pressure altitude and MMS temperature (top), and HHH water vapor mixing ratio and ROZE ozone mixing ratio (bottom) during parts of 56 and 58 kft plume sampling legs.

At this point, a decision was made to only go halfway from P2 to P3 at 58 kft, and then ascend to 59 kft and head back toward P2 to see if the plume extended to the higher altitude. No enhancement in  $H_2O$  was apparent along this leg, however, when the aircraft turned north and began the MMS maneuvers, up to 1.5 ppmv enhancements were apparent in HHH, WICOS, and UCATS water vapor measurements (see Figure 3). The last set of  $H_2O$  enhancements was just after the MMS maneuvers when the aircraft had ascended to ~60 kft. These  $H_2O$  features were likely indication of slight convective detrainment as high 60 kft. This case appears to be the highest detrainment observed so far in DCOTSS.

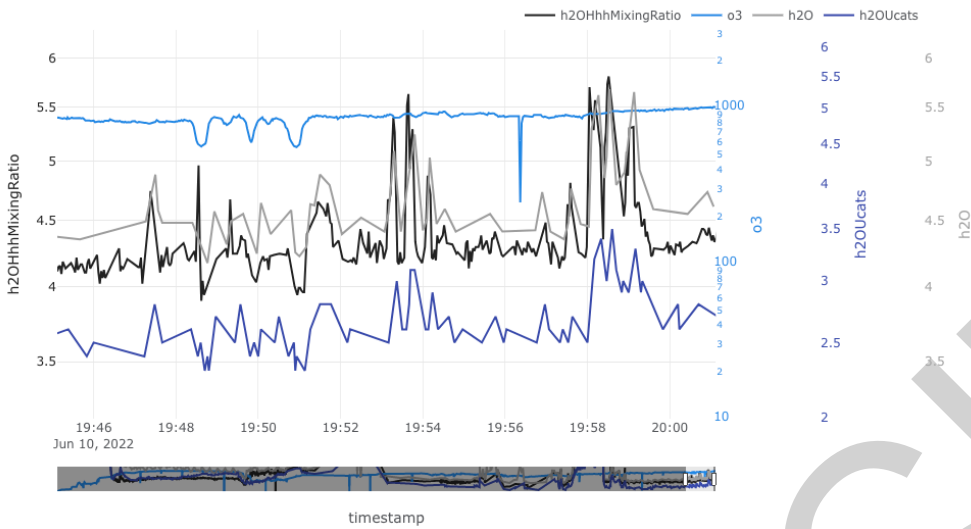


Figure 3. Small (1–1.5 ppmv)  $H_2O$  enhancements were apparent at 59 kft.

After the MMS maneuvers were complete, the aircraft ascended to maximum altitude en route to KSLN, reaching 68 kft pressure altitude. A spiral descent over the airfield for comparison with balloon measurements was precluded by ATC vectoring. The actual flight path is shown in Figure 4.

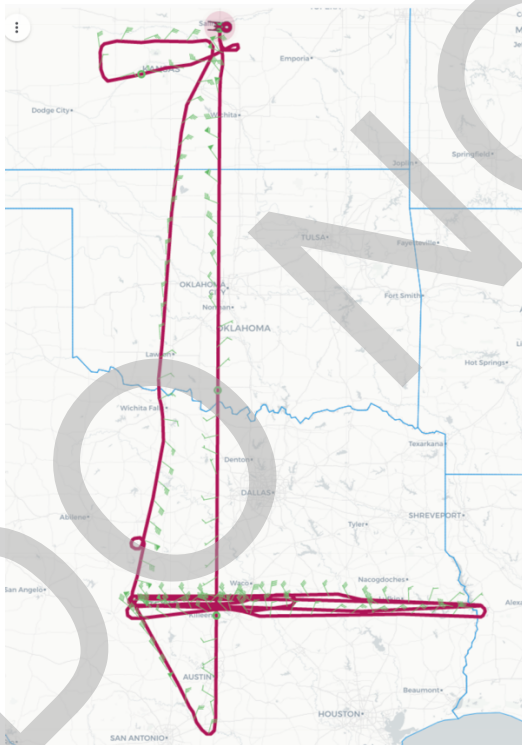


Figure 4. Actual ER-2 flight path.