



Figure S1. WLEF-TV transmitter tower near Park Falls, WI, which is the NOAA site LEF. Booms with meteorological sensors and gas sampling inlets are installed at 30, 122, and 396 m. The 30 m boom is marked with a red arrow.



Figure S2. Sea container laboratory installed at the base of the tower at LEF. Large doors on the end of the container facilitate installation of equipment.





Figure S3. Climbers working on the retractable boom at WBI.



Figure S4. Retractable boom at WBI with three sampling intakes and meteorological sensors. Inlet filters are housed in the aluminum enclosure to which the Synflex tubes are connected. A Yagi antenna that is used to transfer data from the meteorological sensors via radio modem is also visible.



Figure S5. Interior of the sea container laboratory at WBI showing the CO<sub>2</sub>/CO analysis system and calibration gases. The Programmable Flask Package (PFP) is the black plastic suitcase in the foreground. Ducting along the ceiling helps to distribute flow from the HVAC unit. Panels provide access to the outside.

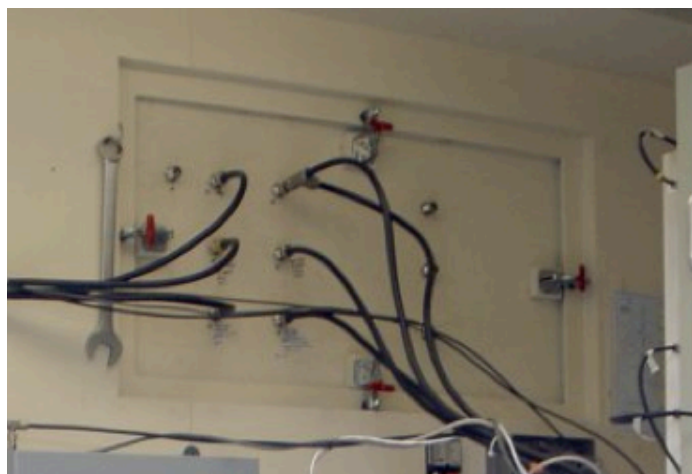
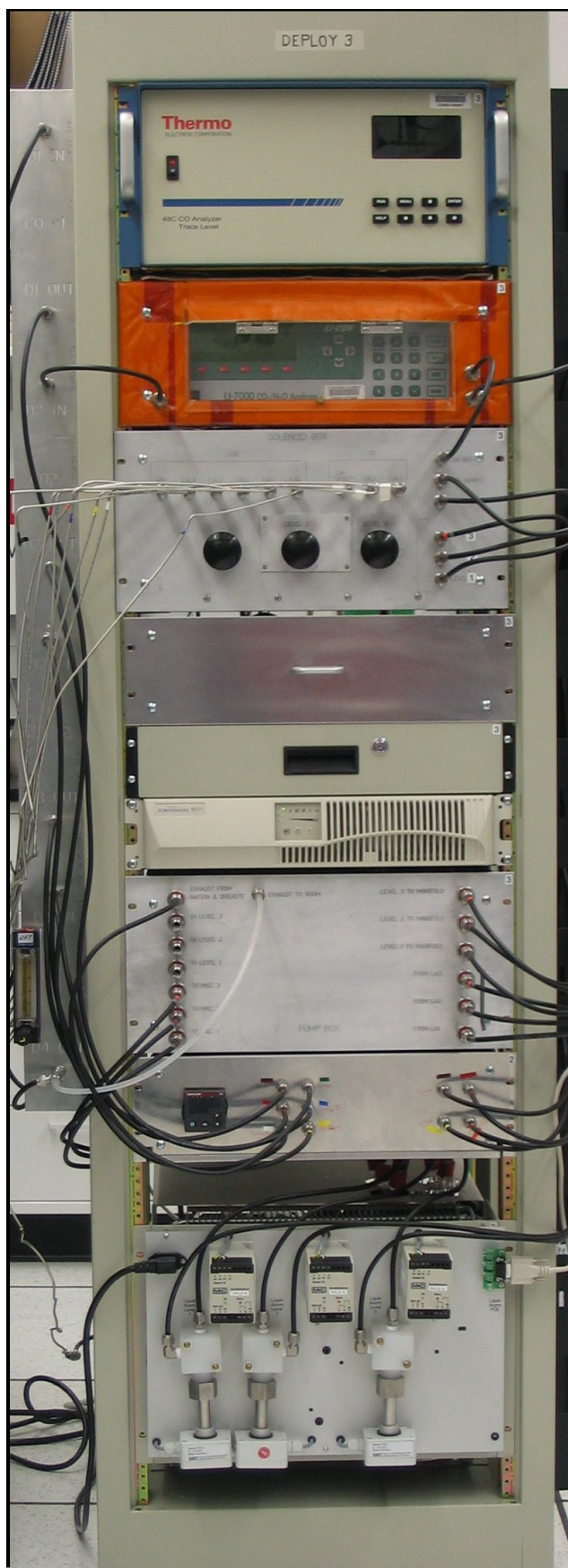


Figure S6. Detail of access panel showing tubing that goes to the CO<sub>2</sub>/CO analyzer and to the PFP flask sampling unit.



Drierite panel



CO analyzer

CO<sub>2</sub> analyzer

Valve manifold

Data/Control

Laptop

UPS

Pump module

Nafion dryer/  
CO scrubber

Chiller/ Liquid  
Alarm Sensors

Figure S7. The NOAA ERSL Tall Tower in situ CO<sub>2</sub>/CO analysis system.

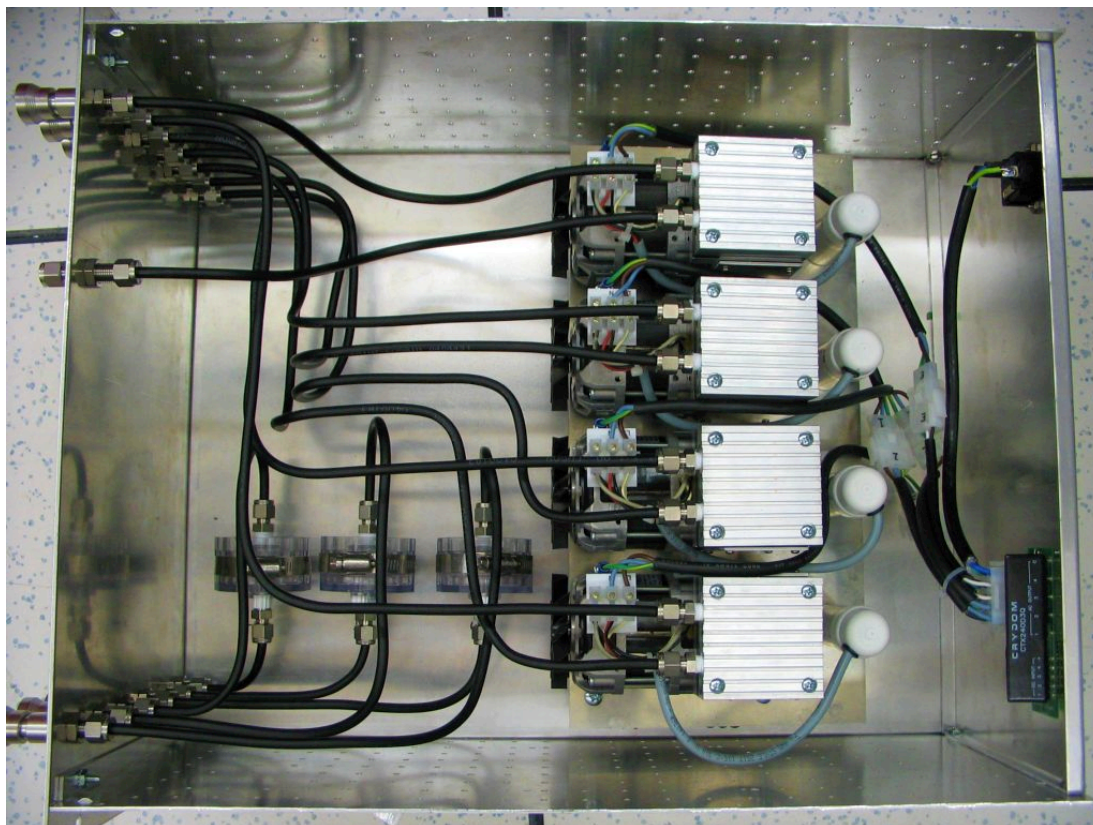


Figure S8. Pump module housing three inlet pumps and one exhaust pump. Pumps are mounted on a separate plate with vibration isolators. PTFE filters are also visible, but the polycarbonate filter holders shown here have since been replaced with aluminum filter holders for better reliability.

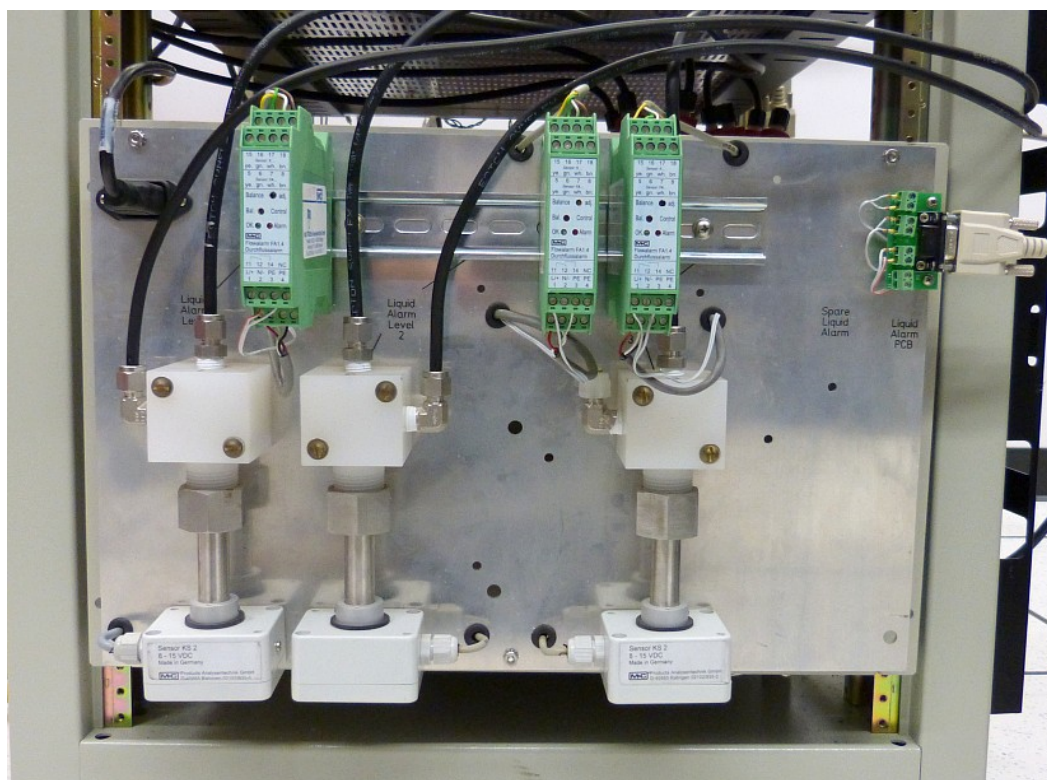


Figure S9. Front view of the M&C chiller with liquid alarm sensors.





Figure S10. Interior of M&C 4-channel chiller showing the glass condensers.



Figure S11. Peristaltic pump assembly for the M&C chiller with modifications to simplify replacement.



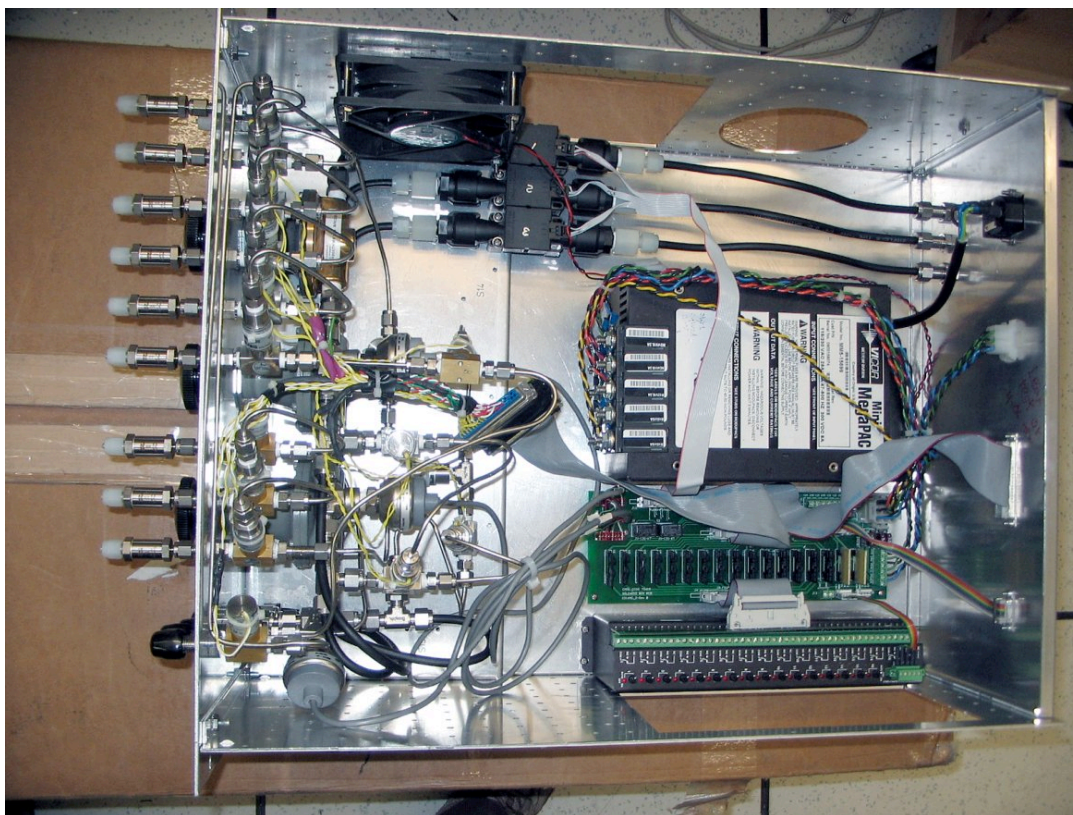


Figure S12. The calibration and sampling manifold with sample line back pressure regulators, pressure transducers and flow meters. The Vicor Mini MegaPAC power supply and Campbell Scientific SDMCD16AC relay module are also visible.

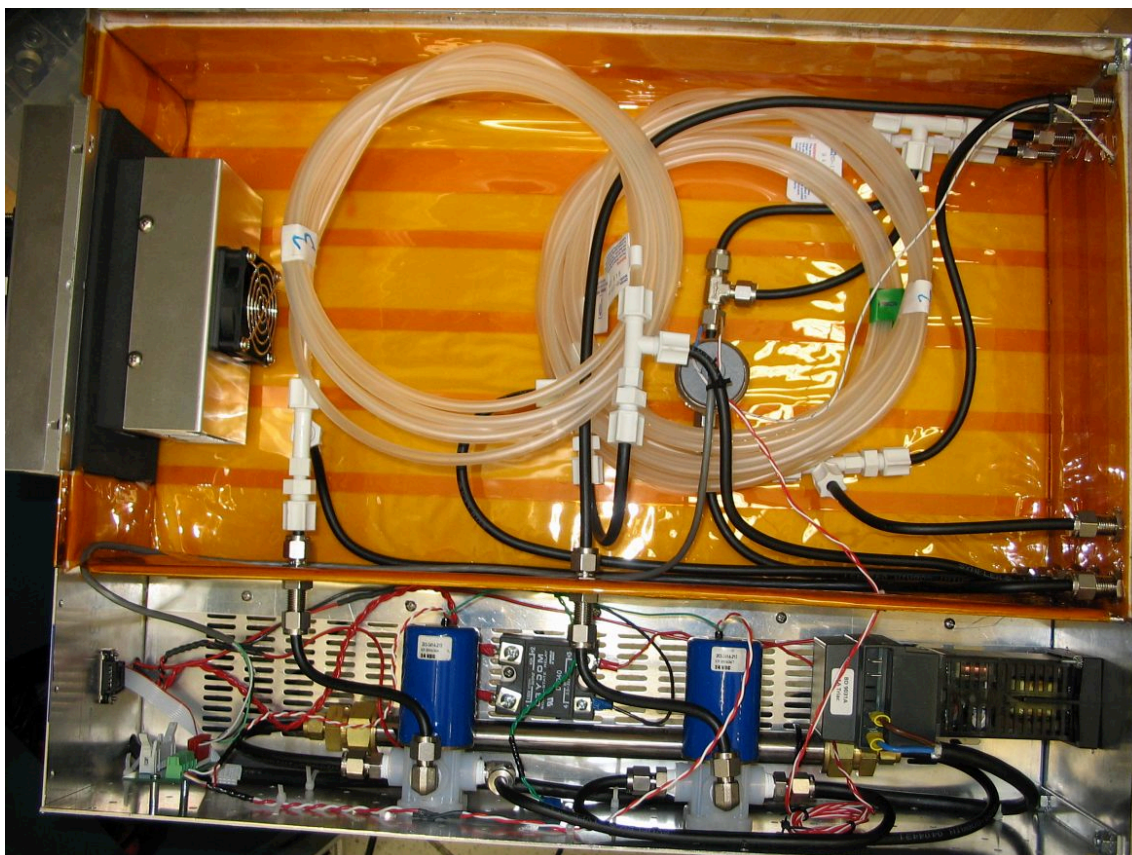


Figure S13. The Nafion drier assembly and CO scrubber assembly share an enclosure. The Nafion portion is insulated and temperature controlled to  $\sim 20^{\circ}\text{C}$ .



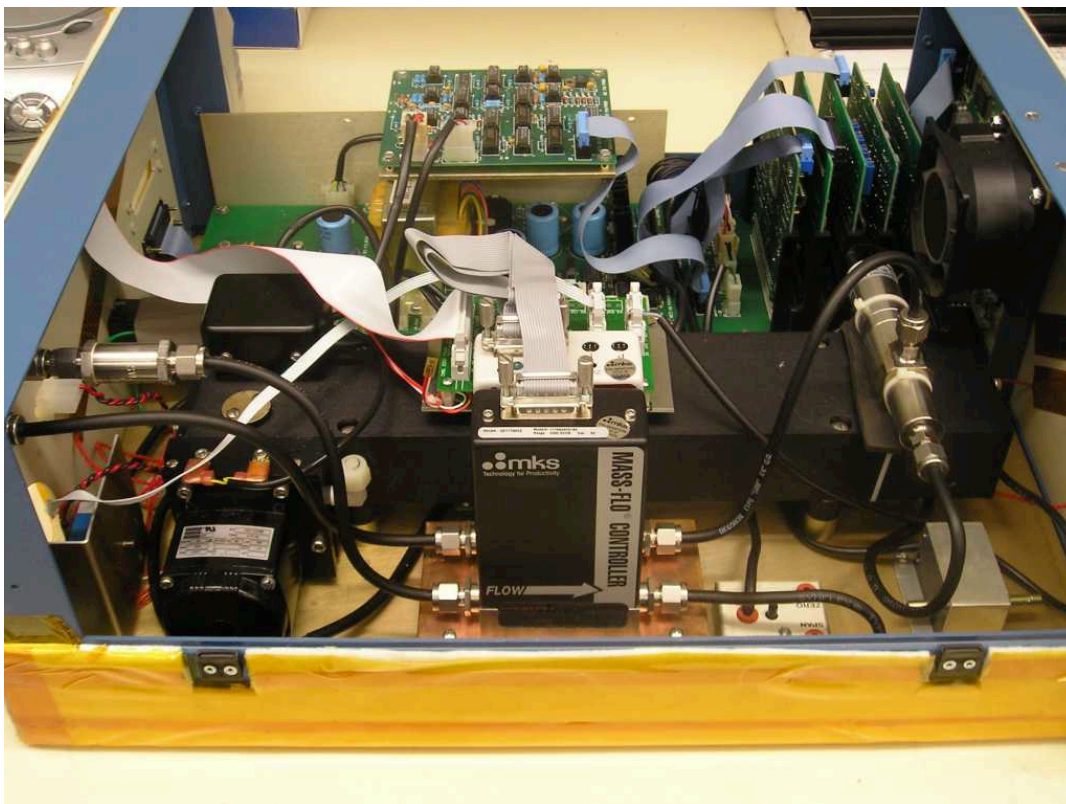


Figure S14. Interior of the Thermo Electron CO analyzer with modifications for flow and pressure control. The dewpoint sensor is on the right and is mounted on the outlet of the sample cell.

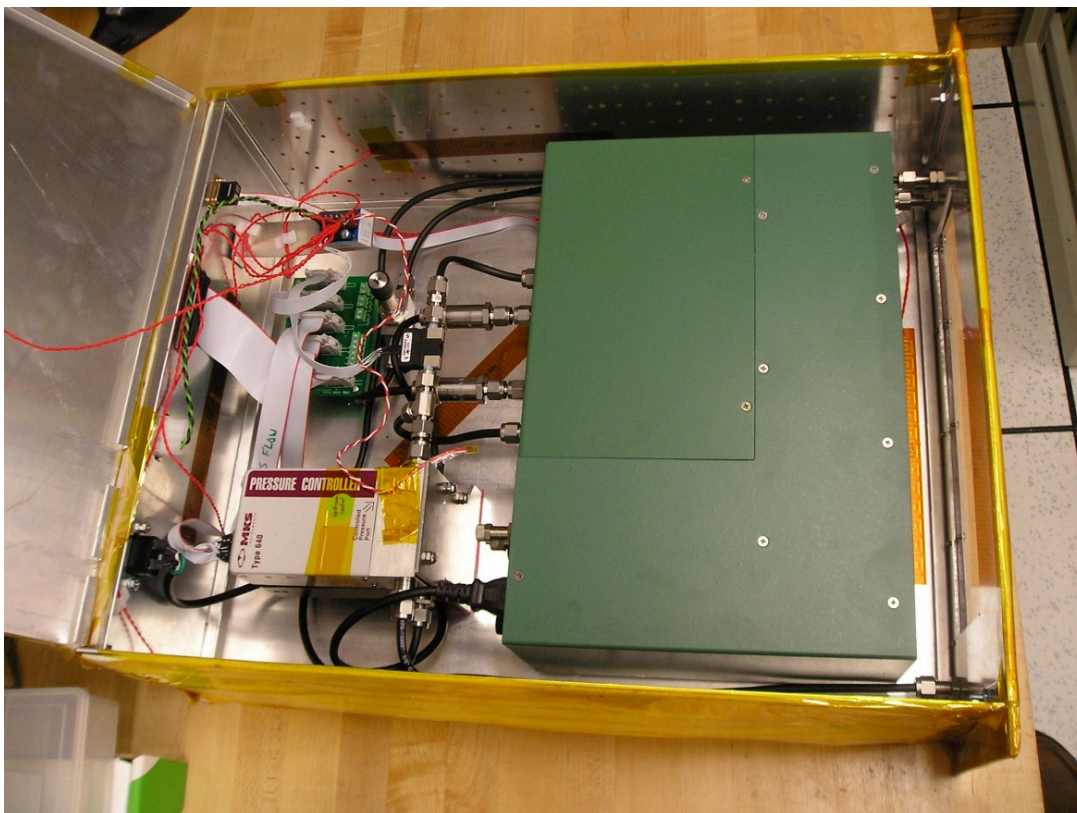


Figure S15. Interior of the CO<sub>2</sub> analyzer module.



Figure S16. Interior of a Programmable Flask Package (PFP).