|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Flight Background | | | | | | | | | | | | | | | | | | |
| Investigator: | | | | | | | | | | | | | | | | | | |
| Date: | | | | | | | | | | | | | | | | | | |
| Description: | | | | | | | | | | | | | | | | | | |
| Consumable Check | | | | | | | | | | | | | | | | | | |
| Check and record zero air pressure. | | | | | | | | | | **Pressure:** | | | | | | | | |
| Turn on O2 cylinder. Record O2 pressure. | | | | | | | | | | **Pressure:** | | | | | | | | |
| Replace scrubber as necessary (every 2 to 3 flights) | | | | | | | | | | **Replaced?** | | | | | | | | |
| Replace CLAP filter, if needed. White side up. | | | | | | | | | | **Replaced?** | | | | | | | | |
| Clean impactor (20 to 30 flight hours) | | | | | | | | | | **Cleaned?** | | | | | | | | |
| Check 2 water reservoir levels (clear reservoirs at rear of instrument). | | | | | | | | | | | | | | | | | | |
| Power Up | | | | | | | | | | | | | | | | | | |
| Check that the 5 PAS Laser breakers are off. | | | | | | | | | | | | | | | | | | |
| Check that bus 1 is selected for 60 Hz. | | | | | | | | | | | | | | | | | | |
| Start instrument by turning on the AC master breaker. Wait for valves to cycle on before continuing. | | | | | | | | | | | | | | | | | | |
| Start host on laptop. (Password is aer0Opt1cs. File is found in C:\Program Files\CRDS\_PAS) | | | | | | | | | | | | | | | | | | |
| Check that water flow indicator and peristaltic pump are spinning. | | | | | | | | | | | | | | | | | | |
| Check for water leaks near main TEC, and along H2O lines. | | | | | | | | | | | | | | | | | | |
| Turn on AC3 (Common Tab). (AC3 = thermal denuder) | | | | | | | | | | | | | | | | | | |
| Turn on thermal denuder heater (switch under the temp. controller on the flow plate). 300 °C | | | | | | | | | | | | | | | | | | |
| Set Main TEC temperature to 18°C (PAS Controls Tab, bottom left). | | | | | | | | | | | | | | | | | | |
| Set the span values for PAS cells 1 through 5 to: 5, 3.3, 5, 5, 5, respectively (PAS Controls Tab). | | | | | | | | | | | | | | | | | | |
| Set the modulation values for PAS cells 1 through 5 to: square, sine, square, square, square, respectively (PAS Controls Tab). | | | | | | | | | | | | | | | | | | |
| Set PAS channels 1-4 to 21°C and channel 5 to 24°C. Toggle all channels to “on,” using buttons under temp readings. | | | | | | | | | | | | | | | | | | |
| When the main TEC reaches its set point turn on PAS lasers breakers. Turn the speakers off. Turn the lasers on in the software (PAS Controls Tab). | | | | | | | | | | | | | | | | | | |
| Check that the mirror purge flow set point for the CRDS is 0.16 lpm (CRDS controls tab). | | | | | | | | | | | | | | | | | | |
| Turn mirror purge valve (I) from critical orifices to flow controller (3-way valve, on shelf w/ flow controllers). Verify the mirror flow is 0.16 lpm (CRD Controls Tab). | | | | | | | | | | | | | | | | | | |
| Turn on vacuum pump (CB3 on power distribution box). | | | | | | | | | | | | | | | | | | |
| Set the CRD flows to 3 lpm and check that the CRD flow controller data are being up dated (CRD Controls Tab). | | | | | | | | | | | | | | | | | | |
| Set the PAS flows to 1 lpm and check that the flow controller data are updating (PAS Controls Tab). | | | | | | | | | | | | | | | | | | |
| Turn off filtering for ~3 seconds, and then turn it back on (Main display). | | | | | | | | | | | | | | | | | | |
| Check that CRD ringdown traces are fitting well and that the time constants are reasonable on filtered air. (red ≈200 μs, green ≈ 80 μs, blue ≈ 20 μs.) Record time constants. ( variable: tau, Main Tab) | | | | | | | | | | | | | | | | | | |
| 1: denude | | **2: denude** | | | **3: gas** | | **4: dry** | | **5: dry** | | | **6: dry** | | **7: med RG** | | | | **8: hi RH** |
| If CRDS traces are not being fit properly, wait a few minutes and go to CRD controls panel and set the laser duty cycle to 40, then reset it to 45. Repeat this procedure until things start to work properly. | | | | | | | | | | | | | | | | | | |
| After lasers have been on for > 10 min. Check that PAS laser power is consistent with previous days. Record laser power level (Housekeeping Tab, lower graph, enable all channels, laser RMS): | | | | | | | | | | | | | | | | | | |
| 1: | | | | **2:** | | | | **3:** | | | **4:** | | | | | **5:** | | |
| Sync computer time with aircraft time (green display mid-plane). Then sync host time with computer time: select “CRDS-PAS” from the pull-down menu on the Housekeeping tab (bottom right) and then click “sync time” button. | | | | | | | | | | | | | | | | | | |
| PAS Pressure Calibrations | | | | | | | | | | | | | | | | | | |
| Check that the PAS cells and thermistor cell (not TEC) are at their temperature setpoints. | | | | | | | | | | | | | | | | | | |
| Open cabin air valve (B) and close LTI valve (A). | | | | | | | | | | | | | | | | | | |
| On “Pressure”, check boxes to indicate that the above two criteria have been met (this will enable the Run button). | | | | | | | | | | | | | | | | | | |
| Verify that “Dwell Time” is 90. | | | | | | | | | | | | | | | | | | |
| Verify that “Num of Steps” is 5. | | | | | | | | | | | | | | | | | | |
| Set “Initial Pressure Source” to “Use Measured P” | | | | | | | | | | | | | | | | | | |
| Set the “Final” value in the “Pressure (mb)” box to 400. | | | | | | | | | | | | | | | | | | |
| Hit the run button (currently displaying Off) | | | | | | | | | **Start time:** | | | | | | | | | |
|  | | | | | | | | | **Stop time:** | | | | | | | | | |
| PAS Calibrations – O3, Ambient Pressure – Red Channel | | | | | | | | | | | | | | | | | | |
| Set dial on O3 generator to 1. (Clockwise for high values – CCW for lower.) | | | | | | | | | | | | | | | | | | |
| Check that laser power (Housekeeping Tab, plot “Laser RMS” on vertical axis) and PAS cell temperatures are stable (Housekeeping Tab, bottom plot “thermistor temperatures” on vertical axis). | | | | | | | | | | | | | | | | | | |
| Switch flow to Filtering (right side of screen, all tabs). | | | | | | | | | | | | | | | | | | |
| Turn on O3 alarm (press and hold left button on yellow device located near O3 generator). | | | | | | | | | | | | | | | | | | |
| Check that speakers are off: toggle button from “Speaker” to “Laser” on PAS controls Tab. | | | | | | | | | | | | | | | | | | |
| Set the thermal denuder to bypass mode (open L then close K). | | | | | | | | | | | | | | | | | | |
| Set the CLAP flow to zero (clap tab) and close the CLAP valve (V). | | | | | | | | | | | | | | | | | | |
| Set the O2 flows to 1.5, 1.25, 1, 0.75, 0.5. (Calibration tab) | | | | | | | | | | | | | | | | | | |
| Check that number of points to collect = 40. | | | | | | | | | | | | | | | | | | |
| Click “run calibration” button (Calibration Tab), noting the start time. It should take ~5-7 minutes for the calibration to finish and the popup box to appear with the results. | | | | | | | | | | | | | | | | | | |
| CALIBRATION START TIME (start of background collection): | | | | | | | | | | | | | | | | | | |
| CALIBRATION STOP TIME (end of background collection): | | | | | | | | | | | | | | | | | | |
| Record slope, intercept and R2 values below for the 3 red and green PAS channels: | | | | | | | | | | | | | | | | | | |
| Slope = | | | **1:** | | | **2:** | | | **3:** | | | | **4: N/A** | | | | **5: N/A** | |
| Intercept = | | | **1:** | | | **2:** | | | **3:** | | | | **4: N/A** | | | | **5: N/A** | |
| R2 = | | | **1:** | | | **2:** | | | **3:** | | | | **4: N/A** | | | | **5: N/A** | |
| PAS Calibrations – O3, Ambient Pressure – Blue Channel | | | | | | | | | | | | | | | | | | |
| Set dial on O3 generator to 8. (Clockwise for high values – Counter Clockwise for lower.) | | | | | | | | | | | | | | | | | | |
| Toggle off RH control (CRD controls tab). | | | | | | | | | | | | | | | | | | |
| Turn off all CRD flows except dry flows. Turn off flows in PAS channels 1, 2, 3. | | | | | | | | | | | | | | | | | | |
| Set temperatures to 10˚C (CRDS Controls, Humidifier Temperatures). | | | | | | | | | | | | | | | | | | |
| Click “run calibration” button (Calibration Tab), noting the start time. It should take ~5-7 minutes for the calibration to finish and the popup box to appear with the results. | | | | | | | | | | | | | | | | | | |
| CALIBRATION START TIME (start of background collection): | | | | | | | | | | | | | | | | | | |
| CALIBRATION STOP TIME (end of background collection): | | | | | | | | | | | | | | | | | | |
| Record slope, intercept and R2 values below for the 2 blue PAS channels: | | | | | | | | | | | | | | | | | | |
| Slope = | | | **1: N/A** | | | **2: N/A** | | | **3: N/A** | | | | **4:** | | | | **5:** | |
| Intercept = | | | **1: N/A** | | | **2: N/A** | | | **3: N/A** | | | | **4:** | | | | **5:** | |
| R2 = | | | **1: N/A** | | | **2: N/A** | | | **3: N/A** | | | | **4:** | | | | **5:** | |
| Turn off O3 alarm. | | | | | | | | | | | | | | | | | | |
| Turn CRD and PAS flow back on. | | | | | | | | | | | | | | | | | | |
| Set dial on O3 generator back to 1. (All the way counterclockwise.) | | | | | | | | | | | | | | | | | | |
| Setup for Sampling | | | | | | | | | | | | | | | | | | |
| Open the clap valve (V) and check that CLAP data are being read (should see updating on Clap tab). | | | | | | | | | | | | | | | | | | |
| Set filter spot to the next location. | | | | | | | | | **Spot Number:** | | | | | | | | | |
| Check the flow valve on the CLAP is open completely. (This valve is on the CLAP body and is not easily accessible.) If the CLAP is reporting data, skip this step. | | | | | | | | | | | | | | | | | | |
| Set CLAP flow to 1 lpm (Clap Tab). | | | | | | | | | | | | | | | | | | |
| Set the humidifier temperatures to 10°C (CRD Controls Tab). | | | | | | | | | | | | | | | | | | |
| When saturators have cooled down (< 20 °C) open the 4 valves isolating the CRD saturators: (N, O, Q, R). Close the bypass valves (P and S) for both channels. | | | | | | | | | | | | | | | | | | |
| Click the RH switch to move it to the up position. (CRD controls tab) | | | | | | | | | | | | | | | | | | |
| Set the med. RH channel to 70% and high RH channel to 85%. (CRD controls tab) | | | | | | | | | | | | | | | | | | |
| Check that speaker cycling time is set to 4 sec. ON and 146 sec. OFF. (PAS controls tab) | | | | | | | | | | | | | | | | | | |
| Turn on auto speaker cycling. (Operate menu, the check mark means it is ON.) | | | | | | | | | | | | | | | | | | |
| Check that filter cycling time is set to 20 sec. ON and 300 sec. OFF. (Common tab) | | | | | | | | | | | | | | | | | | |
| Turn on auto filter cycling. (Operate menu, the check mark means it is ON.) | | | | | | | | | | | | | | | | | | |
| Check that LTI valve (A) is open and cabin air valve (B) is closed. | | | | | | | | | | | | | | | | | | |
| Check that the thermal denuder is not bypassed. (open K then close L) | | | | | | | | | | | | | | | | | | |
| Check and fill water for the CRD saturator as necessary. (Should last more than 4 hours.) | | | | | | | | | | | | | | | | | | |
| Loosen cap on water bottle, so it doesn’t squirt when the altitude changes. | | | | | | | | | | | | | | | | | | |
| Ask if CCN folks are ready and then set the CCN valve to sample from the inlet (turn to the L). | | | | | | | | | | | | | | | | | | |
| Power On UHSAS | | | | | | | | | | | | | | | | | | |
| Open the UHSAS inlet valve on back of instrument (F). | | | | | | | | | | | | | | | | | | |
| Turn on UHSAS breaker at rear of box. (AC1) | | | | | | | | | | | | | | | | | | |
| Start "Spectrometer" LabView program. (Shortcut on the Desktop) | | | | | | | | | | | | | | | | | | |
| Check that the Laser Temperature setting is 1.23 V (Controls Tab) and that the measured laser temperature is controlling within 0.04 V of this value. | | | | | | | | | | | | | | | **T:** | | | |
| Verify the sample flow is ~30 ccpm and total flow is zero (Controls Tab). | | | | | | | | | | | | | | | | | | |
| Go to "histogram" tab and make sure data acquisition is at 1 second, and "run" and "record" are enabled. Look for histogram updates. IMPORTANT: If counts are not seen in all size bins (i.e., there is a gap in the histogram), cycle power. The gap will likely be in the 125-300 nm range if it occurs. | | | | | | | | | | | | | | | | | | |
| During Flight | | | | | | | | | | | | | | | | | | |
| Takeoff Time: | | | | | | | | | | | | | | | | | | |
| Landing Time: | | | | | | | | | | | | | | | | | | |
| IMPORTANT--EVERY 15 MINUTES: Check UHSAS size distribution (Histogram Tab). If counts are not seen across the full spectrum (i.e., there is a gap in the histogram), cycle UHSAS power (in rear). | | | | | | | | | | | | | | | | | | |
| Elevated Absorption Levels: | | | | | | | | | | | | | | | | | | |
|  | **Time On:** | | | | | | | | **Time Off:** | | | | | | | | | |
|  | **Time On:** | | | | | | | | **Time Off:** | | | | | | | | | |
|  | **Time On:** | | | | | | | | **Time Off:** | | | | | | | | | |
| Shutdown | | | | | | | | | | | | | | | | | | |
| Switch from RH control to temperature control, and set temperatures to 10˚C. | | | | | | | | | | | | | | | | | | |
| Turn CRDS sample flows to zero. | | | | | | | | | | | | | | | | | | |
| Turn PAS sample flows to zero. | | | | | | | | | | | | | | | | | | |
| Switch mirror purge valve (I) to critical orifices from flow controller. | | | | | | | | | | | | | | | | | | |
| Close the PAS-CRD host software. Shutdown server. | | | | | | | | | | | | | | | | | | |
| Close UHSAS software. | | | | | | | | | | | | | | | | | | |
| Turn off the 5 breakers for the PAS lasers. | | | | | | | | | | | | | | | | | | |
| Turn OFF the main (AC Master) breaker. | | | | | | | | | | | | | | | | | | |
| Turn OFF the UHSAS breaker (rear of UHSAS). | | | | | | | | | | | | | | | | | | |
| Close the UHSAS inlet valve (F). | | | | | | | | | | | | | | | | | | |
| Close the 4 valves to isolate the saturators. (N, M, O, P). Open saturator bypass valves. | | | | | | | | | | | | | | | | | | |
| Close CLAP valve (V). | | | | | | | | | | | | | | | | | | |
| Open cabin inlet valve (B), and close LTI inlet (A). | | | | | | | | | | | | | | | | | | |
| Set CCN valve to sample from the cabin (turn to the R). | | | | | | | | | | | | | | | | | | |
| Download data from the CRD-PAS (C:\CRD-PAS data), the UHSAS (C:\DMT\Spectrometer Data), and the CLAP. | | | | | | | | | | | | | | | | | | |
| Turn OFF O2 cylinder. Leave zero air cylinder on for mirror purges. | | | | | | | | | | | | | | | | | | |
| Turn OFF laptop. | | | | | | | | | | | | | | | | | | |

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| Restarting after power switchover (only if system freezes; doesn’t always happen) |
| Close UHSAS software and restart. |
| Change RH to 60% and then back to 70% (CRDS controls). |
| Set PAS flows to 1.0 and CRDS flows to 3.0. |
| Turn on PAS lasers. |
| Toggle the CLAP spot size to reset. |
| Toggle the RH switch to reset. |
| Sync the time again. |

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| **Valve Label** | | **Description** | **Location** |
| VA | | Main inlet valve; isolate instrument from inlet | On the wall next to the seat |
| VB | | Scrubbed cabin air to the driers | On the wall next to the seat |
| VC | | Dry air to O3 and NOx scrubber | On the wall next to the seat |
| VD | | Dry, particle filtered air to O3 and NOx scrubber | right side of rack |
| VE | | Cabin or LTI selector for CCN | right side of rack |
| VF | | UHSAS inlet | Flow plate, front |
| VG | | O3 generator inlet | Flow plate, front |
| VH | | ZA supply | Flow plate, front |
| VI | | Mirror purge source selector | Flow plate, front, top left |
| VJ | | O3 addition valve | On the wall next to seat |
| VK | | Denuder inlet | RH plate |
| VL | | Denuder bypass | RH plate |
| VM | | Saturator bypass: medium RH | RH plate |
| VN | | Saturator isolator #1: CRDS medium RH | RH plate |
| VO | | Saturator isolator #2: CRDS medium RH | RH plate |
| VP | | Saturator bypass: high RH | RH plate |
| VQ | | Saturator isolator #1: CRDS high RH | RH plate |
| VR | | Saturator isolator #2: CRDS high RH | Flow plate rear |
| VS | | Saturator bypass: PAS | Flow plate rear |
| VT | | Saturator isolator #1: PAS | Flow plate rear |
| VU | | Saturator isolator #2: PAS | UHSAS rear |
| VV | | CLAP valve | needle valve rear CRD side |
|  | | | |
|  | | | |