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| --- | --- | --- |
| **Research Flight #: Main Operator: Date:** | | |
| **D?** | **L?** |  |
| **Switch on Sequence: I. Hands On (3 hours prior to TO)** | | |
| **⃝** |  | Power up rack (Sequence: Station Power Switch -> Power Bar -> Hard UPS Switch – Aisle Side is On– -> 24 V Main Switch -> Aux1 Switch -> Computer) pw: passjimenez |
| **⃝** |  | Open up .txt and .ppt file; name RFxx.txt and RFxx.ppt. Enter in the ppt the flight objectives and your name. Save in "SEAC4RS" folder inside My Documents (Window should be open) |
| **⃝** |  | Record AMS pressure. Should be <0.2 torr unless after a hard down day. If much greater, it suggests either a possible leak that should be investigated or excess water in the system, more time for cryoregeneration is then advisable |
| **⃝** |  | Start UPS Software. Start Pumpbox software, set "Update rate" to 5 s and autoupdate. |
| **⃝** |  | Confirm by “feeling the vibe” (or not) that the MD-1 is actually running. If not, you should start the MD-1 first in the next step |
| **⃝** |  | Turn all pumps on under "control" menu "on/off control". Choose "All On" then "Send CMD" (NOTE: IF all buttons show red, you either have a communication problem - in which case you want to exit, press update and reenter the PumpControl Window- or the software thinks the MD1 is off, in which case you should press the MD1 button till it turns green) |
| **⃝** |  | When all pumps except P5 are above 300 Hz, open MD-1 valve |
| **⃝** |  | When P2 reaches final speed (963 Hz) start Cryopump software. Just ok standard communication settings. Press “Cool” button |
| **⃝** |  | When all pumps but P5 are up (Heater params will become visible, both should show as “Normal”, not “autotune”), switch on Heater (should show 0.98 A, sometimes will be 0.05 higher at starton, but should come down by the MCP start time) |
| **⃝** |  | Set Pumplog File and Directory (c:/ToFAMS/ ToFAMSDAta/LogFiles/SEAC4RS PumpLog.txt, you can get this via F2 from the Logfile directory) - click "enable logging" and save |
| **⃝** |  | Start Speedfan (click yes when User Account Control bugs you) and minimize it (this will log computer temps) |
| **⃝** |  | Once P5 is up to speed (963 Hz), note the time in the text log, MCP start should be 1 h after this. |
| **⃝** |  | Change update rate of pumpbox software to 59 s |
| **⃝** |  | Switch on TPS (green button). Start TPS software and load TOFAMSMenu.set (typically first file in the list). Set both filament current and MCP to 0, PostAccel to 1500 V. Press “Set all” |
| **⃝** |  | Check MD1 backing pressure. Record "inlet closed" value (Should be around 1.4 torr, except if the plane is really hot, when it might be slightly higher) |
| **⃝** |  | Switch on Meinberg IRIG client (click yes and minimize) (if LED clock by main computer station of DC8 is on, otherwise wait and check later if this point has not been taken care of) |
| **⃝** |  | Start TCP-Com Software. Only click once, it will minimize itself automatically, you can right click and check that COM11 (serial output feed from the DAQ) is open (green leds at bottom). |
| **⃝** |  | Start TofAMS-DAQ. Go into Menu and swap Menu 1 and 7 (if not done before) so that FMS\_SEAC4RS is Menu 1. Enable Menuswitching between Menu 1 and 6 (ePToF\_SEAC4RS). You should get a 1 min cycle. Then check that your timing in on Menu Switching cycle. |
| **⃝** |  | Choose BFSP/Old PToF Menu (#3). Do not enable TPS yet. Go to calibration window and start pulsing (hit "start" in cal window) |
| **⃝** |  | Open both vacuum valves to pump down spare MCP (~10 seconds is fine). If you see a large bump in MD-1 pressure, wait till it comes down and record it (otherwise don’t!). |
| **⃝** |  | Close the MCP valves and switch pressure inlet valve back to lens |
| **⃝** |  | Start NI Device Manager and activate the test panel for the USB-6008 (Digital). Set the Jayne valves to “Filter” by choosing digital, set all lines to “Output”, then all “High” and Ch#0 to low and hit “Start”. (Aux 2 switch is not enabled yet, so nothing will happen with the actual valves at this time) |
| **⃝** |  | Once heater voltage >3.5 V (typically 10 min), set emission current to 1.5 mA. Do not leave the plane before switching on the filament, or your schedule will suffer later. |
| **⃝** |  | Make sure the NI temperature logger is on and logging (sometimes comes up on boot; if not, just find the virtual drive under “My Computer” and click it, then enable logging) |
| **⃝** |  | Check pump fans for dust/fan failure and remedy if necessary |
| **⃝** |  | Optional: It might be a good idea to start the PCI per the instructions below at this time (log MD-1 open backing pressure if you do). DO NOT leave the PCI/inlet running when off the plane (ie close Lens and PCI valve and switch Aux2 off), but a 1 min check to make sure that all orifices are fine and that you do not have to plan for replacing them before flight is a good idea. If you do, remember to go back to Calibration/Menu 3 and pulsing before leaving the plane. |
| **II. MCP turn on (60 min after P5 attained final speed, about -1.5 h before TO)** | | |
| **⃝** |  | 55 min after the logged “all pumps up time”, return to the plane. Inpect toolbag/spares and make sure you have all the spares for an orifice exchange. (Toolbag lives on the plane). |
| **⃝** |  | Start PCI per instructions (Page 3). |
| **⃝** |  | Check and log the MD-1 backing pressure, should be around 4.4 Torr. Return valve to lens monitoring. |
| **⃝** |  | Check heater power (b/c TC temp is low). Should be ~3.8 watts (3.83V, 0.98A). Set voltage is T dependent, so it will need small readjustments in a cold/toasty airplane. If slightly low or high, probably best to wait till power switch (when plane inside temperature starts approaching normal levels) to adjust. Make sure you adjust the Heater, not the Heater Bias! |
| **⃝** |  | Switch on chopper motor and confirm chopper speed (100 Hz, sometimes does not start on the first attempt) |
| **⃝** |  | Confirm that the Cryopump is at 90 K. Confirm that the turbo pumps are cool (<45 C) and the pump currents are normal (<900 mA for P2, less than 250 for everything else) |
| **⃝** |  | Enable TPS in TOFAMS-DAQ (Menu 1, FMS\_SEAC4RS). Hit “Set” and confirm by looking at the TPS window that the MCP is coming up. |
| **⃝** |  | Wait for MCP in TPS window to come up. Start calibration window. Calibrate, and measure AB (should be ~4 ipes). Heater bias should be 35 V (or whichever value was derived in the last AN calibration). Measure AB, if your total signal is 10x too low (ie m/z 28 open should be normally 50-60 bpe, but you only see 0.3-0.5 ipes), this can be due to either a non-working heater bias or a passed out preamp. Tune the heater bias to exclude the first option. If the preamp is the culprit, it is likely that it is simply the fuse on the preamp PSU. In that case: a) shutdown the TPS b) switch the TPS off c) unplug the preamp psu d) wait 1 min e) replug the preamp psu and f) restart the TPS. |
| **⃝** |  | Check resolution. m/z 32 should be ~2100, m/z 149 ~3500 (Use 2 or 5 s averaging for this). Screenshot |
| **⃝** |  | Switch to Menu 3 and calibrate again, then switch to servo window and run the MS delay diagnostic (not needed for acq). Use Y-Zoom. If it needs more than 250 ms, the servo might be on its last legs. Then do a full top hat with 500 ms increments (screenshot). Ideally you will start this right before the preflight brief. |
| **⃝** |  | If not done on cal day, inspect the HIMIL (ie check for alignment of inner diffuser with HIMIL inlet). |
| **⃝** |  | If not done on maintenance day, perform leak test (instructions on Page 3) |
| **⃝** |  | After the leak test, close the lens valve and set the inlet line back to filter. Very slowly open the HIMIL valve to vent the PCI thru the filter. Once the HIMIL valve is fully open, open the PCI Valve and wait for the PCI pressure to stabilize. Then open the lens valve again and recheck all pressures and flows for a plugged orifice (94 Torrr/1.4 Torr, 690/600 sccm) |
| **⃝** |  | Stay in Menu 3 and let it pulse till about 30 min before the flight. You might consider closing the lens in the meantime, especially if it’s hot |
| **III. After doors close (-30 min before TO)** | | |
| **⃝** |  | When doors are about to close, check on the location of the car keys. Open lens valve and PCI if you kept it closed. |
| **⃝** |  | Plug in Flowcontroller. Press bottom left button so it displays vlpm. Open Bypass valve behind the flowcontroller and close the small MD-1 bypass valve |
| **⃝** |  | Go back to FMS Menu Cal window and pulse till the power switch is completed (if there are problems that lengthen the powerswitch, please close the lens valve). If the UPS still beeps after the power comes back on, cycle the back switch of the UPS. |
| **⃝** |  | After calibrating Menu1 do bitwise and screenshot |
| **⃝** |  | Go to Menu 6 and calibrate m/z. Do baseline (not SI) in bitwise. |
| **⃝** |  | Go into the Menu editing window and copy the SI setting over from Menu1 to the ePToF cal group (ie Group 1 to 2, ePToF Menu is 6) |
| **⃝** |  | Confirm you are using the proper menus and that timegrid by menucycle is enabled |
| **⃝** |  | Start Chrome, xchat (ignore the warnings) and IRIG, if not done before. Start Igor, load the last Flight, clear it, save it as new (Quickview RFxx.pxp) and resume import. |
| **⃝** |  | When they start taxiing, open the top bypass flow valve (as late as possible but before they yell at you) and check that the heater is about 0.98 A and 3.83 V, HB is stable and log them. |
| **⃝** |  | Go to acquisition and start on the full minute (about 2 min before take off, ie when you can see the beginning of the runway) - this will be still filtered air |
| **⃝** |  | Note Run # at take off point and the official UTC take off time. |
| **⃝** |  | After 2 full switching cycles in the air, switch over to ambient sampling (ie Ch#2 down, everything else up, in the NI digital out). Follow procedures on next page for flight. Good luck! |
| **Taxi List (check after Bitwise/before taxing)** | | |
| **⃝** |  | Are baseline, SI, and MCP settings consistent across menus? |
| **⃝** |  | Did you close both spare MCP valves? |
| **⃝** |  | Are you on the proper menu switching cycle for take off? Is menuswitching enabled as well as timegrid on menucycle? |
| **⃝** |  | Is Real Time with serial output on? Did the Daq find the COM Port? |
| **⃝** |  | Can you read CabinTemp in the NI software? |
| **⃝** |  | Is the Inlet FC on and displaying vlpm? |
| **⃝** |  | Are all your lens and PCI flows in the right ballpark (94 Torrr/1.4 Torr, 690/600 sccm at MSL)? |
| **⃝** |  | Are the cryopump, the turbos and the AP240 happy (cryo<40 skin and 90 K), P2<50 C, P3-P6<40C, AP240=52-56 C |
| **⃝** |  | Are the exhaust valve and window HIMIL valve open? Are you on Filter? Is the little PCI exhaust valve closed? Is the water container and the cal line closed? |
| **⃝** |  | Are you on Xchat? Is the IRIG active? Is Igor quickview up and running? |
| **⃝** |  | Is the toolbag on the plane? Do you have fresh orifice spares and Kimwipes? |
| **⃝** |  | Heater, Chopper and bias all working? |
| **⃝** |  | Is your AB in the right ballpark? |
| **Shutdown Procedures** | | |
| **⃝** |  | About 3 min before landing (<5 kft), start regenerating the cyro. If it takes longer than 4 min to land ( ie you hit 130 K), just stop the regeneration until touchdown. |
| **⃝** |  | When in final approach, go to filter (ie 1-2 min before landing) (You can also wait till 10 s before touchdown if needed, but make sure you are on filter when braking on the runway) |
| **⃝** |  | As above, note R# of touchdown and UTC time. Stop acquisition after the end of the current cycle |
| **⃝** |  | Disable TPS control in AMS DAQ, Close AMS DAQ, shutdown TPS software |
| **⃝** |  | When you are able to get up, disconnect FC (you might need a screwdriver), switch off TPS. Open the small PCI pump valve, close big exhaust bypass valve. |
| **⃝** |  | Close the top bypass valve, the aerosol lens valve and the PCI valve. Switch off aux 2 (watch for that main switch) and stop chopper motor (try to finish this before the powerswich) |
| **⃝** |  | Shutdown temp log, NI valve switcher, xchat, quickview (save the file first!), irig, chrome, powerpoint log |
| **⃝** |  | Watch the UPS software during the powerswitch. If the UPS still beeps after the power comes back on, cycle the back switch of the UPS. |
| **⃝** |  | After the powerswitch, save the UPS log to My Documents/SEAC4RS and clear it. Close the UPS software. Switch off noise cancellation on headset. |
| **⃝** |  | Connect external drive and run both viceversa profiles. Stop pumplogging while doing so, otherwise the file will not be saved. Restart after finishing backup. |
| **⃝** |  | Once the cryo hits 270 K, switch the heater off |
| **⃝** |  | Once the cryo is over 300 K, shut down both the cryo and the turbos (by software). If you had excess water before, you might want to leave the cryo at 310 for an extra 10 min. |
| **⃝** |  | Set the autoupdate on the pump software to 5 s. |
| **⃝** |  | When P6 hits 200 Hz, close the MD1 valve |
| **⃝** |  | Wait till P5 is at least below 250 Hz shutdown the computer. Then flip both Aux1 and the main 24 V switch and switch off the UPS AC (2 right front buttons) |
| **⃝** |  | Switch off UPS (back switch should face window), switch off power bar and flip off 60 Hz switch |

**General Reminders:**1) Be very, very careful not to flip of main 24V when switching on Aux2 (PCI pump).   
2) Be sure that main bypass valve to Venturi (big green handle valve) or little bypass just after PCI MD1 is open before turning on PCI MD1.

3) Wait till log shows up in the ToF-DAQ software till you hit any buttons/checkboxes (about 15 s after the window comes up)

4) You cannot “refine” your m/z cal while acquiring in the cal window. Just set it to “Refine during tuning instead”

5) Try to avoid running on the ground with P2 over 50 C (or AP240 over 60 C)  
6) Do not start taxiing without having both bypass valves open (before and after the main flowcontroller), the flow controller on and the little bypass valve on the MD1 closed

7) Do not start taxiing without having the temperature logger running

8) Before doors close, make sure you have handed over the rental car keys to your ground crew

9) Make sure before starting the preflight that you have enough Helium in the lecture bottle to perform the leak test

**Regular checks during flight**

1) Check turbo and cryo temperatures and currents every 30 min, more often if the cabin temperature changes a lot.

2) Check Heater Bias and heater power every 20 min, more often if cabin temperature changes a lot (keep the EBox on HB during flight)

3) Monitor AP240 temperature (every 10 min or so). If temperature goes over 56 C, open the bay door and prop it with something, If it goes below 53 C, close the bay door.

4) Try to do a filter every 45-90 min. ideally you want a range of altitudes, and certainly always a filter at top altitude (to check for leaks). Try to get 2 minutes cycles. One of the best times to do this is when the airplane performs a level turn in preparation for the next wall level. Ideally you open both valves on the last second of PToF and close the filter/sample valve in the time before FMS starts again.

5) It is a good idea to remeasure the baseline (NOT the SI) every 3 h or so (ie 1-2x per flight). Takes typically one cycle, do this before a filter (for both M1 and M6). Always restart on the full minute.

5) Monitor the PCI flow vs Inlet Pressure closely (every 10 min or so, more often during altitude changes) to check for plugging of orifice 2

6) Try to record R# for altitude changes/patterns (begin/end, monitor the climb/sink rate in the main parameter window for that)

7) Try to record interesting features in our data by screenshot to powerpoint

8) Try to record interesting trends in other people’s data to the txt log

9) Keep an eye on the PCI pressure, especially above 35 kft. Monitor the Inletflow (FC display), should be ~ 22-25 vlpm except when flying very high or very low, when it will be somewhat less

10) When flying low, monitor RH and total temp in the parameter table. If you suspect that Inlet line RH will be >50%, make a note in the log. It it’s raining heavily outside, consider opening the water collector briefly (ie no more than 10 s)

11) If temperatures vary a lot, consider taking some screenshots of the TPS window

12) Monitor both our concentrations and timetrace in Reveal and let David V know if things stopped working

**PCI Opening/Test procedure (to be repeated every time the PCI/Lens is opened)**

1) Check valves: Calibration line should be closed (on both ends, also check if Cal rack exhaust line is closed), HIMIL valve should be open, HIMIL flow should enter the AMS thu the filter, Top bypass line should be closed, PCI valve should be closed, small PCI bypass line should be open and main exhaust valve should be closed)

2) Switch on PCI pump. Open the PCI pump valve and let the PCI pressure stabilize. Once the PCI pressure is at 94 Torr, record the PCI flow (either on the flowmeter -the upside-down Alicat FM after the PCI MD1 - or in the Acquisition Window of ToF-DAQ under AI06), should be between 670-700 sccm.

3) Slowly crack open the lens valve (should take you about 15 s to open it, try to keep the pressure under 4 Torr). Make sure you fully open it.

4) Once all flows stabilize, you should read: 94 Torr on the PCI, 1.36-1.38 Torr on the lens pressure (make small allowances for a cold or very hot plane) and 590-620 sccm on the PCI bypass flow. If either lens pressure or bypass flow are low (>10%), one of the orifices is likely plugged and needs service. (For logging, a screenshot of AI6 in the acq window before and after opening the lens is best).

**Leak Test Procedure**

1) Go to Leak Test Menu (#2). Make sure that a) the chopper is in the open position b) you are still going thru the filter c) the top bypass flow valve (and the cal line valve) are still closed. Set your timetrace to m/z 4 (with resolution display disabled) & 32 and MS display to log (so you can see it in relation with the other peaks).

2) Close the inlet valve on the window side, and watch the PCI flow go to zero. Then close the PCI valve. Pressure should rapidly drop to <0.5 Torr or so. Make sure both filter and sampling valves are open (ie both Ch2 and Ch0 are low). Then start spraying all fittings from the lens valve on to the HIMIL valve liberally with Helium (no need to do them individually, just bath individual sections in a good cloud and see if something comes up).

3) Because of water accumulation in the HEPA filter, it is a good idea to leak check the filter first and the close both filter valves before completing the rest of the filter test. Once the filter is taken out of the equation, you should be able to pump the line down to 0 Torr easily.

4) When done, close lens valve, reset Jayne valves to filter and open HIMIL valve slowly. Then follow std PCI opening procedure

**In case you need to change orifices**

* Stop acquisition
* Close all Jayne valves (ie all high)
* Close the lens, the PCI valve and top bypass valve
* Switch off Aux 2 and disconnect PCI ultratorr from filter
* Undo the fittings per normal procedure (ie loosen top and bypass nut as well as orifice #2 nut before undoing the clamp, loosen the clamp and then carefully undo the fittings by hand and extract the PCI without jacking the lens)
* Once you have extracted the PCI, it is a good idea to put the top clamp back in to protect the inlet line in case of turbulence.
* Extract the orifice by pushing it vertical with a cable tie, and extract both the orifice and o-ring. Make sure to seat the o-ring properly before putting in the spare orifice
* Make sure you mark the plugged orifice properly
* After reassembling the PCI, reconnect the PCI pump and switch on Aux2
* Set Jayne valves to filter and slowly open the bypass valve. Then open the PCI valve and shortly after the lens.
* Acquire 1-2 min of filter to check for large leaks
* Once you are acquiring again, you can check in quickview if your flow is “normal”