**I. General information:**

1. Mission name: **SENEX 2013**

2. Instrument name: UW-HR-ToF-CIMS

3. What is measured:

Mostly gaseous carboxylic acids with the potential for molecular halogens and inorganic acids to be determined before April 2013.

4. Short description of measurement technique:

Chemical Ionization using negative reagent ions, iodide and/or acetate, followed by detection with a Tofwerk AG high-resolution time of flight mass spectrometer.

5. Contact information for all personnel going to the field with this instrument:

 (*for multiple investigators,* *please list the PI or primary contact person first*)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Email** | **Office phone**  | **Cell phone** |
| 1. Joel Thornton (PI) | thornton@atmos.uw.edu | Before June 19, 2013: After June 19, 2013 | 358 41 750 0988 or 206-923-9673206-962-1430 |
| 2. Felipe Lopez-Hilfiker\* (\*Primary in-field contact) | lopezf@uw.edu | 360-298-2761 | 360-298-2761 |
| 3. Ben Lee | benhlee@uw.edu |  |  |
| 4. |  |  |  |
| 5. |  |  |  |
| 6. |  |  |  |

**II. Specific information:**

**1. Total installed weight: 350 lbs**

(rack, gas cylinders, hoses, cabling, pumps, inlets, permeation tubes, etc.)

|  |  |  |
| --- | --- | --- |
| **Rack weight and balance info** | **Allowed** | **Actual** |
| Weight, lbs.: |  | 350 lbs |
| Overturning moment, in-lbs.: |  |  |

**Pod weight and CG:**

**NOTE**: Please also provide weight-and-balance information for all installed equipment. Templates for standard electronics racks are available for download [here](http://esrl.noaa.gov/csd/groups/csd7/measurements/2013senex/P3/integration/). PIs with non-standard installations will need to provide relevant information in a similar format.

**2. Individual subassembly info** (weights should sum to total listed above)

|  |  |  |
| --- | --- | --- |
| **Component name** | **Location name and flight station** | **Weight, lbs** |
| 1. ToF Chamber/Pump | Station 6a | 130 |
| 2. TPS Electronics | Station 6a | 50 |
| 3. Instrument Control | Station 6a | 46 |
| 4. Computer  | Station 6a | 40 |
| 5. Scroll Pump | Station 6a | 44 |
| 6. UPS | Station 6a | 40 |

**3. Component power consumption in Amps**

Please provide an electrical power diagram in Appendix A

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Component name** | **Location name** | **400 Hz****3Ø** | **400 Hz****1Ø** | **60 Hz** | **28VDC** | **28VDC****WOW** |
| 1. TPS |  |  |  | 125 W |  |  |
| 2. 24 VDC Supply |  |  | 2.5 A |  |  |  |
| 3. 5VDC Supply |  |  | 1A |  |  |  |
| 4. +/- 15VDC Supply |  |  | 1A |  |  |  |
| 5. Computer |  |  |  | 150 W |  |  |
| 6. Scroll Pump |  |  |  | 190 W |  |  |
| 7. Inlet Heaters |  |  |  | 500W |  |  |
| 8.  |  |  |  |  |  |  |
| 9. |  |  |  |  |  |  |
| 10. |  |  |  |  |  |  |
| 11. |  |  |  |  |  |  |
| 12. |  |  |  |  |  |  |
|  | **Totals:** |  | 4.5A | 9A |  |  |
|  |  | **400 Hz****3Ø** | **400 Hz****1Ø** | **60 Hz** | **28VDC** | **28VDC****WOW** |

**4. Inlet and exhaust information:**

Please provide an inlet/exhaust line diagram in Appendix B

|  |  |  |
| --- | --- | --- |
| **Inlet/exhaust name** | **Location name and flight station** | **Hole size through hull, inches** |
| 1. Sampling Inlet | Window Plate Station 5 | <3cm |
| 2. Scroll Pump Exhaust | Flight Rack (station 6) to common exhaust |  |
| 3.  |  |  |
| 4. |  |  |
| 5. |  |  |
| 6. |  |  |

**5. Source of flow** (name and location of pump or venturi)

|  |  |
| --- | --- |
| **Pump name** | **Location name and flight station** |
| 1. Scroll Pump (input) | Flight Rack (station 6a) |
| 2. Scroll Pump (exhaust) | Flight Rack (station 6) to common exhaust |
| 3.  |  |
| 4. |  |
| 5. |  |
| 6. |  |

**6. Installed hazardous materials or equipment:**

(only for items *installed* *in the aircraft for use during flight*)

**A. Lasers (N/A)**

 Type:

 Class:

 Wavelength:

 Output power:

 Eye-safe?

 Beam fully contained within instrument during normal operation?

*For non-eye-safe lasers, please attach a description of safety measures taken (safety interlocks, beam fully enclosed within instrument, etc.) and a procedure for safe instrument operation during testing and laser alignment. Please contact the* *AIC* *for an example of laser safety documentation from TexAQS 2006.*

**B. RF transmitters**:  **(N/A)** (note that mass spectrometer RF generators are not designed to transmit, and do not need to be included here)

 Description:

 Transmitted RF power:

 Frequency range:

**C. Radioactive materials:**

Isotope: Po (210)

Half-life: 165 Days

Type of emitter: alpha

Generally licensed? yes

# installed and location: 1 – Chemical Ionization Mass Spectrometer Ion Molecule Region (IMR) (First Region)

# of spares and location: 0 - No spares

**D. Compressed gases:** (1 ft3 = 28.32 liters; cabin volume = 4260 ft3 = 1.21 x 105 liters)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cylinder number:** | **1** | **2** | **3** | **4** | **5** |
| Gas description |  |  |  |  |  |
| Mixing ratio |  |  |  |  |  |
| Cylinder size (ft3) |  |  |  |  |  |
| Max pressure (psig) |  |  |  |  |  |
| # installed on aircraft |  |  |  |  |  |
| Location on aircraft |  |  |  |  |  |
| Service frequency |  |  |  |  |  |
| *toxic/flammable gases:* |  |  |  |  |  |
| In containment vessel? |  |  |  |  |  |
| Gas alarm provided? |  |  |  |  |  |
| MR if vented to cabin, ppmv |  |  |  |  |  |
| OSHA 8-hr PEL, ppmv |  |  |  |  |  |
| 30-min IDLH, ppmv |  |  |  |  |  |

**E. Chemicals (solids and liquids):**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Chemical number:** | **1** | **2** | **3** | **4** | **5** | **6** |
| Concentration | Pure | Pure | Pure |  |  |  |
| Amount | 2 mL | 20 mL | 1 mL |  |  |  |
| Container description | Double-encased vacuum-sealed permeation tube | Vacuum-sealed Stainless Steel | Double-encased vacuum-sealed permeation tube |  |  |  |
| Purpose | Ion source | Ion Source | Cal Gas |  |  |  |
| Solution pH |  |  |  |  |  |  |
| Spill kit provided? | Yes | Yes | Yes |  |  |  |

**Chemical 1**= Methyl Iodide perm tube, **Chemical 2**= Acetic Anhydride reservoir, **Chemical 3**= Formic Acid perm tube

**F. Cryogens:**

 Location: TBD

Description: Shared for UHP N2 delivery during flight

Container description: NOAA ESRL PLiN

Quantity on board per flight: 1

Serviced on the aircraft?

**G. UPS and battery installation:**

 Location: Flight Rack (rack mountable 1U)

Description: (Manufacturer, model no., power) APC model: SUA750RM1U

750 VA

Battery type: Maintenance-free sealed Lead-Acid battery with suspended electrolyte: leak-proof

Has an adjustable input voltage tolerance? (highly recommended)! Yes

**H. Motors**

 Description: SH110 Varian Dry Scroll Pump

 Motor current draw 0.25 HP (0.19 kW) 100/115: 200/230 VAC, 50-60 Hz

 Thermal interlock enabled? Yes

**I. Operator seat requests -**

Test flights: 1

Transit flights: 1

Science flights: 1

**7. Data and plumbing drops**

 Network (Cat. 5/6 ethernet) drops requested: 1

 Serial drops requested: None

 IRIG-B drops (BNC coax connector) requested: None

 Vacuum/exhaust/ emergency dump lines:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Flow rate, slpm** | **Line pressure, Torr** | **Pump type** | **Trace gas concentration(s)** |
| 1. Pump Exaust | 6 slpm | Cabin pressure | SH110 Scroll | CH3I/Formic Acid/ Acetic Anhydride all <10ppm (scrubbed by activated charcoal) |
| 2. |  |  |  |  |
| 3. |  |  |  |  |
| 4. |  |  |  |  |

 Ground gas service lines (number, location, type of service): 5.0 UHP N2 2 slpm

 Other gas lines (number, location, type of service): 5.0 UHP N2 2 slpm

Will you be sending data to the AOC data station? If so, please provide the following information:

|  |  |  |
| --- | --- | --- |
| **Parameter name** | **Voltage range** | **Unit conversion** |
| 1. Instrument Status | 0-5 Digital Signal |  0 = Failure || +5= Normal |
| 2.  |  |  |
| 3. |  |  |

**8. Aircraft access**

 **a. flight days:**

Pre-flight time requested at aircraft (hours): 3 Hours – spin up pumps, attain vacuum; diagnostic checks

 Routine pre-flight ground support required? None

Routine post-flight time requested at aircraft (hours): 1 Hour, Spin down pumps; data retrieval, purge flows

Routine post-flight ground support required? None

**b. non-flight days:**

 Routine external access to inlets or zenith mounts required?

No routine access needed, periodic calibrations may require external access to inlet manifold.

*Please note there is zero access and zero power to the aircraft (including pods) on hard-down days. These occur at least once every seven calendar days while in the field.*

**9. Aircraft maneuvers**

 Briefly describe in-flight calibration frequency, duration, altitudes desired:

We will use C-13 formic acid as a continuous calibration source. If unavailable or problematic, we will use short (0.5 minute) cals at random frequencies during flight. Special altitudes not required.

 Briefly describe instrument sensitivity to flight conditions:

(issues during roll/pitch, ascent/descent, sampling in cloud, icing etc.)

Rapid direction changes increase load on split flow turbo, will continue normal operation, Interlock protected. Inlets will be heated slightly to prevent icing, off-axis to reject cloud droplets and aerosol particles, and pressure controlled.

**10. Miscellaneous**

 *1. Hazmat for preflight/postflight calibrations*: Please describe fully any additional hazardous materials - compressed gases, solvents, radioactive ion sources – that you anticipate *temporarily* bringing onto the aircraft for periodic instrument calibration purposes (e.g., *n*-butanol in a CN counter, 210Po in a DMA, a UPS for power, compressed gas cylinders for calibrations, etc.)

 *2. Fabrication and sheet metal support:* Please describe fully any anticipated requests for fabrication or sheet-metal support during installation in Tampa. This list should be kept to an absolute minimum; please recognize that this superb AOC resource is quite limited. To ease the strain on the AOC shop, we will work with each PI to ensure they arrive in Tampa with as much in hand as possible.

 No fabrication anticipated. All fabrication should be completed prior to arrival.

 *3. Ferry flight/check flight procedures.* On occasion, AOC will perform an aircraft check flight, during which the instruments may be flown without power. Aircraft maintenance needs may also dictate a ferry flight without science crew or SED techs on board. Instruments should be designed with these eventualities in mind. However, if your instrument requires standby power during this kind of flight, this may be provided at the discretion of AOC personnel.

 If so, the flight crew will need to be briefed well ahead of time to ensure proper instrument operation. Please provide with this document a bare-minimum checklist of instrument startup and shutdown procedures requested for these flights.

**III. Ground laboratory space**

**1. Tampa space requests**:

 Power requirements: Full instrument capacity for testing operation (120 VAC)

 Special requests: None.

**2. Field space requests**:

 Workspace, ft2: 15 ft2

 Number of tables/chairs: 2 Chairs, 1 Table

 Power requirements: Normal full operation power (1.5 kW)

Storage space, ft2: 3x5ft area for shipping container storage/Spares storage

 Other requests: