**I. General information:**

1. Mission name: **SONGNEX 2015**

2. Instrument name: NOxCaRDS (Nitrogen Oxides Cavity Ring Down Spectrometer)

3. What is measured: Nitrogen oxide (NO), Nitrogen dioxide (NO2), Total Reactive Nitrogen (NOy), Ozone (O3)

4. Short description of measurement technique:

Cavity ring-down measurement of NO2 in four optical cavities, with chemical conversion of NO, NOy and O3 to NO2 before measurement in three of those cavities. It uses a 405 nm diode laser light source and measures the intensity in the cavity using photomultiplier tubes.

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. Rob Wild | robert.wild@noaa.gov | 303-497-5797 | 720-299-7790 |
| 2. Steve Brown | steven.s.brown@noaa.gov | 303-497-6306 | 303-261-2265 |
| 3. Bill Dube | william.p.dube@noaa.gov | 303-497-3933 | 303-859-1592 |
| 4. |  |  |  |
| 5. |  |  |  |
| 6. |  |  |  |

**II. Specific information:**

**1. Total installed weight: 296 lbs**

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

|  |  |  |
| --- | --- | --- |
| **Rack weight and balance info** | **Allowed** | **Actual** |
| Weight, lbs.: | 250 | 240 |
| Overturning moment, in-lbs.: | 7875 | 6500 |

**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. NOxCaRDS rack | Floor mount, Sta DualPass | 240 |
| 2. Zero Air Cylinder | Floor mount, Sta DualPass | 35 |
| 3. Window Plate | Sta DualPass Window | 8 |
| 4. NOx/Ox Inlet | Sta DualPass Window | 6 |
| 5. NOy Inlet | Sta DualPass Window | 7 |
| 6. |  |  |

**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. NOxCaRDS rack | Sta DualPass |  | 3 |  |  |  |
| 2. |  |  |  |  |  |  |
| 3. |  |  |  |  |  |  |
| 4. |  |  |  |  |  |  |
| 5. |  |  |  |  |  |  |
| 6. |  |  |  |  |  |  |
| 7. |  |  |  |  |  |  |
| 8. |  |  |  |  |  |  |
| 9. |  |  |  |  |  |  |
| 10. |  |  |  |  |  |  |
| 11. |  |  |  |  |  |  |
| 12. |  |  |  |  |  |  |
|  | **Totals:** |  |  |  |  |  |
|  |  | **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. NOxCaRDS NOx winglet | Sta DualPass Window | 4” |
| 2. NOxCaRDS NOy winglet | Sta DualPass Window | 4” |
| 3. NOxCaRDS exhaust | DualPass exhaust, FS787 | na |
| 4. |  |  |
| 5. |  |  |
| 6. |  |  |

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

|  |  |
| --- | --- |
| **Pump name** | **Location name and flight station** |
| 1. NOxCaRDS va cuum | Sta DualPass |
| 2. |  |
| 3. |  |
| 4. |  |
| 5. |  |
| 6. |  |

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

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

**A. Lasers**

Type: CW Diode

Class: 3B

Wavelength: 405 nm

Output power: 80 mW

Eye-safe? No

Beam fully contained within instrument during normal operation? Yes

*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*](mailto:carsten.warneke@noaa.gov) *for an example of laser safety documentation from TexAQS 2006.*

**B. RF transmitters**: none

**C. Radioactive materials:** none

**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 | NO in N2 | O2 | Zero Air |  |  |
| Mixing ratio | 2000ppm | 100% | na |  |  |
| Cylinder size (ft3) | 9 | 9 | 67 |  |  |
| Max pressure (psig) | 2216 | 2216 | 2216 |  |  |
| # installed on aircraft | 1 | 1 | 1 |  |  |
| Location on aircraft | Sta  DualPass | Sta  DualPass | Sta DualPass |  |  |
| Service frequency | 5 flts | 5 flts | 3 flts |  |  |
| *toxic/flammable gases:* |  |  |  |  |  |
| In containment vessel? | na | na | na |  |  |
| Gas alarm provided? | yes |  |  |  |  |
| MR if vented to cabin, ppmv | 4.2 |  |  |  |  |
| OSHA 8-hr PEL, ppmv | 25 |  |  |  |  |
| 30-min IDLH, ppmv | 100 |  |  |  |  |

**E. Chemicals (solids and liquids):** none

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Chemical number:** | **1** | **2** | **3** | **4** | **5** | **6** |
| Concentration |  |  |  |  |  |  |
| Amount |  |  |  |  |  |  |
| Container description |  |  |  |  |  |  |
| Purpose |  |  |  |  |  |  |
| Solution pH |  |  |  |  |  |  |
| Spill kit provided? |  |  |  |  |  |  |

**F. Cryogens:** none

**G. UPS and battery installation:** none

**H. Motors**

Description: Two Vacuum pumps

Motor current draw: 1 Ø, 400 Hz, 0.5A running

(e.g., 3Ø, 400Hz, 8A startup, 4A running)

Thermal interlock enabled? yes

**I. Operator seat requests -**

Test flights:

Transit flights:

Science flights:

**7. Data and plumbing drops**

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

Serial drops requested:

IRIG-B drops (BNC coax connector) requested: 0

Vacuum/exhaust/ emergency dump lines:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Flow rate, slpm** | **Line pressure, Torr** | **Pump type** | **Trace gas concentration(s)** |
| 1. |  |  |  |  |
| 2. |  |  |  |  |
| 3. |  |  |  |  |
| 4. |  |  |  |  |

Ground gas service lines (number, location, type of service):

Other gas lines (number, location, type of service):

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

|  |  |  |
| --- | --- | --- |
| **Parameter name** | **Voltage range** | **Unit conversion** |
| 1. |  |  |
| 2. |  |  |
| 3. |  |  |

**8. Aircraft access**

**a. flight days:**

Pre-flight time requested at aircraft (hours):

Routine pre-flight ground support required? none

(stands, ladders, forklifts, covers, external equipment, etc.)

Routine post-flight time requested at aircraft (hours): 1

Routine post-flight ground support required? none

(stands, ladders, forklifts, covers, external equipment, etc.)

**b. non-flight days:**

Routine external access to inlets or zenith mounts required?

(please describe location, how often, for how long, type of ground support equipment needed, weather constraints, etc.)

none

*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:

none desired

Briefly describe instrument sensitivity to flight conditions:

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

none we are aware of

**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.)

none

*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.

none anticipated

*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.

no startup or shutdown required

**III. Ground laboratory space**

**1. Tampa space requests**:

Power requirements: Single phase, 120 VAC, 60 or 400 Hz

Special requests:

**2. Field space requests**:

Workspace, ft2: 50 ft2

Number of tables/chairs: 1 table, 3 chairs

Power requirements: Single phase, 120 VAC, 1 kW

Storage space, ft2: 50 ft2

Other requests: