Request for University of Wyoming

King Air Support

*Insert project name/acronym here*

*Date submitted:*

*\*User information and documentation available at* [http://www.atmos.uwyo.edu/uwka/users](http://www.atmos.uwyo.edu/n2uw/users)

#### General Information

## Corresponding Principal Investigator

|  |  |
| --- | --- |
| Name: |  |
| Institution: |  |
| Address: |  |
| Phone: |  |
| FAX: |  |
| Email: |  |

## Project Description

|  |  |
| --- | --- |
| Project Title: |  |
| Co-Investigator(s) and Affiliation(s): |  |
| Location of Project: |  |
| Start and End Dates of Field Deployment Phase: |  |

## Abstract of Proposed Project

## PROPOSAL SUMMARY

## What are the scientific objectives of the proposed project?

## What are the hypotheses and ideas to be tested?

## Please summarize previous experiments of similar type that you or other investigators have performed?

## Give references of results published and explain how the proposed experiment and the use of the requested facilities go beyond the current scientific understanding.

## List any additional facilities (aircraft, sounding systems, radars, etc.) that will be used in the proposed project?

## How will the requested instruments/platforms be used to test the hypotheses and address each of the objectives?

## What results do you expect and what are the limitations?

## Expected publication(s) date and journal:

## Provide details regarding experiment design:

## EDUCATIONAL BENEFITS OF THE PROJECT

## List anticipated number of graduate and undergraduate students who will participate directly and in a meaningful way in fieldwork and/or data analysis related to this project. Briefly describe the involvement.

## Do you plan to enhance undergraduate and/or graduate classes with hands-on activities and observations related to this project? If yes, describe.

## Do you plan any outreach activities related to the project directed towards elementary and/or secondary school students and/or the public? If yes, please describe.

## Will information about the project's activities, results, data, and publications be made available via the Internet? If yes, where?

## PREVIOUS RESEARCH EXPERIENCE

## Past airborne research support *(include all NCAR/EOL, Wyoming and other aircraft-supported projects)*:

## Publications resulting from past airborne research:

## FUNDING AGENCY INFORMATION

|  |  |
| --- | --- |
| Funding Agency: |  |
| Contract Officer: |  |
| Contract Identification: |  |
| Proposal Status: |  |
| Approximate Amount Budgeted (total research): |  |
| Is support for deployment expected through NSF-LAOF deployment pool (see note below)? |  |
| If answer to above is no, provide amount budgeted for deployment costs: |  |

## *NOTE: NOT ALL NSF-FUNDED PROJECTS ARE ELIGIBLE FOR SUPPORT THROUGH THE LAOF DEPLOYMENT POOL (*[*https://www.eol.ucar.edu/*](https://www.eol.ucar.edu/)*)*

## DATA ACCESS POLICY

*UWYO King Air policy will make all King Air data publicly available once the data are quality controlled. If a PI wants to have exclusive access to these data for the first year, s/he has to officially request such a restriction via email from the flight facility manager (*[*rodi@uwyo.edu*](mailto:rodi@uwyo.edu)*) eight weeks prior to the start of an experiment.*

## Do you intend to request restricted access?

## AIRCRAFT OPERATIONS

|  |  |
| --- | --- |
| Preferred flight period: |  |
| Number of flights required: |  |
| Estimated duration of each flight (typically 4 hours maximum): |  |
| Number of flights per day: |  |
| Preferred base of operation: |  |
| Alternate base: |  |
| Is Laramie Airport acceptable as your operations base? |  |
| Average flight radius from base: |  |
| Desired flight altitudes(s): |  |
| Particular part(s) of day for flights: |  |
| Statistically, how many days during specified period should be acceptable for flight operations? |  |
| Number of scientific observers required for each flight: |  |

## If the preferred base of operations is in a foreign country, is the PI aware of any factors that could impact operations from this location? Health and safety issues in particular should be noted.

## Scientific rationale for the use of this aircraft in the proposed project:

**Description of desired flight pattern(s), priorities, and estimated number of flights for each:**

*(Please include graphics and flight pattern images as needed.)*

## UWYO KING AIR AIRBORNE SCIENTIFIC INSTRUMENTATION AND MEASUREMENTS

## Standard Measurements

*The UWYO King Air’s standard measurements include time and location, aircraft and atmospheric state parameters, and flight log files. Complete information on variables and instruments can be found at* [*http://www.atmos.uwyo.edu/uwka/users/*](http://www.atmos.uwyo.edu/n2uw/users/)

## *Standard measurement data made available after quality control include:*

* 3-D position, ground velocity, orientation, airspeed, flow angles, altitude
* Pressure, winds, temperature, water vapor, liquid water

## Instrumentation Available for Request

*Before requesting instruments in this section, please consider that some require additional resources and may need special preparation, maintenance, or data handling and processing. The number and/or combination of instruments may exceed UWYO’s personnel and/or hardware resource limits. In addition, some instruments are mutually exclusive and may result in the inability to request others in the list.*

*Please indicate requested instruments on the following pages.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Requested? (Check box)** | | **Instrument** | **Available Measurement(s)** |
| ***Cloud Measurements*** | | | |
|  | Rosemount 871FA | | * Icing Rate |
|  | DMT LWC-100 | | * Cloud Liquid Water |
|  | Gerber PVM-100 | | * Cloud Liquid Water * Droplet Surface Area * Droplet Effective Radius |
|  | DMT Cloud Droplet Probe (CDP) | | * Cloud Particle Size Distribution (2-50 m) * Total Concentration |
| ***Radiative Measurements*** | | | |
|  | | Eppley PSP (Pyranometer) | * Up-welling and Down-welling Radiation (0.285 – 2.800 m) |
|  | | Eppley PIR (Pyrgeometer) | * Up-welling and Down-welling Radiation (3.50 - 50 m) |
|  | | Heitronics KT-15.85 (Radiative Thermometer) | * IR Radiometric Surface Temperature * *Primary* Surface Temp Measurement |
|  | | Heitronics KT-19.85 (Radiative Thermometer) | * IR Radiometric Surface Temperature * *Secondary* Surface Temp Measurement * Precludes Downward Lidar |
| ***Aerosol Measurements*** | | | |
|  | | TSI 3010 CPC | * CN Concentration (> 15 nm) |
|  | | TSI 3025 CPC | * UFN Concentration (> 5 nm) |
| ***Miscellaneous Measurements*** | | | |
|  | | Digital Video recording | * Standard forward-looking video is supplied for every project * Down-looking with date/time stamp may be requested by checking this box * Video is composite of 1 frame per second images |
|  | | Cabin pressure | * Ambient cabin pressure * *Recommended when in-cabin aerosol or gas phase measurements are required* |
|  | | Licor 7000 | * Water Vapor * Carbon Dioxide |
|  | | MRI Universal Indicated Turbulence System | * Intensity of turbulence in inertial subrange |

## Canister-based Instruments Available for Request

*The UWyo King Air has four PMS-style wing canisters; therefore* ***NO MORE THAN 4*** *instruments can be checked in the following section.*

|  |  |  |
| --- | --- | --- |
| **Requested? (Check box)** | **Instrument** | **Available Measurement(s)** |
|  | PMS FSSP-100 | * Cloud Particle Size Distribution (0.5 – 47m; selectable) * Total Concentration |
|  | PMS OAP-2DC | * Cloud Particle Images (>25 m) * Cloud Particle Size Distribution |
|  | PMS OAP-2DP | * Precipitation Particle Images (>200 m) * Precipitation Particle Size Distribution |
|  | PMS PCASP-100X w/ DMT Signal Processing Package | * Aerosol Particle Size Distribution (0.1-3.0 m; 30 size bins) * Total Concentration |
|  | DMT Cloud Imaging Probe (CIP) | * Cloud Particle Images (>25 m) * Cloud Particle Size Distribution * *Faster electronics provide better estimate of smallest detectable particles* |

## Potential Instruments Available for Request

*The following instruments have been operated aboard the UWyo King Air during previous projects or are new experimental instruments. They require additional discussion and/or planning to ensure scientific goals are attainable.* ***It is required that dialog with technical contacts listed be undertaken before the request is submitted****. Be aware that* ***additional funding*** *may be required to deploy these instruments.*

|  |  |  |
| --- | --- | --- |
| **Instrument** | **Available Measurement(s)** | **Technical Contact** |
| ***Aerosol Measurements*** | | |
| Radiance Research M903 Nephelometer | * Light Scattering Extinction Coefficient @ 530 nm | Dr. Jeff Snider, [jsnider@uwyo.edu](mailto:jsnider@uwyo.edu), 307-766-2637 |
| TSI 3563 Nephelometer | * Light Scattering Extinction Coefficient @ 450, 550, and 700 nm * 50 nm bandwidth on each wavelength | Dr. Jeff Snider, [jsnider@uwyo.edu](mailto:jsnider@uwyo.edu), 307-766-2637 |
| UWYO CCNC-100A | * CCN Concentration (0.2% - 1.6% S) | Dr. Jeff Snider, [jsnider@uwyo.edu](mailto:jsnider@uwyo.edu), 307-766-2637 |
| ***Gas Measurements*** | | |
| TEI model 49 | * Ozone (0-1000 ppbv) | Dr. Jeff Snider, [jsnider@uwyo.edu](mailto:jsnider@uwyo.edu), 307-766-2637 |
| ***Miscellaneous*** | | |
| Licor 7500 | * Water Vapor * Carbon Dioxide   *Note: Should also fly Licor 7000.*  *Cannot be flown in icing conditions.* | Contact Dr. Jeff French, [jfrench@uwyo.edu](mailto:jfrench@uwyo.edu), 307-766-4143 |

**Potential Instrument Rationale**

## *After dialog with technical contact, please supply a scientific rationale for each instrument/measurement, and any additional information may be necessary to evaluate the appropriateness for that instrument to meet measurement objectives.*

## Scientific rationale for the use of special instruments in the proposed project (add justification for each instrument/measurement):

## Summary of any special requirements that pertain to potential instrument measurements, please include spatial resolution, accuracy and precision requirements:

#### Wyoming Cloud Radar (WCR)

*The Wyoming Cloud Radar is available for deployment on the UWYO King Air or other platforms with support through the LAOF Deployment Pool. Deployment of the WCR on the UWYO KA requires considerably more resources than the UWYO King Air alone. Requests for the WCR require additional information pertaining to both operational considerations and scientific justification.*

*Specific Technical Questions may be addressed to:*

#### *Dr. Samuel Haimov; Email:* [*haimov@uwyo.edu*](mailto:haimov@uwyo.edu)*; Phone: (307) 766-2726*

[*http://www.atmos.uwyo.edu/uwka/wcr/*](http://www.atmos.uwyo.edu/uwka/wcr/)

|  |  |
| --- | --- |
|  | Please ***Check box*** if requesting deployment of the WCR on the UWYO King Air  (*If so, please fill out the remainder of this section*) |

## RADAR OPERATIONS

## Scientific rationale for the use of WCR in the proposed project:

## Weather events during which radar operation and data collection are desired:

## Estimated number of flights for which the radar will be used:

## Desired radar configuration and parameters:

|  |  |  |
| --- | --- | --- |
| **Antenna configuration** +#(*select all desired*): | |  |
| Up/side-pointing\* antenna (one of the two below): | |  |
|  | linear single-polarization |  |
|  | linear dual-polarization |  |
| Down-pointing antenna (linear single polarization) | |  |
| Down-slant-pointing antenna (linear single polarization) | |  |

+ Alternative configurations could be made available (*e.g.* side-slant pointing antenna)

# Up to 4 fixed-direction antennas are switched electronically on a pulse-by-pulse basis

\* Mechanical switching from side-pointing to up-pointing using a reflector

|  |  |
| --- | --- |
| ***Typical operating parameters*** |  |
| Maximum range: | 6 – 10 km |
| Number of Gates: | 100 – 600 |
| Sampling along the beam: | 7.5 – 37.5 m |
| Minimum sampling along the flight track: | 3 – 4 m |
| First data gate range from aircraft: | 100 m |
| Minimum Detectable Signal: | -25 to -37 dBZ at 1 km |

## IF the typical operating parameters listed above do not meet the needs of the proposed project, please provide necessary parameters along with the scientific rationale:

## WCR SUPPORTING AND DATA SERVICES

## Multiple radar coordination requirements:

*If WCR will coordinate with other radars (airborne or surface), please provide brief details*

## Summary of on-site radar data access and analysis requirements:

## *Standard processed data made available after quality control include:*

* Radar parameters such as co-polarized reflectivity
* Cross-polarized reflectivity (if applicable)
* Mean Doppler velocity (radial velocity along each active antenna beam corrected for aircraft motion)
* 3-dimensional spatial reference (radar platform location and speed, and beam pointing directions)

## Note: *Consultation with the facility manager or WCR scientist is encouraged before submitting a request that includes the WCR*.

#### Wyoming Cloud LIDAR (WCL)

*The Wyoming Cloud Lidar is available for deployment on the UWYO King Air or other platforms with support through the LAOF Deployment Pool. Deployment of the WCL on the UWYO King Air requires more resources than the standard instrument suite. Requests for the WCL require additional information pertaining to both operational considerations and scientific justification.*

*Specific Technical Questions may be addressed to:*

#### *Dr. Min Deng, Email:* [*mdeng2@uwyo.edu*](mailto:mdeng2@uwyo.edu)*; Phone: (307) 766-6334*

<http://www.atmos.uwyo.edu/uwka/wcl/>

|  |  |
| --- | --- |
|  | Please ***Check box*** if requesting deployment of the WCL on the UWYO King Air  (*If so, please fill out the remainder of this section*) |

## LIDAR OPERATIONS

## Scientific rationale for the use of WCL in the proposed project:

## Weather events during which collection is desired (ie clouds, precipitation, aerosol):

## Estimated number of flights for which the lidar will be used:

## Desired lidar configuration and parameters *(if known)*:

The WCL system consists of an up- and down-pointing lidar, which can be deployed together or individually. Both operate at 355 nm and provide similar along beam sampling/resolution (3-5 m, typical). Both Lidars are capable of providing measurements of parallel and perpendicular channels returned power.

|  |  |
| --- | --- |
| **Lidar configuration**(*select all desired*): |  |
| Up-Pointing WCL |  |
| Down-pointing WCL |  |

|  |  |
| --- | --- |
| ***Typical operating parameters*** |  |
| Maximum range: | 7 km |
| Minimum sampling along the beam: | 1.5 m |
| Minimum sampling along the flight track: | 5 – 100 m |
| First Useable gate: | 30 m |

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |

## Scientific rationale for desired configuration(s):

## *Standard processed data made available after quality control include:*

* Level 0 product
  + Parallel and perpendicular channels return power
  + Depolarization ratio
* Level 1 product
  + Calibrated attenuated backscattering coefficient for parallel channel
  + Lab calibrated depolarization ratio

## *Non-standard products (e.g. Cloud mask, Cloud phase, Retrieved cloud extinction, Collocated lidar and radar data (assuming WCR operation) that require more extensive analyses or development may be available through special arrangement with UWYO but require additional funding from the project. Please contact the facility manager or the WCL scientist for consultation.*

**Do you intend to request any WCL non-standard products? If yes, please list the products and relate the corresponding funding budget.** *Please contact the facility manager or WCL scientist for consultation.*

**Summary of on-site lidar data access and analysis requirements:**

## Note: *Consultation with the facility manager or WCL scientist is encouraged before submitting a request that includes the WCL*.

## USER-SUPPLIED SCIENTIFIC PAYLOAD

*Note: UWYO will supervise the installation of all user-supplied instrumentation to ensure compatibility with existing instrument systems and ensure aircraft flight safety and crash-load specifications.*

*Please provide the following information for each user-supplied scientific instrument.* ***Additional copies of this page and the next one should be made for each user-supplied instrument.***

Specific technical questions may be addressed to either the facility manager or chief engineer:

#### *Matthew Burkhart*

#### *Email:* [*monoski@uwyo.edu*](mailto:monoski@uwyo.edu) *Phone: (307) 766-4150*

|  |  |
| --- | --- |
| **Instrument Name:** |  |
| Primary Contact Name: |  |
| Primary Contact Institution: |  |
| Primary Contact Phone: |  |
| Primary Contact Email: |  |
| Individual weight of all components: |  |
| Complete size dimensions of all components: |  |
| Rack-mountable 19” panel space required: |  |
| \*Supplying your own 19” rack (yes/no): |  |
| Hazardous material required: |  |
| Radioactive sources or materials: |  |
| Power required (watts, volts, amps): |  |
| Type of power (DC, 60 Hz, 400 Hz): |  |
| \*External sensor location (if any): |  |
| \*Special inlet required (if so please describe) |  |
| Are signal(s) to be recorded on King Air’s Data System (yes/no)? |  |
| If yes: Signal format (digital, analog, serial): |  |
| Full-scale Voltage: |  |
| Range: |  |
| Resolution: |  |
| Sample Rate (1, 5, 100 sps): |  |
| Need real-time, in-flight, King Air-measurement, serial data feed (RS-232, RS422)? |  |
| Need IRIG time-code feed? |  |
| Special sensor calibration service required? |  |
| Need full-time operator during flight? |  |
| Number of lap-top computers for on-board use: |  |

## *\*Note: user supplied racks, inlets, and externally mounted instruments will require FAA approval and therefore require a minimum 6-month lead-time.*

## Will UWYO King Air support be required in preparing the instrument(s) for use on the aircraft (other than inspection, installation and power hook-up)?

## UWYO King Air Engineering group can provide design and fabrication support for hardware and electronic interfaces. *(If so, specify type and lead-time).*

## SUPPORT NEEDS

## SPECIAL DATA RECORDING AND PROCESSING REQUIREMENTS

## What additional recording capability is needed? Please provide details on the number of signals, their characteristics, format, synchronous, fire-wire, ethernet, etc. *(It may not be possible to accommodate any and all signals.)*

## If nonstandard output formats and/or data rates are required, how often are the measurements needed? Note: The standard format for processed, King Air output data is RAF Nimbus compliant netCDF. The standard output media are ftp transfer. *(Nonstandard rates and/or formats will be considered as special processing requests.)*

**PAYLOAD GROUND SUPPORT NEEDS FOR USER-SUPPLIED INSTRUMENTATION**

## Preflight needs (prior to take-off) on flight days:

|  |  |
| --- | --- |
| Access: | hrs |
| Power | hrs |

**Post-flight needs (after landing) on flight days**:

|  |  |
| --- | --- |
| Access: | hrs |
| Power: | hrs |

## Special support needs on flight days:

## Routine Maintenance on non-flight days:

|  |  |
| --- | --- |
| Access: | hrs |
| Power: | hrs |

## Special support needs on non-flight days:

**SUPPORTING SERVICES**

## Will you require air-ground communication? *(If so, specify location of base station and operating frequencies, some limited communications may also be available through sat phone connections on the UWYO King Air.)*

## What real-time display and data services are required?

*A basic data/analysis center with LAN connections to the UWYO computers and access to the Internet will be provided in the field by UWYO. Support,* ***if requested,*** *may include real-time communications links to the aircraft via “chat” and real-time display of selected variables through UDP data forwarding, currently supported through NCAR JOSS. Access to forecasting tools and preparations of operational forecasts are not usually included as part of this service.*

## Please list on-site data access requirements:

#### DATA files and distribution

Initial preliminary data will be made available during the project. Following the conclusion of the experiment, a fully processed data set will be made available. A Level 2 user file, complying with RAF Nimbus NetCDF conventions will be disseminated including all standard measurements and data from selected instruments. There are many redundant and variable measurements, and Level 1 files contain the suggested measurements for analysis. Level 1 data files with all measured quantities are available upon request. Further information on data files and instruments can be found at [http://www.atmos.uwyo.edu/uwka/users/](http://www.atmos.uwyo.edu/n2uw/users/).

These files can be visualized via the NCAR AEROS software package (<https://www.eol.ucar.edu/software/aeros>).

It is common to provide data at 1 Hz rates. High-rate processing is available for some instruments. **Please indicate below if high-rate data is desired.**