Next-generation University of Wyoming King Air Research Aircraft Facility
Mission Ready Aircraft and Instruments for Atmospheric and Environmental Research

Facility Description
- Next-generation UWKA (UWKA-2) will be available to the community in 2024
- Owned by the University of Wyoming
- Available to the NSF-GEO community through the Facilities for Atmospheric Research and Education (FARE) program as an LAOF Facility.
- Track 1A and 3 Projects

Scientific Payload Capabilities
- Mechanical
  - Max payload: 2,970 lbs. (3 crew) or 2760 lbs. (4 crew)
  - Payload Volume: 344 Cu Ft
  - Six “PMS” Canisters, 3/wing (center position max 70 lbs.)
  - Two Nadir ports (22” x 19” clear apertures)
  - Two Zenith Ports (13” dia and 18” x 13.5” clear apertures)
  - Six “minor” Zenith multi function ports (5.25” x 3.375”)
  - Two zenith aerosol inlet ports (19” x 9”)
  - Four belly hardpoints (two pair or in combination)
  - Extended nose w/ radial mounts & nadir compartment
  - Four starboard multi use ports
  - Dropsonde port (2.9” x 6.9”)
- Electrical and Communications
  - 400A 28VDC 11.3kw Electrical Power
  - 10kw 120VAC 60Hz (max, DC reduced proportionally)
  - Global Satcom (200-700kbps)
  - 5G data services >4 kft (Domestic)
  - Gate-to-gate WiFi

The new N2UW Aircraft
- 2013 Beechcraft King Air 350i
- Blackhawk XP -67A Conversion
- Garmin G1000 Avionics
- Heavyweight Gear Modification
- 16,000 lbs MTOW
- 3-4 Scientific Crew
- 3.1 to 5.4 hr duration
- Up to 2100 nm range (1-way)
- 3100 lbs max Scientific Payload
- Service Ceiling 33,000-35,000 feet

www.uwyo.edu/atsc/uwka
## Standard Instrumentation
- True Wind: Rosemount 0858
- Static Pressure: Mensor CPT & Weston
- Temperature (heated): Rosemount 102
- Temperature (fast response, unheated): Reverse Flow PRT
- Humidity: EdgeTech 137 Vigilant
- Aircraft Attitude – Applanix POS AV 410 v6 w/ IMU-64
- Aircraft Position– L1/L2 GPS (opt ~30cm RT corrections)
- Aircraft state – ARINC 429 & 717 data buses
- Aircraft Attitude – Applanix POS AV 410 v6 w/ IMU-64
- Aircraft Position– L1/L2 GPS (opt ~30cm RT corrections)
- Aircraft state – ARINC 429 & 717 data buses
- Partially correlated kalman filter (see separate poster)
- Video and Still Imagery: forward & nadir (20FPS)

## Data and Display Capabilities
- Standard 25Hz and 1Hz data products
- NetCDF file support
- 1000Hz Analog (+/- 10VDC) sampling
- Serial and Network sampling
- NTP/IRIG-B/PPS Timing
- IWG1 data broadcast and reception
- Remote connections (VNC, RDP)
- Windows environment for user instrument apps
- PI and Operator displays stations
- Realtime data telemetry (200k, 700k, 5G)
- Cockpit/crew intercom with voice ground link and IRC
- Satcom and realtime position tracking
- Traceable calibration and test equipment

## Requestable Instrumentation
- Remote Sensors, all fixed antenna, looking up and down
  - Wyoming Cloud Radar, fixed antennas, nadir & zenith (see separate poster)
  - Wyoming Cloud Lidars, fixed view, nadir & zenith (see separate poster)
  - Ka-band Profiling Radar
- Air Chemistry / Trace Gas
  - CO₂/H₂O (closed Path): Li-COR LI-7000 (20Hz, suitable for fluxes)
  - CO₂/H₂O (open path): Li-COR LI-7500 (20Hz, suitable for fluxes)
  - CO/CO₂/CH₄/H₂O: Picarro 2401-M (20Hz)
  - CO/N₂O: Aeris Ultra*
  - CH₄/CO₂: Aeris Ultra*
  - H₂O/H₂S/NO/NO₂/O₃/CO₂/CO/CH₄/H₂O/SO₂: MIRO Analytical MGA10-GP*
- Aerosol Size Spectra / Composition
  - 0.004 - 3μm: TSI 3775 Ultratine CPC (1Hz)
  - 0.06 - 1μm: DMT UHSAS (20Hz)
  - 0.13 - 3 μm: Handix POPs (1Hz)
  - 0.1 - 3+ μm: TSI 3010 CPC (1Hz)
  - 0.1 - 3μm (ambient/in-situ): DMT PCASP-100X (25Hz)
- Inlet (isokinetic): Brechtel isokinetic 0.005-10um, 300LPM @ 100m/s
- Black Carbon: DMT SP2-XR (100-500 nm Scattering, 50-800 nm Incandescent, mass)
- Solar Radiation / Albedo
  - 295 to 385 nm: Eppeley UV
  - 285 to 2800nm: Eppeley PSP (Nadir and Zenith)
  - 4000-50000 nm: Eppeley PIR (Nadir and Zenith)
  - Radiometric IR 7500 - 13500 nm (Nadir): FLIR Vue Pro-R*
- LW / Droplet Spectra / Cloud Physics
  - 2-50 μm DMT CDP
  - 25-1550 μm DMT CIP
  - 0.01-1.28mm SPEC 2DS
  - 0.3-19.2mm SPEC HVPS
  - LWC/TWC: Sky PhysTech Nevzorov Hot Wire
  - 3-50 μm LW, PSA, Re: Gerber PVM-100A
  - SPEC 3V-CPI*

## PI Mission-Specific Instrumentation
- Facility support for:
  - Modifications to user-supplied instruments to make them aircraft ready
  - Aircraft certification of instruments (Mechanical and Electrical DERs)
  - CNC Machining and electrical fabrication
  - Racking
  - Inlet and sample system development
  - Environmental testing
  - Project specific data products
  - STC enabling lidar installations
- User-Supplied Instrument Collaborations
  - MARLI & CRL (Raman lidar T, q profiles) -- Zhien Wang, Stonybrook
  - PTR-TOF-MS -- Hu, UMMt
  - CIMS (Br₂, Cl₂, BrO) – Pratt UMich
  - PILS / Impactor – UMich, CSU
  - Flask Sampling – UW
  - CVI – Lance, SUNY
  - Ammonia – Fisher, CSU
  - Ozone – Rheem, Pitt
  - SOF – Volkamer, CZU
  - Holodec – UMich
  - MTHP – Lim, JPL
  - SPEC HVPS
  - 3-50 µm LWC, PSA, Re: Gerber PVM-100A
  - 0.01-1.28mm SPEC 2DS
  - 25-1550 µm DMT CIP

## Science Mission Capabilities
- O&G / CAFO Emissions
- Air mass composition and characterization
- Fluxes
- Particulates / Black Carbon
- Eddy Covariance
- Wildfire / smoke
- Land Use / Agriculture
- Cloud physics, cloud microphysics
- Atmospheric dynamics
- Air chemistry & Aerosols
- Severe Weather
- Tropospheric profiling
- Boundary layer
- Air-sea interactions
- Atmospheric Radiation
- Water Resources

## NCAR EOL Partnerships
- AVAPS Dropsondes – Hock
- Field Catalog
- HARPS – Hock
- CO – Campos
- HIML Inlet – RAF
- “Chat”

EOL instruments and services require a separate PI request

[www.uwyo.edu/atsc/uwka](http://www.uwyo.edu/atsc/uwka)
Next-generation University of Wyoming King Air Research Aircraft Facility
Mission Performance and Planning

- **NSF Projects Supported:**
  - 2004 -- 2023
  - 37 projects
  - 2100 flight hours
  - 79 PIs and co-PIs
  - 14 states
  - 4 countries
  - 2 non-UW aircraft

- **Aircraft operations**
  - Domestic
  - International
    - Atlantic & Pacific Ferry Possible
  - 33,000-35,000 ft ceiling
  - 200 ft AGL min operating altitude
    (w/ waiver and risk assessment)

**Nominal Research Mission Ranges**

**Performance Metrics**
(2300# payload, 3900# fuel)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SL</td>
<td>3.3</td>
<td>677</td>
<td>339</td>
</tr>
<tr>
<td>2000</td>
<td>3.4</td>
<td>710</td>
<td>355</td>
</tr>
<tr>
<td>4000</td>
<td>3.5</td>
<td>739</td>
<td>370</td>
</tr>
<tr>
<td>10000</td>
<td>3.9</td>
<td>866</td>
<td>433</td>
</tr>
<tr>
<td>14000</td>
<td>3.9</td>
<td>780</td>
<td>390</td>
</tr>
<tr>
<td>18000</td>
<td>3.9</td>
<td>800</td>
<td>400</td>
</tr>
<tr>
<td>22000</td>
<td>3.9</td>
<td>840</td>
<td>430</td>
</tr>
<tr>
<td>26000</td>
<td>3.9</td>
<td>980</td>
<td>490</td>
</tr>
<tr>
<td>30000</td>
<td>3.9</td>
<td>1050</td>
<td>525</td>
</tr>
<tr>
<td>34000</td>
<td>3.9</td>
<td>1100</td>
<td>550</td>
</tr>
</tbody>
</table>

- Anticipated mission performance based on manufacturer charts and pre-delivery flight testing. External stores/instruments will reduce these values. These examples are for informational purposes only and should not be relied upon for any formal use. Contact UWKA Facility personnel for project specific guidance.

**Mission Configuration Performance Metrics**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload [lb.]</td>
<td>2300</td>
<td>1300</td>
<td>3100</td>
</tr>
<tr>
<td>Fuel [lb.]</td>
<td>3900</td>
<td>4900</td>
<td>3100</td>
</tr>
<tr>
<td>Duration w/ Res. [hr.]</td>
<td>4.1</td>
<td>5.4</td>
<td>3.1</td>
</tr>
<tr>
<td>Range SL/FL330 [nm.]</td>
<td>760/1560</td>
<td>860/2100</td>
<td>580/1120</td>
</tr>
</tbody>
</table>

This material is based upon work supported by The National Science Foundation under Grant Nos. 1917369 & 1935930.
‘N2UW’: University of Wyoming Cloud Research Aircraft Facility
Wyoming Airborne Cloud Lidars

WCL Nadir-Pointing “Down Lidar”

WCL2FOV Zenith-Pointing “Up Lidar”

Lidar Collaborations

This material is based upon work supported by the National Science Foundation under Grant Nos. 1917369 & 1935930

www.uwyo.edu/atsc/uwka

* In Development
Example ISO and x-section of cabin with rack and instrument highlights

IMAGES TBD BY 09/14/2023